

# ESCoP 2011, 17TH MEETING OF THE EUROPEAN SOCIETY FOR COGNITIVE PSYCHOLOGY

## Table of Contents

WELCOME	ii
GENERAL INFORMATION	iii
CONFERENCE PROGRAM	
Condensed Schedule A, sessions by time	v
Condensed Schedule B, sessions by room	x
Condensed Schedule C, abstracts by time	xiv
KEYNOTE LECTURES	xxxi
ABSTRACTS	
Symposia, Friday Morning	1
Symposia, Friday Afternoon	15
Symposia, Saturday Morning	17
Symposia, Saturday Afternoon	29
Symposia, Sunday Morning	39
Symposia, Sunday Noon	48
Oral Sessions, Friday Morning	59
Oral Sessions, Friday Afternoon	65
Oral Sessions, Saturday Morning	73
Oral Sessions, Saturday Afternoon	81
Oral Sessions, Sunday Morning	89
Oral Sessions, Sunday Afternoon	93
Oral Sessions, Sunday Evening	98
Poster Session 1, Friday Evening	105
Poster Session 2, Saturday Evening	135
Poster Session 3, Sunday Evening	167
AUTHOR INDEX	194

**WELCOME – ESCoP 2011, 17<sup>th</sup> Meeting of the European Society for Cognitive Psychology**

Welcome to the 17<sup>th</sup> ESCoP conference since the society was founded 25 years ago. I hope the conference is a memorable and fascinating event for you and I am very much looking forward to seeing you here. The conference was not initially planned for Donostia-San Sebastián in 2011 but Nuria Sebastián and Axel Cleeremans encouraged us to take up this challenge, using some very convincing arguments that I don't quite remember now except that they were very convincing, considering that the venue was booked for most of September and we had very few degrees of freedom to choose the dates! The number of participants has been steadily increasing over the years and this seems to be also the trend in the present meeting, on the 25th anniversary of the society. Now that we are sending the program to press there are 850 people registered. The program contains a special event for the opening ceremony: *Pintxos on my mind: When gastronomy meets cognitive psychology*, which combines science and pleasure in a city that is renowned for the high quality of its award-winning restaurants. On the scientific side there will be five keynote speeches, two plenary symposiums, one a joint initiative of APS and ESCoP entitled "*Where is embodiment going?*" and the second one organized by ESCAN (European Society of Cognitive and Affective Neuroscience) entitled "*Feedback processing and the brain*". In addition there are 32 symposiums, 156 oral presentations, and 358 posters scheduled in 7 parallel sessions. As you can imagine, organizing so many presentations in a packed program has involved many restrictions. We have tried our best to accommodate people's wishes and we hope we have succeeded most of the time. In the few cases where we could not do so, I am sure you will understand the multiple constraints we have had to deal with, and sincerely wish you still enjoy the conference.

The planning and organization of this event has involved the effort of many people that I would really like to thank. I would like to express my deep gratitude to the members of the scientific and the organizing committee. In addition, I would like to especially thank the people involved in the day- to- day activities of the conference organization. They deserve a special mention: Leire Arietalanizbeascoa, Maider Goñi, Eider Juaristi, Pawel Kuszelewski, and Jon Orozco. I cannot imagine the conference running without them. I would also like to thank all the research assistants and PhD students who will be helping during the meeting and who are a very important part of running this conference. Finally, I would like to thank our sponsors, whose support is so important for this event.

It is a pleasure and an honor for me to host the 17th ESCoP conference during the 25th anniversary of the society. I really hope you will greatly enjoy the conference and your stay in beautiful Donostia-San Sebastián.

Manuel Carreiras  
Chair of the Organizing Committee

## TRAVEL IN SAN SEBASTIAN

The taxi fare to the San Sebastian Airport should not exceed 30 euros. The airport bus takes around 25 minutes to reach the airport, costs 2.10 euros and stops at the central Plaza de Gipuzkoa. However, the airport bus frequency is not ideal (+/- every 1 hour.). There is a regular bus connection between Bilbao airport and the city of San Sebastián. It takes around one hour to reach the city center and costs 15 euros. Buses depart from San Sebastián to Bilbao airport every hour.

## ESCoP TIME

People chairing sessions, will be asked to keep the spoken papers scheduled on times standardized against a clock at the ESCoP registration desk. All attendees are asked to synchronize their watches with ESCoP time.

## HOSPITALITY

Social Event (Wine tasting): Friday, September 30th at 20:00 at the banquet room. Previous online registration required.

Conference dinner: Saturday October 1st at 20:30 in the Auditorium Foyer. Previous online registration required.

## THE PROGRAM

The Scientific Committee has reviewed proposals for symposia and abstracts submitted for talks and poster presentations. We have received 783 submissions this year, so it was not so easy for the Scientific Committee to review all the scientific submissions, accepting ones and rejecting others. There are:

- 32 symposia, that include 171 talks
- 156 talks
- 358 posters

## SCIENTIFIC COMMITTEE

*Manuel Carreiras* (Chair). BCBL

*Douglas Davidson*. BCBL

*Nicolas Dumay*. BCBL

*Andrea Kiesel*. Universität Würzburg, Germany

*Itziar Laka*. University of the Basque Country, Spain

*Helena Matute*. Deusto University, Spain

*Mante S. Nieuwland*. BCBL

*Arthur Samuel*. BCBL

*Nuria Sebastián*. Universitat Pompeu Fabra, Spain

*Eiling Yee*. BCBL

## ORGANIZING COMMITTEE

*Manuel Carreiras* (Chair). BCBL

*Leire Arietaleanizbeascoa*. BCBL

*Ana Fernández*. BCBL

*Ansgar Hantsch*. BCBL

*Pawel Kuszelewski*. BCBL

*Marie Lallier*. BCBL

*Nicola Molinaro*. BCBL

*Monika Molnar*. BCBL

## ACKNOWLEDGEMENTS

We wish to thank the following sponsors for their support:

- Spanish Ministry of Science and Innovation
- Government of the Basque Country
- Local Government of Gipuzkoa
- SEPEX: Spanish Society of Experimental Psychology
- ESCoP: European Society for Cognitive Psychology

We are grateful to the organizers of previous ESCoP symposiums for their valuable advice.

Finally, we would like to thank the Kursaal Congress Center for their help and generosity in helping us host the conference.

## LUNCH & COFFEE BREAKS (BANQUET ROOM).

Thursday 29

- ✓ Welcome Cocktail: 20:30 – 22:30

Friday 30

- ✓ Coffee breaks: 10:30-10:50 & 16:00-16:20
- ✓ Lunch: 13:00-14:20

Saturday 1

- ✓ Coffee breaks: 10:30-10:50 & 16:00-16:20
- ✓ Lunch: 13:00-14:20

Sunday 2

- ✓ Coffee breaks: 11:10-11:30 & 16:40-17:00
- ✓ Lunch: 14:20-15:40

## **ABOUT THE SOCIETY**

ESCoP is a large Society with over 500 members, across a range of European countries and beyond. ESCoP's mission is "the furtherance of scientific enquiry within the field of Cognitive Psychology and related subjects, particularly with respect to collaboration and exchange of information between researchers in different European countries". There are three types of membership within the Society: associated members: postgraduates or postdoctoral researchers who are developing their research career, full members and retired members. The Society encourages scientific research through the publication of the Journal of Cognitive Psychology. Other forms of communication include less formal newsletters sent to all members, the website ([www.escop.eu](http://www.escop.eu)), and an electronic mailing list. The Society also promotes research through its regular conference meetings, has a highly successful programme of summer schools. It has recently initiated research workshops to act as a catalyst for the establishment and networking of research groups in emerging areas of cognitive psychology. The Society has a constitution and a committee who oversee the workings of the Society. From relatively humble beginnings, ESCoP has developed into a broad, successful and respected Society that promotes research in cognate subjects.

## **ESCoP COMMITTEE**

Núria Sebastián Gallés, President, Spain, [nuria.sebastian@upf.edu](mailto:nuria.sebastian@upf.edu)

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**[www.escop.eu](http://www.escop.eu)**

## THURSDAY AFTERNOON

Registration and material pack delivery	15:00-18:00
Women in Cognitive Science meeting (Room 6)	15:30-17:00

## THURSDAY EVENING

Opening Ceremony	17:30-18:00
Brain Talks V: Pintxos on my mind: When gastronomy meets cognitive psychology	18:00-19:15
<b>KEYNOTE LECTURE 1 – DANA SMALL</b>	<b>19:30-20:30</b>
<b>The flavor modality</b>	
Welcome Cocktail – Pintxos Dinner	20:30-22:30

## FRIDAY MORNING

<b>SYMPOSIA SY_(01-07)</b>	<b>08:30-10:30</b>
1. Prediction and integration during language comprehension	ROOM - 2
2. Contingency and causality: From cognitive theories to clinical reasoning, social stereotypes, pseudoscience, and legal issues	ROOM - 3
3. Visual-word recognition: The state of the art	AUDITORIUM
4. Number processing: Core deficits and recent developments in cognitive intervention	ROOM - 6
5. Learning novel grammars, vocabularies and orthographies: Developmental and neural perspectives	ROOM - 4
6. Functional characteristics of instructed and practiced task-sets	ROOM - 5
7. From unconscious processing to metacognition: Are we explaining consciousness yet?	ROOM - 1

<i>OS_0.2* (beginning of SY_02, 08:30 – 08:50)</i>	
<i>Reasoning about other people's intentions: The side effect phenomenon</i>	ROOM - 3

<b>ORAL SESSIONS OS_(01-07)</b>	<b>10:50-11:50</b>
1. Dyslexia	ROOM - 2
2. Memory	ROOM - 4
3. Emotions	ROOM - 3
4. Executive Control	ROOM - 6
5. Bi/Multi-lingualism	ROOM - 5
6. Modeling	ROOM - 1
7. Social Cognition	AUDITORIUM

## FRIDAY NOON

<b>KEYNOTE LECTURE 2 – RANDI MARTIN</b>	<b>12:00-13:00, AUDITORIUM</b>
Working memory and language processing: An updated multiple-components view	

## FRIDAY AFTERNOON

### PLENARY SYMPOSIUM SY\_08

Where is Embodiment going?

14:20-16:00, AUDITORIUM

### ORAL SESSIONS OS\_(08-13)

- 8. Human Learning
- 9. Executive Control
- 10. Attention
- 11. Spatial Cognition
- 12. Orthographic Processing
- 13. Face Recognition
- 13\*. (13.3 & 13.4)

14:20-16:00

- ROOM - 6
- ROOM - 4
- ROOM - 3
- ROOM - 5
- ROOM - 2
- ROOM - 1
- ROOM - 1

### KEYNOTE LECTURE 3 – ANTONINO VALLESI

Organization of executive functions: Asymmetries along the x-axis

16:20-17:20, AUDITORIUM

## FRIDAY EVENING

### POSTER SESSION 1. PS\_(1.001 – 1.123)

- Applied Cognitive Psychology (1.001-1.004)
- Visual Perception (1.005-1.009)
- Perception and Action (1.010-1.015)
- Attention (1.016-1.024)
- Emotions (1.025-1.031)
- Executive Control (1.032-1.038)
- Motor Control (1.039-1.043)
- Numerical Cognition (1.044-1.049)
- Patient Studies (1.050-1.054)
- Judgment and Decision Making (1.055-1.060)
- Human Learning/Implicit Learning (1.061-1.066)

- Memory (1.067-1.075)
- Working Memory (1.076-1.081)
- Semantic Memory (1.082-1.085)
- Speech Perception (1.086-1.090)
- Language Acquisition/Cognitive Development (1.091-1.096)
- Language Comprehension (1.097-1.104)
- Sentence and Text Processing (1.105-1.108)
- Language Production (1.109-1.114)
- Bi/Multi-lingualism (1.115-1.120)
- Dyslexia (1.121-1.123)

17:20-19:20

### ESCoP BUSINESS MEETING

19:00-20:00, AUDITORIUM

## SATURDAY MORNING

### SYMPOSIA SY\_(09-14)

- 9. Recent developments in the cognitive neuroscience of number processing
- 10. Timing and Language
- 11. Perceiving transformed movements when using tools
- 12. Neurocognitive correlates of Cognitive Control
- 13. Orthographic variation and brain processes: A non-alphabetic perspective
- 14. Affective modulation of cognitive control processes

08:30-10:30

- ROOM - 2
- ROOM - 1
- ROOM - 4
- AUDITORIUM
- ROOM - 5
- ROOM - 3

OS\_14. Auditory perception and multisensory integration

ROOM - 6

OS\_14\* (beginning of SY\_10, 08:30 – 08:50)

ROOM - 1

Insights into response capture and inhibition with Transcranial magnetic stimulation

## ORAL SESSIONS OS\_(15-21)

15. Working Memory	10:50-11:50
16. Abnormal Psychology	ROOM - 6
17. Language Acquisition	ROOM - 5
18. Emotions	ROOM - 2
19. Attention	ROOM - 4
20. Sentence and Text Processing	AUDITORIUM
21. Object Recognition and Visual Processing	ROOM - 1
	ROOM - 3

## SATURDAY NOON

### KEYNOTE LECTURE 4 – CATHY PRICE

12:00-13:00, AUDITORIUM

The interactive account of brain activation during reading

## SATURDAY AFTERNOON

### SYMPOSIA SY\_(15-20)

14:20-16:00

15. Bilingual word and sentence processing: Electrophysiological investigations	ROOM - 2
16. Memory consolidation: Surprisingly pervasive effects on language, at multiple levels	ROOM - 1
17. Interactions between vision and language: The state of the art	ROOM - 3
18. Recent advances in the research on strategy selection and execution in mathematics problem solving	ROOM - 6
19. Reasoning as memory	ROOM - 5
20. Inside the social brain: Developmental, linguistic, cognitive and brain mechanisms	AUDITORIUM
OS_22. <i>Motor Control</i>	ROOM - 4

### ORAL SESSIONS OS\_(23-29)

16:20-17:20

23. Working Memory	ROOM - 6
24. Language Production	AUDITORIUM
25. Time and Cognition	ROOM - 5
26. Skill Acquisition and Attention in Aging	ROOM - 4
27. Learning	ROOM - 3
28. Numerical Cognition	ROOM - 2
29. Perception and Action	ROOM - 1

## SATURDAY EVENING

### POSTER SESSION 2. PS\_(2.001-2.124)

17:20-19:20

Consciousness (2.001-2.005)	Numerical Cognition (2.065-2.070)
Attention (2.006-2.014)	Spatial Cognition (2.071-2.077)
Perception and Action (2.015-2.019)	Social Cognition (2.078-2.085)
Face and Object recognition (2.020-2.024)	Orthographic Processing (2.086-2.189)
Emotions (2.025-2.031)	Language Acquisition/Cognitive
Executive Control (2.032-2.039)	Development (2.090-2.096)
Human/Implicit Learning (2.040-2.045)	Language Comprehension (2.097-2.106)
Memory (2.046-2.055)	Sentence and Text Processing (2.107-2.111)
Working Memory (2.056-2.061)	Language Production (2.112-2.117)
Episodic and Semantic Memory (2.062-2.064)	Bi/Multi-lingualism (2.118-2.124)

## SUNDAY MORNING

### **SYMPOSIA SY\_(21-26)**

- |  |                    |
|--|--------------------|
| 21. The emergence of lexical networks in the second year of life   | <b>09:30-11:10</b> |
| 22. Do we need vision? The effects of visual impairment on the development of the cognitive system                     | ROOM - 3           |
| 23. Neurocognitive bases of learning and consolidation for spoken and written language                                 | ROOM - 5           |
| 24. Auditory learning  | ROOM - 2           |
| 25. Face perception: ERP correlates of rapid adaptation, category-selectivity, recognition, and individual differences | ROOM - 1           |
| 26. Response-related effects in task switching   | AUDITORIUM         |
|  | ROOM - 4           |

*OS\_30. Orthographic Processing*

*ROOM - 6*

## SUNDAY NOON

### **SYMPOSIA SY\_(27-32)**

- |   |                    |
|---|--------------------|
| 27. Processing frequent multi-words expressions: Behavioral and electrophysiological perspectives | <b>11:30-13:10</b> |
| 28. <b>PLENARY SYMPOSIUM. Feedback processing and the brain: The ESCAN symposium at ESCoP</b>     | ROOM - 4           |
| 29. L1 influences on L2 revisited   | <b>AUDITORIUM</b>  |
| 30. Context modulations of neurocognitive processes evoked by counterintuitive meanings           | ROOM - 2           |
| 31. Motor and perceptual aspects of temporal expectation  | ROOM - 1           |
| 32. The cognitive neuropsychiatry of delusional belief  | ROOM - 6           |
|   | ROOM - 3           |

*OS\_31. Executive Control*

*ROOM - 5*

## SUNDAY AFTERNOON

### **KEYNOTE LECTURE 5 – ROBERT ZATORRE**

**13:20-14:20, AUDITORIUM**

Music in the brain: Pitch, plasticity, imagery and emotion

### **ORAL SESSIONS OS\_(32-38)**

- |                                  |                    |
|----------------------------------|--------------------|
| 32. Cognitive Development        | <b>15:40-16:40</b> |
| 33. Social Cognition             | ROOM - 5           |
| 34. Implicit Learning            | ROOM - 6           |
| 35. Executive Control            | ROOM - 4           |
| 36. Judgment and Decision Making | ROOM - 3           |
| 37. Perception and Action        | ROOM - 2           |
| 38. Language Comprehension       | ROOM - 1           |
|                                  | AUDITORIUM         |



## SUNDAY EVENING

### ORAL SESSIONS OS\_(39-45)

- 39. Implicit Learning
- 40. Bi/Multi-lingualism
- 41. Language Comprehension
- 42. Consciousness
- 43. Attention
- 44. Emotions
- 45. Working Memory

**17:00-18:00**

ROOM - 4  
ROOM - 3  
ROOM - 2  
ROOM - 6  
ROOM - 5  
AUDITORIUM  
ROOM - 1

### POSTER SESSION 3. PS\_3

Aging and Dementia (3.001-3.005)  
Applied Cognitive Psychology (3.006-3.013)  
Attention (3.014-3.022)  
Executive Control (3.023-3.030)  
Multisensory Integration and Motor Control  
(3.031-3.033)  
Human/Implicit Learning (3.034-3.040)  
Memory (3.041-3.053)  
Working Memory (3.054-3.059)  
Numerical Cognition (3.060-3.065)

**18:00-20:00**

Reasoning and Problem Solving (3.066-3.072)  
Music Perception (3.073-3.075)  
Speech/Auditory Perception (3.076-3.081)  
Orthographic Processing (3.082-3.086)  
Language Acquisition / Cognitive  
Development (3.087-3.091)  
Language Comprehension (3.092-3.098)  
Language Production (3.099-3.104)  
Bi/Multi-lingualism (3.105-3.111)

## Condensed Schedule B

ROOM	1	2	3
<b>THURSDAY EVENING</b>			
	SYMPOSIUM 07: From unconscious processing to metacognition: Are we explaining consciousness yet?	SYMPOSIUM 01: Prediction and integration during language comprehension	SYMPOSIUM 02: Contingency and causality: From cognitive theories to clinical reasoning, social stereotypes, pseudoscience, and legal issues **
<b>FRIDAY MORNING</b>	08:30-10:30	08:30-10:30	08:30-10:30
	Modeling 10:50-11:50	Dyslexia 10:50-11:50	Emotions 10:50-11:50
<b>FRIDAY NOON</b>			
<b>FRIDAY AFTERNOON</b>	Face Recognition 14:20-15:00 *	Orthographic Processing 14:20-16:00	Attention 14:20-16:00
<b>FRIDAY EVENING</b>			
	SYMPOSIUM 10: Timing and Language ***	SYMPOSIUM 09: Recent developments in the cognitive neuroscience of number processing	SYMPOSIUM 14: Affective modulation of cognitive control processes
<b>SATURDAY MORNING</b>	08:30-10:30	08:30-10:30	08:30-10:30
	Sentence and Text Processing 10:50-11:50	Language Acquisition 10:50-11:50	Object Recognition 10:50-11:50
<b>SATURDAY NOON</b>			
	SYMPOSIUM 16: Memory consolidation: Surprisingly pervasive effects on language, at multiple levels	SYMPOSIUM 15: Bilingual word and sentence processing: Electrophysiological investigations	SYMPOSIUM 17: Interactions Between Vision and Language: The state of the art
<b>SATURDAY AFTERNOON</b>	14:20-16:00 Perception and Action 16:20-17:20	14:20-16:00 Numerical Cognition 16:20-17:20	14:20-16:00 Learning 16:20-17:20

Poster Session 1 (PS\_1): Friday 17:20 – 19:20

Poster Session 2 (PS\_2): Saturday 17:20 – 19:20

Social Event- Wine tasting: Friday 20:00 (Previous On-line registration required)

Conference dinner: Saturday 20:30 (Previous On-line registration required)

\* Oral Session 13.3 & 13.4, 15:00 – 15:40

\*\* Oral Session 02\* (OS\_02\*) Beginning of SY\_02

\*\*\* Oral Session 14\* (OS\_14\*) Beginning of SY\_10

Condensed Schedule B

4	5	6	AUDITORIUM
KEYNOTE LECTURE 1 19:30-20:30			
SYMPOSIUM 05: Learning novel grammars, vocabularies and orthographies: developmental and neural perspectives	SYMPOSIUM 06: Functional characteristics of instructed and practiced task-sets	SYMPOSIUM 04: Number processing: core deficits and recent developments in cognitive intervention	SYMPOSIUM 03: Visual-word recognition: The state of the art
08:30-10:30	08:30-10:30	08:30-10:30	08:30-10:30
Memory 10:50-11:50	Bi/Multi-lingualism 10:50-11:50	Executive Control 10:50-11:50	Social Cognition 10:50-11:50
KEYNOTE LECTURE 2 12:00-13:00			
Executive Control	Spatial Cognition	Human Learning	PLENARY SYMPOSIUM SY_08: Where is Embodiment going? 15:00-16:00
14:20-16:00	14:20-16:00	14:20-16:00	KEYNOTE LECTURE 3 16:20-17:20
ESCoP BUSINESS MEETING 19:00-20:00			
SYMPOSIUM 11: Perceiving transformed movements when using tools	SYMPOSIUM 13: Orthographic variation and brain processes: A non-alphabetic perspective	Auditory Perception	SYMPOSIUM 12: Neurocognitive correlates of Cognitive Control
08:30-10:30	08:30-10:30	08:30-10:30	08:30-10:30
Emotions 10:50-11:50	Abnormal Psychology 10:50-11:50	Working Memory 10:50-11:50	Attention 10:50-11:50
KEYNOTE LECTURE 4 12:00-13:00			
Motor Control	SYMPOSIUM 19: Reasoning as Memory	SYMPOSIUM 18: Recent advances in the research on strategy selection and execution in mathematics problem solving	SYMPOSIUM 20: Inside the Social Brain: Developmental, Linguistic, Cognitive and Brain Mechanisms
14:20-16:00	14:20-16:00	14:20-16:00	14:20-16:00
Skill Acquisition and Attention in Aging 16:20-17:20	Time and Cognition 16:20-17:20	Working Memory 16:20-17:20	Language Production 16:20-17:20

LUNCH & COFFEE BREAKS

Friday 30

- ✓ Coffee breaks: 10:30-10:50 & 16:00-16:20
- ✓ Lunch: 13:00-14:20

Saturday 1

- ✓ Coffee breaks: 10:30-10:50 & 16:00-16:20
- ✓ Lunch: 13:00-14:20

Condensed Schedule B

ROOM	1	2	3
SUNDAY MORNING	SYMPOSIUM 24: Auditory learning	SYMPOSIUM 23: Neurocognitive bases of learning and consolidation for spoken and written language	SYMPOSIUM 21: The emergence of lexical networks in the second year of life
	09:30-11:10	09:30-11:10	09:30-11:10
SUNDAY NOON	SYMPOSIUM 30: Context modulations of neurocognitive processes evoked by counterintuitive meanings	SYMPOSIUM 29: L1 influences on L2 revisited	SYMPOSIUM 32: The cognitive neuropsychiatry of delusional belief
	11:30-13:10	11:30-13:10	11:30-13:10
SUNDAY AFTERNOON	Perception and action 15:40-16:40	Judgment and Decision Making 15:40-16:40	Executive Control 15:40-16:40
SUNDAY EVENING	Working Memory 17:00-18:00	Language Comprehension 17:00-18:00	Bu/Multi-lingualism 17:00-18:00

Poster Session 3 (PS\_3): Sunday 18:00 – 20:00

- ✓ Coffee breaks: 11:10-11:30 & 16:40-17:00
- ✓ Lunch: 14:20-15:40

Condensed Schedule B

4	5	6	AUDITORIUM
SYMPOSIUM 26: Response-related effects in task switching	SYMPOSIUM 22: Do we need vision? The effects of visual impairment on the development of the cognitive system	Orthographic Processing	SYMPOSIUM 25: Face perception: ERP correlates of rapid adaptation, category-selectivity, recognition, and individual differences
09:30-11:10	09:30-11:10	09:30-11:10	09:30-11:10
SYMPOSIUM 27: Processing frequent multi-words expressions: behavioral and electrophysiological perspectives	Executive Control	SYMPOSIUM 31: Motor and perceptual aspects of temporal expectation	PLENARY SYMPOSIUM SY_28: Feedback processing and the brain: The ESCAN symposium at ESCoP
11:30-13:10	11:30-13:10	11:30-13:10	11:10-13:10
Implicit Learning 15:40-16:40	Cognitive Development 15:40-16:40	Social Cognition 15:40-16:40	KEYNOTE LECTURE 5 13:20-14:20 Language Comprehension 15:40-16:40
Implicit Learning 17:00-18:00	Attention 17:00-18:00	Consciousness 17:00-18:00	Emotions 17:00-18:00

**THURSDAY EVENING**  
**KEYNOTE LECTURE 1: 19:30-20:30**  
**Dana Small (AUDITORIUM)**

**FRIDAY MORNING**  
**Spoken Sessions: 08:30-10:30**

**SY\_01 - Prediction and integration during language comprehension** *Martin, Nieuwland & Costa. (Room 2)*

(SY\_01.1) Corley, MacGregor & Donaldson  
(SY\_01.2) McRae, Metusalem, Kutas, Urbach, Hare & Elman  
(SY\_01.3) Joergensen & Altmann  
(SY\_01.4) Moreno  
(SY\_01.5) Nieuwland & Martin  
(SY\_01.6) Martin, Thierry, Kuipers & Costa

**SY\_02 - Contingency and causality: From cognitive theories to clinical reasoning, social stereotypes, pseudoscience, and legal issues.** *Matute & Cobos. (Room 3)*

\* (OS\_02\*) Byrne  
(SY\_02.1) Cobos, Flores, López, Godoy & González-Martín  
(SY\_02.2) Hagmayer  
(SY\_02.3) Murphy  
(SY\_02.4) Lagnado, Harris & Cullen  
(SY\_02.5) Matute, Yarritu Corrales & Vadillo

**SY\_03 - Visual-word recognition: The state of the art.** *Perea. (Auditorium)*

(SY\_03.1) Gomez, Perea & Moret-Tatay  
(SY\_03.2) Norris & Kinoshita  
(SY\_03.3) Brysbaert, Keuleers & Diependaele  
(SY\_03.4) Lupker, Acha, Davis & Perea  
(SY\_03.5) Duñabeitia, Molinaro & Carreiras  
(SY\_03.6) Grainger

**SY\_04 - Number processing: core deficits and recent developments in cognitive intervention** *Goebel & Kaufmann. (Room 4)*

(SY\_04.1) Goebel, Pixner & Kaufmann  
(SY\_04.2) Reynvoet, Defever & Goebel  
(SY\_04.3) Szucs, White & Soltesz  
(SY\_04.4) Nuerk, Fischer, Moeller & Cress  
(SY\_04.5) Hannula-Sormunen, Rasanen, Mattinen, Kajamies & Lehtinen

**SY\_05 - Learning novel grammars, vocabularies and orthographies: developmental and neural perspectives.** *Taylor. (Room 4)*

(SY\_05.1) Litt, Nation & Watkins  
(SY\_05.2) Duff & Hulme  
(SY\_05.3) Wonnacott  
(SY\_05.4) Cunillera  
(SY\_05.5) Hulten  
(SY\_05.6) Taylor, Rastle & Davis

**SY\_06 - Functional characteristics of instructed and practiced task-sets.** *Liefooghe, Wenke & Dreisbach. (Room 6)*

(SY\_06.1) Liefooghe, Wenke & De Houwer  
(SY\_06.2) Oberauer, Souza da Silva, Druey & Gade  
(SY\_06.3) Stephan & Koch  
(SY\_06.4) Dreisbach & Wenke  
(SY\_06.5) Verguts  
(SY\_06.6) Wenke, Liefooghe & De Houwer

**SY\_07 - From unconscious processing to metacognition: Are we explaining consciousness yet?** *Cleeremans. (Room 1)*

(SY\_07.1) Lau  
(SY\_07.2) Cleeremans, Pasquali & Timmermans  
(SY\_07.3) Scott & Dienes  
(SY\_07.4) Dienes  
(SY\_07.5) Norman, Scott, Jones, Price & Dienes  
(SY\_07.6) Jiménez & Méndez

\* (OS\_02\*) *Beginning of SY\_02*

**FRIDAY MORNING**  
**Spoken Sessions: 10:50-11:50**

**OS\_01. Dyslexia (Room 2)**

(OS\_01.1) Serrano Chica, Lupiáñez, Soccini & Defior  
(OS\_01.2) Casini, Pech-Georgel, Burle & Ziegler  
(OS\_01.3) Szmalec, Loncke, Page & Duyck

**OS\_02. Memory (Room 4)**

(OS\_02.1) Bell, Buchner, Erdfelder, Giang, Schain & Riether  
(OS\_02.2) Topolinski  
(OS\_02.3) Spataro, Rossi-Arnaud & Mulligan

**OS\_03. Emotions (Room 3)**

(OS\_03.1) Rummer & Schweppe  
(OS\_03.2) Mazzietti & Koenig  
(OS\_03.3) Olszanowski, Balas & Klyszejko

**OS\_04. Executive Control (Room 6)**

(OS\_04.1) Karbach & Brieber  
(OS\_04.2) Stevens & Monsell  
(OS\_04.3) Alfimova, Korovaitseva, Lezheiko & Golimbet

**OS\_05. Bi/Multi-lingualism (Room 5)**

(OS\_05.1) Martín, Macizo & Bajo  
(OS\_05.2) Ferré, Sánchez-Casas & Fraga  
(OS\_05.3) Comesaña, Soares, Sánchez-Casas, Frade, Rauber, Pinheiro & Fraga

**OS\_06. Modeling (Room 1)**

(OS\_06.1) Andrews & Vigliocco  
(OS\_06.2) Keuleers & Brysbaert  
(OS\_06.3) Sima

**OS\_07. Social Cognition (Room 7)**

(OS\_07.1) Böckler, Knoblich & Sebanz  
(OS\_07.2) Desmet, Deschrijver, Fias & Brass  
(OS\_07.3) Ondobaka, de Lange, Newman-Norlund, Wiemers & Bekkering

**FRIDAY NOON**  
**KEYNOTE LECTURE 2: 12:00-13:00**  
**Randy Martin (AUDITORIUM)**

**FRIDAY AFTERNOON**  
**Spoken Sessions: 14:20-16:00**

**SY\_08 - PLENARY SYMPOSIUM. Where is Embodiment going? *Semin.* (Auditorium)**

(SY\_08.1) Glenberg  
(SY\_08.2) Hommel  
(SY\_08.3) Schwarz & Lee  
(SY\_08.4) Vigliocco

**OS\_08. Human Learning (Room 6)**

(OS\_08.1) Bertels, Franco, San Anton & Destrebecqz  
(OS\_08.2) Vadillo & Ortega-Castro  
(OS\_08.3) Blanco, Matute & Vadillo  
(OS\_08.4) Gaschler, Vaterrodt & Frensch  
(OS\_08.5) Ortega-Castro, Barberia, Vadillo & Baker

**OS\_09. Executive Control (Room 4)**

(OS\_09.1) Barenberg, Berse, Hilboll & Dutke  
(OS\_09.2) Alario, Ostrand, Thoenig & Burle  
(OS\_09.3) Berse, Dutke, Uhlenbrock, Völker & Knecht  
(OS\_09.4) Lawo, Philipp, Schuch & Koch  
(OS\_09.5) Gade & Paelecke

**OS\_10. Attention (Room 3)**

(OS\_10.1) Soetens, Henderickx, Maetens & Deroost  
(OS\_10.2) Goethe & Oberauer  
(OS\_10.3) Kyllingsbæk, Sy & Giesbrecht  
(OS\_10.4) Reuss, Kiesel, Pohl & Kunde  
(OS\_10.5) Martella, Roca, Marotta, López-Ramón, Castro, Lupiáñez & Fuentes

**OS\_11. Spatial Cognition (Room 5)**

(OS\_11.1) Gyselinck, Picucci & Bosco  
(OS\_11.2) Dorianne, Perrussel & Gyselinck  
(OS\_11.3) Galati, Michael, Greenauer, Mello & Avraamides  
(OS\_11.4) van Elk & Blanke  
(OS\_11.5) Saracini, Bluemel & Olivetti Belardinelli

**OS\_12. Orthographic Processing (Room 2)**

(OS\_12.1) Ktori, Grainger, Dufau & Holcomb  
(OS\_12.2) Pattamadilok, Colin, Morais & Kolinsky  
(OS\_12.3) Dimitropoulou, Carreiras & Duñabeitia  
(OS\_12.4) Bosse, Chaves & Largy  
(OS\_12.5) Petrova & Gaskell

**OS\_13. Face Recognition (Room 1)**

(OS\_13.1) Arnold & Sieroff  
(OS\_13.2) Lowenthal, Fortemps & Wautie  
(OS\_13.3) Aguado, Valdes-Conroy & Fernandez-Cahill  
(OS\_13.4) Vandierendonck & Liefoghe

**FRIDAY AFTERNOON**  
**KEYNOTE LECTURE 3: 16:20-17:20**  
**Antonino Vallesi (AUDITORIUM)**



## FRIDAY EVENING

### Poster Session 1 (1.001-1.085): 17:20-19:20

#### • Applied Cognitive Psychology •

- (1.001) Herzig, Nutt & Mohr
- (1.002) Sokka, Kalakoski, Haavisto, Korpela, Henelius, Lukander & Huotilainen
- (1.003) Paulewicz, Blaut & Gronostaj
- (1.004) Bengoetxea, Peña, García & Ojeda

#### • Visual Perception •

- (1.005) Samuel & Kerzel
- (1.006) Navarro
- (1.007) Asanowicz, Śmigasiewicz & Verleger
- (1.008) Madec, Arnaud & Grainger
- (1.009) Garaizar, Vadillo & Matute

#### • Perception and Action •

- (1.010) Massen, Rieger & Sülzenbrück
- (1.011) Nishimura, Ariga & Michimata
- (1.012) Nakayama & Saito
- (1.013) Ottoboni, Borghi & Tessari
- (1.014) Pellicano & Binkofski
- (1.015) Ladwig, Sutter, Müsseler, Wendler & Bade

#### • Attention •

- (1.016) Risom, Lien & Ruthruff
- (1.017) Menor de Gaspar
- (1.018) Laura Gabriela & Siéhoff
- (1.019) Vermeulen, Chang & Mermillod
- (1.020) Dampure, Rouet, Ros & Vibert
- (1.021) Dalmaso, Pavan, Castelli & Galfano
- (1.022) Panadero Sanchis, Castellanos & Tudela Gramendia
- (1.023) Thomaschke & Dreisbach
- (1.024) Roca, Castro, López-Ramón & Lupiáñez

#### • Emotions •

- (1.025) Macizo, Boldini & Herrera
- (1.026) Jellema & Palumbo
- (1.027) Orzechowski, Smieja & Asanowicz
- (1.028) Mathy, Dumay & Faurous
- (1.029) Tedesco, Croisile & Reynaud
- (1.030) Pêcher & Lemerrier
- (1.031) Moldovan, Ferré, Guasch & Sánchez-Casas

#### • Executive Control •

- (1.032) Sackur
- (1.033) Bardi & Mapelli
- (1.034) Pacheco Ungueti, Rueda, Castellanos, Acosta & Lupiáñez
- (1.035) Steinhäuser
- (1.036) Kleinsorge
- (1.037) Kolańczyk, Reszko & Mordasiewicz
- (1.038) Zinke, Einert, Pfennig & Kliegel

#### • Motor Control •

- (1.039) Ruitenberg & Verwey
- (1.040) Kirsch
- (1.041) Dreszer-Drogorób, Szelag & Osinski
- (1.042) Kunde, Lozo & Neumann
- (1.043) Harrison, Meyer & Wuergler

#### • Numerical Cognition •

- (1.044) Sobanska, Szumska, Warakowski & Jaskowski
- (1.045) Didino, Vespignani & Lombardi
- (1.046) Iza, Rodriguez, Calleja, Garcia & Damas
- (1.047) Herrera, Macizo, Flores & Juárez
- (1.048) Nys & Content
- (1.049) Cipora & Wood

#### • Patient Studies •

- (1.050) Chevalère, Postal, Jauregi, Copet, Laurier & Thuilleaux
- (1.051) Mayor
- (1.052) Triviño, Arnedo, Lupiáñez, Chirivella & Correa
- (1.053) Rusted, Broulidakis, Dowell & Ruest
- (1.054) Colin, Ecalte, Truy, Lina-Granade & Magnan

#### • Judgement and Decision Making •

- (1.055) Luini, Marucci & Mastroberardino
- (1.056) Schrooten & Vlaeyen
- (1.057) Keuken, Forstmann & Van Maanen
- (1.058) Mulder, Forstmann & Wagenmakers
- (1.059) Beatty & Ball
- (1.060) Braverman & Meiran

#### • Human Learning/Implicit Learning •

- (1.061) Orgaz, Matute & Vadillo
- (1.062) Yarritu Corrales & Matute
- (1.063) Schmitz & Wentura
- (1.064) Pasquali, Gaillard & Cleeremans
- (1.065) Pichon, Kissine & Destrebecqz
- (1.066) Coomans, Deroost, Van den Bussche & Soetens

#### • Memory •

- (1.067) Rossi-Arnaud, Spataro, Pieroni & Cestari
- (1.068) Horn, Bell, Bayen & Buchner
- (1.069) Riou & Versace
- (1.070) Larsson Sundqvist, Todorov & Jönsson
- (1.071) Yannick & Serge
- (1.072) Cherdieu, Mazza & Versace
- (1.073) Jean-Baptiste, Fiori & Nicolas
- (1.074) Ishibashi, Ikeda & Osaka
- (1.075) Estévez, Esteban, Melero, Vivas, López-Crespo & Easton

#### • Working Memory •

- (1.076) Kalakoski, Akila, Vuori & Puttonen
- (1.077) Schweppe, Grice & Rummer
- (1.078) Oftinger & Camos
- (1.079) Perriard & Camos
- (1.080) Sant'Anna Pereira & Galera
- (1.081) Barrett

#### • Semantic Memory •

- (1.082) Ishibashi, Lambon Ralph, Saito & Pobric
- (1.083) Mirman & Graziano
- (1.084) Kent, Matthews, Bolbecker, Rass, Klaunig, Jones, O'Donnell & Hetrick
- (1.085) Yee, Chrysikou, Hoffman & Thompson-Schill

## FRIDAY EVENING

### Poster Session 1 (1.086-1.123): 17:20-19:20

#### • Speech Perception •

- (1.086) Maionchi-Pino, Takahashi, Yokoyama, Écalle, Magnan & Kawashima  
(1.087) Spinelli, Sumner & Johnson  
(1.088) Feldker, Hirschfeld & Zwitterlood  
(1.089) Villegas, Aubanel & Cooke  
(1.090) Dekerle, Boulenger & Meunier

#### • Language Acquisition/Cognitive Development •

- (1.091) Potocki, Ecalle & Magnan  
(1.092) Lendinez Rodríguez, Pelegrina López, Lechuga García & Martín Puga  
(1.093) Kleinsz, Ecalle & Magnan  
(1.094) Vivas Fernández, López Ornat, Karousou & Gallego  
(1.095) Knoll, Brauer & Friederici  
(1.096) Labat, Ecalle & Magnan

#### • Language Comprehension •

- (1.097) Bien, Hanulikova, Weber & Zwitterlood  
(1.098) Robert, Zagar & Mathey  
(1.099) Marino, Borghi & Riggio  
(1.100) Mancuso & Laudanna  
(1.101) Stregapede, Meyer & Miall  
(1.102) Kwon & Sturt  
(1.103) Kwon & Sturt  
(1.104) Hancock & Bever

#### • Sentence and Text Processing •

- (1.105) Fahrat & Tapiero  
(1.106) Morera, León & de Vega  
(1.107) Lobina & Garcia-Albea  
(1.108) Irmen & Schumann

#### • Language Production •

- (1.109) Shao, Roelofs & Meyer  
(1.110) Navarrete, Sessa, Mulatti & Dell'Acqua  
(1.111) Jescheniak, Oppermann, Schriefers, Klaus & Berwig  
(1.112) Amore & Laudanna  
(1.113) Biedermann, Lorenz, Beyersmann, Schiller & Nickels  
(1.114) Finocchiaro & Nevins

#### • Bi/Multi-lingualism •

- (1.115) Foucart, Santesteban, Branigan & Pickering  
(1.116) Branzi, FitzPatrick, Abutalebi & Costa  
(1.117) Philipp & Koch  
(1.118) Lin & Tzeng  
(1.119) Morales, Bajo & Gómez-Ariza  
(1.120) Burani, Primativo, Arduino, O'Brien, Paizi & Rinaldi

#### • Dyslexia •

- (1.121) Frost, Landi, Preston, Mencl, Fulbright & Pugh  
(1.122) Mahe, Bonnefond & Doignon-Camus  
(1.123) Cameirão & Vicente

## SATURDAY MORNING

### Spoken Sessions: 08:30-10:30

#### **SY\_09 - Recent developments in the cognitive neuroscience of number processing.** *Reynvoet & Gevers.* **(Room 2)**

(SY\_09.1) Santens & Verguts  
(SY\_09.2) Sasanguie, Reynvoet & Goebel  
(SY\_09.3) Previtali, Ginsburg, Vermeiren, Van Dijck & Gevers  
(SY\_09.4) Doricchi  
(SY\_09.5) Lindemann & Krausse  
(SY\_09.6) Popescu, Sader, Thomas, Terhune, Cohen Kadosh, Dowker & Cohen Kadosh

#### **SY\_10 - Timing and Language.** *de Diego-Balaguer & Kotz.* **(Room 1)**

\* (OS\_14\*) Van Campen, Van den Wildenberg, Ridderinkhof  
(SY\_10.1) Penhune  
(SY\_10.2) Lehongre, Ramus, Schwartz, Pressnitzer & Giraud  
(SY\_10.3) de Diego-Balaguer, Lopez-Barroso, Rodriguez-Fornells & Bachoud-Lévi  
(SY\_10.4) Idsardi  
(SY\_10.5) Kotz

#### **SY\_11 - Perceiving transformed movements when using tools.** *Sutter & Suelzenbrueck.* **(Room 4)**

(SY\_11.1) Osiurak  
(SY\_11.2) Farnè, Cardinali, Brozzoli & Roy  
(SY\_11.3) Hermsdörfer, Randerath, Goldenberg, Stadler & Dieler  
(SY\_11.4) Suelzenbrueck, Sutter & Ladwig  
(SY\_11.5) Holmes  
(SY\_11.6) Watt, Diedrichsen & Takahashi

#### **SY\_12 - Neurocognitive correlates of Cognitive Control.** *Colzato.* **(Auditorium)**

(SY\_12.1) Colzato  
(SY\_12.2) Forstmann  
(SY\_12.3) Hommel  
(SY\_12.4) van den Wildenberg  
(SY\_12.5) Cohen & Israel  
(SY\_12.6) Jahfari

#### **SY\_14 - Affective modulation of cognitive control processes.** *Schuch & Koch.* **(Room 3)**

(SY\_14.1) Katzir, Eyal, Meiran & Kessler  
(SY\_14.2) van Steenbergen, Band, Hommel, Rombouts & Nieuwenhuis  
(SY\_14.3) Braem, Verguts, Roggeman & Notebaert  
(SY\_14.4) Froeber & Dreisbach  
(SY\_14.5) Owens & Derakshan  
(SY\_14.6) Schuch & Koch

#### **SY\_13 - Orthographic variation and brain processes: A non-alphabetic perspective.** *Lee, Lee & Tzeng.* **(Room 5)**

(SY\_13.1) Lee, Chang & Shen  
(SY\_13.2) Lee  
(SY\_13.3) Kuo, Lee, Lee & Tzeng  
(SY\_13.4) Wu & Lin  
(SY\_13.5) Tsai  
(SY\_13.6) Tzeng

#### **OS\_14. Auditory perception and Multisensory integration** **(Room 6)**

(OS\_14.1) Mayr, Möller & Buchner  
(OS\_14.2) Lukas, Philipp & Koch  
(OS\_14.3) Colin, Hoonhorst, Markessis, Collet, Pablos Martin & Deltenre  
(OS\_14.4) Heimler & Pavani  
(OS\_14.5) Leybaert, Berthommier & Huyse  
(OS\_14.6) Dubois, Poeppel & Pelli

\* (OS\_14\*) *Beginning of SY\_10*

**SATURDAY MORNING**  
**Spoken Sessions: 10:50-11:50**

**OS\_15. Working Memory (Room 6)**

(OS\_15.1) Camos & Mora  
(OS\_15.2) Delogu, Nijboer & Postma  
(OS\_15.3) Kessler & Guy

**OS\_16. Abnormal Psychology (Room 5)**

(OS\_16.1) Vandenbossche, Deroost, Soetens,  
Coomans, Nieuwboer & Kerckhofs  
(OS\_16.2) Priftis, Umiltà & Zorzi  
(OS\_16.3) Price

**OS\_17. Language Acquisition (Room 2)**

(OS\_17.1) Diaz & Mesa  
(OS\_17.2) Altvater-Mackensen & Mani  
(OS\_17.3) Henderson, Weighall & Gaskell

**OS\_18. Emotions (Room 4)**

(OS\_18.1) Schacht, Adler, Guo & Sommer  
(OS\_18.2) Gillioz & Gyga  
(OS\_18.3) Sweklej, Balas, Pochwatko & Godlewska

**OS\_19. Attention (Auditorium)**

(OS\_19.1) Hughes, Hurlstone, Vachon & Jones  
(OS\_19.2) Atas, Vermeiren & Cleeremans  
(OS\_19.3) Peressotti, Pesciarelli, Mulatti &  
Dell'Acqua

**OS\_20. Sentence and Text Processing (Room 1)**

(OS\_20.1) Zawiszewski, Erdocia, Santesteban &  
Laka  
(OS\_20.2) Frank  
(OS\_20.3) Foster & Keane

**OS\_21. Object Recognition & Visual Processing  
(Room 3)**

(OS\_21.1) Pascucci, Mastropasqua & Turatto  
(OS\_21.2) Hartendorp, Van der Stigchel, Hooge &  
Postma  
(OS\_21.3) Van der Haegen & Brysbaert

**SATURDAY NOON**  
**KEYNOTE LECTURE 4: 12:00-13:00**  
**Cathy Price (AUDITORIUM)**

## SATURDAY AFTERNOON

### Spoken Sessions: 14:20-16:00

**SY\_15 - Bilingual word and sentence processing: Electrophysiological investigations.** *Tokowicz & van Hell.* (Room 2)

(SY\_15.1) Davidson  
(SY\_15.2) Midgley, Holcomb & Grainger  
(SY\_15.3) Tokowicz, Tolentino, Warren & Tuninetti  
(SY\_15.4) Brenders, van Hell & Dijkstra  
(SY\_15.5) Rossi, Dussias & Kroll

**SY\_16 - Memory consolidation: Surprisingly pervasive effects on language, at multiple levels.** *Dumay & Samuel.* (Room 1)

(SY\_16.1) Rastle & Davis  
(SY\_16.2) Dumay & Bowers  
(SY\_16.3) Gaskell  
(SY\_16.4) Nusbaum

**SY\_17 - Interactions Between Vision and Language: The state of the art.** *Lupyan.* (Room 3)

(SY\_17.1) Lupyan  
(SY\_17.2) Yee, Huffstetler & Thompson-Schill  
(SY\_17.3) Altmann  
(SY\_17.4) Ozgen  
(SY\_17.5) Richardson & Dale

**SY\_18 - Recent advances in the research on strategy selection and execution in mathematics problem solving.** *Imbo & Luwel.* (Room 6)

(SY\_18.1) Thevenot  
(SY\_18.2) Grabner & De Smet  
(SY\_18.3) Ardiale & Lemaire  
(SY\_18.4) Imbo & LeFevre  
(SY\_18.5) Luwel, Foustana, Papadatos & Verschaffel

**SY\_19 - Reasoning as Memory.** *Tokowicz & van Hell.* (Room 5)

(SY\_19.1) Sloutsky  
(SY\_19.2) Hayes & Heit  
(SY\_19.3) Feeney & Leckey  
(SY\_19.4) Markovits, Forgues & Brunet  
(SY\_19.5) Thompson

**SY\_20 - Inside the Social Brain: Theory, Development, Cognitive and Brain Mechanisms.** *Cross & Bekkering.* (Auditorium)

(SY\_20.1) Bekkering  
(SY\_20.2) Rueschemeyer  
(SY\_20.3) Brass  
(SY\_20.4) Ramsey

**OS\_22. Motor control (Room 4)**

(OS\_22.1) Tessari, Perazzolo, Ceciliani & Ottoboni  
(OS\_22.2) Rigoni, Brass & Burle  
(OS\_22.3) Ziessler & Nattkemper  
(OS\_22.4) Waszak, Schuetz-Bosbach, Weiss & Ticini  
(OS\_22.5) Cardinali, Brozzoli, Luauté, Roy & Farnè

**SATURDAY AFTERNOON**  
**Spoken Sessions: 16:20-17:20**

**OS\_23. Working Memory (Room 6)**

(OS\_23.1) Lucidi & Barrouillet  
(OS\_23.2) Barrouillet, De Paepe & Langerock  
(OS\_23.3) Corbin & Camos

**OS\_24. Language Production (Auditorium)**

(OS\_24.1) Wheeldon, Ohlson, Ashby & Gater  
(OS\_24.2) Qu, Damian, Zhang & Zhu  
(OS\_24.3) Ganushchak, Acheson, Christoffels & Hagoort

**OS\_25. Time and Cognition (Room 5)**

(OS\_25.1) Bisiacchi, Tarantino, Cona & Arcara  
(OS\_25.2) Rattat & Picard  
(OS\_25.3) Haering & Kiesel

**OS\_26. Skill Acquisition and Attention in Aging (Room 4)**

(OS\_26.1) Lien, Gemperle & Ruthruff  
(OS\_26.2) Strobach, Frensch, Müller & Schubert  
(OS\_26.3) Bilalic

**OS\_27. Learning (Room 3)**

(OS\_27.1) Balas & Sweklej  
(OS\_27.2) Lemerrier  
(OS\_27.3) Deroost, Vandenbossche, Zeischka, Coomans & Soetens

**OS\_28. Numerical Cognition (Room 2)**

(OS\_28.1) Zorzi & Stoianov  
(OS\_28.2) Ranzini, Anelli, Borghi, Carbone, Lugli & Nicoletti  
(OS\_28.3) Campbell, Dowd & Thompson

**OS\_29. Perception and Action (Room 1)**

(OS\_29.1) Pfister, Melcher, Kiesel, Dechent & Gruber  
(OS\_29.2) Band, Piederiet, Hultzer & Hamming  
(OS\_29.3) Cross, Liepelt, Prinz & Hamilton

## SATURDAY EVENING

### Poster Session 2 (2.001-2.089): 17:20-19:20

#### • Consciousness •

- (2.001) Szczepanowski
- (2.002) Vermeiren, Beyens, Fu & Cleeremans
- (2.003) Windey, Gevers & Cleeremans
- (2.004) Pohl, Pfister, Kiesel & Kunde
- (2.005) Barandiaran & Di Paolo

#### • Attention •

- (2.006) Iani, Stella & Rubichi
- (2.007) Aznar-Casanova, Amador, Moreno & Sole
- (2.008) Gálvez García, Zwick, Plaza & Michael
- (2.009) Pieczykolan & Huestegge
- (2.010) Janczyk & Kunde
- (2.011) Huestegge & Koch
- (2.012) Stolarski, Ledzińska & Zdral
- (2.013) Pilling & Gellatly
- (2.014) Comparetti, Pichon, Ricciardelli & Vuilleumier

#### • Perception and Action •

- (2.015) Dolk, Hommel, Prinz & Liepelt
- (2.016) Müsseler & Skottke
- (2.017) Ferraro, Rubichi, Nicoletti, Iani & Gallese
- (2.018) Sutter, Skottke & Müsseler
- (2.019) Bednarek

#### • Face and Object Recognition •

- (2.020) Forster, Leder & Gerger
- (2.021) Suegami & Michimata
- (2.022) Sierro, Mohr, Hadjikhani & Brandner
- (2.023) Fernandes & Albuquerque
- (2.024) Davies, Walker & Ziessler

#### • Emotions •

- (2.025) Czajak & Cipora
- (2.026) Faurous, Dumay & Mathey
- (2.027) Marta & Nęcka
- (2.028) Rebernjak
- (2.029) Bayer, Sommer & Schacht
- (2.030) Traczyk, Szczepanowski & Fan
- (2.031) Dael, Goudbeek & Scherer

#### • Executive Control •

- (2.032) Juan, Yu, Tseng, Muggleton, Tzeng & Hung
- (2.033) Torres-Quesada, Funes & Lupiáñez
- (2.034) Postal, Copet, Jauregi & Thuilleaux
- (2.035) Nigbur & Stürmer
- (2.036) Honma, Shiozaki, Utsumi, Goto & Saito
- (2.037) Ruiz Muñoz, Colzato, Bajo, van den Wildenberg & Hommel
- (2.038) Schouppe, Ridderinkhof, De Houwer, Verguts & Notebaert
- (2.039) Galer, Schmitz, De Tiège, Van Bogaert & Peigneux

#### • Human and Implicit Learning •

- (2.040) Vuong, Meyer & Christiansen
- (2.041) Pérez Cubillas & Vadiello
- (2.042) Siemieniuk, Sweklej & Balas
- (2.043) van Asselen, Rodrigues & Castelo-Branco
- (2.044) de Vries, Reed, Gemmink & Jolles
- (2.045) Bertels, Demoulin, San Anton, Franco & Destrebecqz

#### • Memory •

- (2.046) Deliens, Schmitz, Mary & Peigneux
- (2.047) Brouillet, Milhau, Heurley, Ferrier, Rolland-Thiers & Brouillet
- (2.048) Lesourd & Versace
- (2.049) Cosenza, Brandimonte, Cicogna & Nigro
- (2.050) Cubelli, Sellaro & Fiorino
- (2.051) Ortega Segura, Gómez-Ariza & Bajo
- (2.052) Albuquerque & Miranda
- (2.053) Todorov, Larsson Sundqvist & Jönsson
- (2.054) Entwistle & Rusted
- (2.055) Balouch & Rusted

#### • Working Memory •

- (2.056) van Genuchten, Scheiter & Schüller
- (2.057) Plancher, Stocker & Barrouillet
- (2.058) Vergauwe, Barrouillet & Camos
- (2.059) Bourke, Davies, Sumner & Green
- (2.060) Acheson & Hagoort
- (2.061) Coltheart

#### • Episodic and Semantic Memory •

- (2.062) Karlsson, Sikström & Willander
- (2.063) Brunetti, Delogu, Del Gatto, Del Grosso & D'Ausilio
- (2.064) Kubik, Jönsson, Knopf & Nilsson

#### • Numerical Cognition •

- (2.065) Szucs, White & Soltesz
- (2.066) Mussolin, Hoffmann, Schiltz, Leybaert & Content
- (2.067) Patro & Cipora
- (2.068) Seyll & Content
- (2.069) Treccani, Sellaro, Job & Cubelli
- (2.070) Smets, Gebuis & Reynvoet

#### • Spatial Cognition •

- (2.071) Renzi, Ricciardi, Bonino, Handjaras, Vecchi & Pietrini
- (2.072) Avraamides, Galati, Meneghetti, Pazzaglia & Denis
- (2.073) Conson, Mazzarella & Trojano
- (2.074) van der Ham, van der Kuil & Delogu
- (2.075) Basso
- (2.076) Valdes-Conroy, Shorkey, Román & Hinojosa
- (2.077) Van Maanen, Grasman, Forstmann, Keuken, Brown & Wagenmakers

#### • Social Cognition •

- (2.078) Sellaro, Treccani, Rubichi & Cubelli
- (2.079) Cañadas, Niedenthal, Rodríguez-Bailón & Lupiáñez
- (2.080) Eder & Rothermund
- (2.081) Thiele, Foltz, Bartels, Kahsnitz & Stenneken
- (2.082) Reber
- (2.083) Hünefeldt, Ortu & Olivetti Belardinelli
- (2.084) Riggio, Marino & Mussi
- (2.085) Timmermans, Schilbach & Vogeley

#### • Orthographic Processing •

- (2.086) Bracco & Laudanna
- (2.087) Montani, Facchetti & Zorzi
- (2.088) Barca, Castrataro, Rinaldi & Caselli
- (2.089) Carrillo Gallego & Alegria Iscoa

## SATURDAY EVENING

### Poster Session 2 (2.090-2.124): 17:20-19:20

#### • Language Acquisition/Cognitive Development •

- (2.090) Dye, Walenski, Prado, Mostofsky & Ullman
- (2.091) López-Ornat, Gómez Martínez-Piñeiro & Gallego
- (2.092) Geukes & Zwitterlood
- (2.093) Dumay, Sharma, Kellen & Abdelrahim
- (2.094) Avecilla Ramirez, Ruiz-Correa, Marroquín, Harmony, Alba & Mendoza-Montoya
- (2.095) Mueller, Friederici & Männel
- (2.096) Havas, de Diego-Balaguer & Rodriguez-Fornells

#### • Language Comprehension •

- (2.097) Calderon, Ricardo-Garcell, Avecilla & Harmony
- (2.098) Becker, Knoeferle & Zwaan
- (2.099) Leonard, Ferjan Ramirez, Torres, Hatrak, Mayberry & Halgren
- (2.100) Siyanova-Chanturia, Pesciarelli & Cacciari
- (2.101) Urrutia, Domínguez, Hernández-Cabrera, León & De Vega
- (2.102) De Martino & Laudanna
- (2.103) De Scalzi, Oakhill & Rusted
- (2.104) Kung, Wu, Huang & Hsieh
- (2.105) Nordt, Keuper, Zwanzger & Dobel
- (2.106) Bobb & Mani

#### • Sentence and Text Processing •

- (2.107) Tavares, Fajardo, Ávila, Ferrer & Salmerón
- (2.108) Bultena, Dijkstra & Van Hell
- (2.109) Esaulova, Reali & Irmen
- (2.110) Fernández Hernández, Martín-Loeches, Casado Martínez, Jiménez-Ortega & Fondevila
- (2.111) Rausch, Krifka & Sommer

#### • Language Production •

- (2.112) Hantsch & Mädebach
- (2.113) Hanique & Ernestus
- (2.114) Schiller, Verdonshot, Kiyama, Tamaoka, Kinoshita & La Heij
- (2.115) Macizo, Herrera, Morales & Juárez
- (2.116) Janssen & Barber
- (2.117) Schnur

#### • Bi/Multi-lingualism •

- (2.118) Marzecová, Bukowski, Lupiáñez, Boros & Wodniecka
- (2.119) Murphy, Macaro, Alba & Cipolla
- (2.120) Calabria, Hernández, Marne, Juncadella, Reñé, Ortiz-Gil, Ugas, Lleó, Blesa & Costa
- (2.121) Bassetti
- (2.122) Tzeng
- (2.123) Wodniecka, Zeelenberg, Marzecová, Szewczyk & Taft
- (2.124) Franco, San Anton, Destrebecqz & Cleeremans



## **SUNDAY MORNING**

### **Spoken Sessions: 09:30-11:10**

#### **SY\_21 - The emergence of lexical networks in the second year of life. *Mayor*. (Room 3)**

(SY\_21.1) Arias-Trejo & Plunkett  
(SY\_21.2) Mani  
(SY\_21.3) Mayor  
(SY\_21.4) Plunkett & Sebastian-Galles  
(SY\_21.5) von Holzen & Mani

#### **SY\_22 - Do we need vision? The effects of visual impairment on the development of the cognitive system. *Vecchi & Postma*. (Room 4)**

(SY\_22.1) Struiksma, Noordzij, Barsalou & Postma  
(SY\_22.2) Amedi  
(SY\_22.3) Postma, Struiksma & Noordzij  
(SY\_22.4) Renier & De Volder  
(SY\_22.5) Cattaneo & Vecchi

#### **SY\_23 - Neurocognitive bases of learning and consolidation for spoken and written language. *Pugh & Rueckl*. (Room 2)**

(SY\_23.1) Karni  
(SY\_23.2) Pugh  
(SY\_23.3) Rueckl  
(SY\_23.4) Davis  
(SY\_23.5) Magnuson

#### **SY\_24 - Auditory learning. *Vroomen*. (Room 1)**

(SY\_24.1) Agus & Pressnitzer  
(SY\_24.2) Holt  
(SY\_24.3) Samuel & Kraljic  
(SY\_24.4) Seits & Protopapas  
(SY\_24.5) Ley, Hausfeld, Vroomen, Valente, de Weerd & Formisano

#### **SY\_25 - Face perception: ERP correlates of Rapid Adaptation, Category-selectivity, Recognition, and Individual Differences. *Schweinberger*. (Auditorium)**

(SY\_25.1) Eimer  
(SY\_25.2) Thierry, Dering, Martin & Pegna  
(SY\_25.3) Schweinberger  
(SY\_25.4) Sommer, Herzmann, Hildebrandt & Wilhelm

#### **SY\_26 - Response-related effects in task switching. *Hubner*. (Room 1)**

(SY\_26.1) Koch & Schuch  
(SY\_26.2) Druet  
(SY\_26.3) Grzyb & Hubner  
(SY\_26.4) Hubner & Grzyb  
(SY\_26.5) Meiran & Hsieh

#### **OS\_30 - Orthographic processing (Room 5)**

(OS\_30.1) Sausset, Lambert & Olive  
(OS\_30.2) Chetail & Content  
(OS\_30.3) Moret-Tatay, Perea & Rosa  
(OS\_30.4) Gobin, Faïta-Ainseba & Mathey  
(OS\_30.5) Castles & Kohnen

## SUNDAY NOON

### Spoken Sessions: 11:30-13:10

**SY\_27 - Processing frequent multi-words expressions: behavioral and electrophysiological perspectives.** *Vespignani & Cacciari.* **(Room 4)**

(SY\_27.1) Arnon  
(SY\_27.2) Siyanova-Chanturia, Conklin, Kaan & van Heuven  
(SY\_27.3) Vespignani & Cacciari  
(SY\_27.4) Rommers, Bastiaansen & Dijkstra  
(SY\_27.5) Katz

**SY\_28 - PLENARY SYMPOSIUM. Feedback processing and the brain: The ESCAN symposium at ESCoP.** *van der Molen.* **(Auditorium)**

(SY\_28.1) Vidal, Carbonnell, Sequeira & Caverni  
(SY\_28.2) Notebaert, Nunez Castellar, Van der Borgh & Fias  
(SY\_28.3) Ridderinkhof, van Wouwe, Band, van de Vijver, van den Wildenberg & Wylie  
(SY\_28.4) Falkenstein, Wild-Wall & Willemsen  
(SY\_28.5) van der Molen, Gunther Moor & Crone

**SY\_29 - L1 influences on L2 revisited.** *Román & Kotz.* **(Room 2)**

(SY\_29.1) Kroll, Misra & Guo  
(SY\_29.2) Van Hell & Tokowicz  
(SY\_29.3) Dussias  
(SY\_29.4) Kotz  
(SY\_29.5) Román, Gómez-Ariza & Bajo

**SY\_30 - Context modulations of neurocognitive processes evoked by counterintuitive meanings.** *Aristei & Sommer.* **(Room 1)**

(SY\_30.1) Molinaro, Carreiras & Andoni Duñabeitia  
(SY\_30.2) Regel, Gunter & Friederici  
(SY\_30.3) Fondevila, Martín-Loeches, Jiménez-Ortega, Casado, Fernández Hernández & Sommer  
(SY\_30.4) Aristei, Nehrllich, Knoop, Sommer, Lubrich, Jacobs & Abdel Rahman

**SY\_31 - Motor and perceptual aspects of temporal expectation.** *Thomaschke.* **(Room 6)**

(SY\_31.1) Boulinguez  
(SY\_31.2) Los & Van der Burg  
(SY\_31.3) Seibold, Bausenhardt & Rolke  
(SY\_31.4) Lange  
(SY\_31.5) Correa & Sanabria

**SY\_32 - The cognitive neuropsychiatry of delusional belief.** *Coltheart.* **(Room 3)**

(SY\_32.1) Coltheart  
(SY\_32.2) Langdon  
(SY\_32.3) McKay  
(SY\_32.4) Corlett

**OS\_31. Executive control (Room 5)**

(OS\_31.1) Suarez, Burle, Vidal & Casini  
(OS\_31.2) Schmidt & De Houwer  
(OS\_31.3) Dambacher & Hübner  
(OS\_31.4) De Baene, Albers & Brass  
(OS\_31.5) Duthoo, Wühr & Notebaert

## SUNDAY AFTERNOON

### KEYNOTE LECTURE 2: 13:20-14:20

Robert Zatorre **(AUDITORIUM)**

**SUNDAY AFTERNOON**  
**Spoken Sessions: 15:40-16:40**

**OS\_32. Cognitive development (Room 5)**

(OS\_32.1) velasco, Egurza, Lertxundi, Aranbarri, Begiristain, Santa Marina, Basterrechea, Ibarluzea & Arranz  
(OS\_32.2) Lertxundi, Lertxundi, Fano, Basterrechea, Santa Marina, Begiristain, Arranz, Vegas & Ibarluzea  
(OS\_32.3) Arranz, Velasco, Olabarrieta, Egurza, Galende, Manzano, Martin, Ibarluzea, Sanchez de Miguel & Lertxundi

**OS\_33. Social cognition (Room 6)**

(OS\_33.1) Santamaría García, Panunzi, Deco & Sebastián-Gallés  
(OS\_33.2) Schubert, Toscano, Seibt, Mazzurega, Paladino & Pavani

**OS\_34. Implicit learning (Room 4)**

(OS\_34.1) Poptawska, Kolańczyk, Sterczyński & Roczniowska  
(OS\_34.2) Jones & Norman  
(OS\_34.3) Schultz, Stevens, Tillmann & Keller

**OS\_35. Executive control (Room 3)**

(OS\_35.1) Rochet, Casini, Thierry & Burle  
(OS\_35.2) Demanet, De Baene, Arrington & Brass  
(OS\_35.3) Kiesel, Waszak & Pfister

**OS\_36. Judgment and decision making (Room 2)**

(OS\_36.1) Abadie, Terrier & Villejoubert  
(OS\_36.2) Trémolière, De Neys & Bonnefon  
(OS\_36.3) Hancock, McCloy & Beaman

**OS\_37. Perception and action (Room 1)**

(OS\_37.1) Heinemann, Janczyk, Pfister, Thomaschke & Kiesel  
(OS\_37.2) Dittrich, Rothe & Klauer  
(OS\_37.3) Gianelli & Ranzini

**OS\_38. Language comprehension (Auditorium)**

(OS\_38.1) Guo, Martin, Hamilton, Van Dyke & Tan  
(OS\_38.2) Mestres Missé, Turner & Friederici  
(OS\_38.3) Tan & Martin

**SUNDAY EVENING**  
**Spoken Sessions: 17:00-18:00**

**OS\_39. Implicit learning (Room 4)**

(OS\_39.1) Marescaux & ROUJON  
(OS\_39.2) Roujon & Marescaux  
(OS\_39.3) Poletiek

**OS\_40. Bi/Multi-lingualism (Room 3)**

(OS\_40.1) Kreiner & Maimon  
(OS\_40.2) Pivneva, Delpero & Titone

**OS\_41. Language comprehension (Room 2)**

(OS\_41.1) Ilić & Ković  
(OS\_41.2) Guerra & Knoeferle  
(OS\_41.3) Scorolli, Daprtati, Nico & Borghi

**OS\_42. Consciousness (Room 6)**

(OS\_42.1) Chica, Botta, Lupiáñez & Bartolomeo  
(OS\_42.2) Wierzchon, Asanowicz & Cleeremans  
(OS\_42.3) Van den Bussche & Reynvoet

**OS\_43. Attention (Room 5)**

(OS\_43.1) Veronelli, Vallar, Marinelli, Primativo & Arduino  
(OS\_43.2) Marzouki, Jouanin & Grainger  
(OS\_43.3) Bourgeois, Chica, Migliaccio, Thiebaut de Schotten, Valero Cabre & Bartolomeo

**OS\_44. Emotions (Auditorium)**

(OS\_44.1) Everaert, Spruyt & De Houwer  
(OS\_44.2) Keuper, Beintner, Peter & Dobel  
(OS\_44.3) Vinson, Anderson, Ratoff, Bahrami & Vigliocco

**OS\_45. Working memory (Room 1)**

(OS\_45.1) Souza da Silva, Oberauer, Gade & Druey  
(OS\_45.2) Gade, Druey & Oberauer  
(OS\_45.3) Hein & Oberauer

## SUNDAY EVENING

### Poster Session 3 (3.001-3.091): 17:20-19:20

#### • Aging and Dementia •

- (3.001) Lacey, Gordon & Hillis
- (3.002) Emilie, Perrone-Bertolotti, Jouvenel, Moreaud, Toescu & Baciú
- (3.003) Dioux, Mathey, Lacassagne, Cometti, Robert & Zagar
- (3.004) van Muijden, Band, Colzato & Hommel
- (3.005) Gaillard

#### • Applied Cognitive Psychology •

- (3.006) Logan, Marshak & Thompson
- (3.007) Stevenage
- (3.008) Schüler, Scheiter & Gerjets
- (3.009) Soriano, Lozano, Aznarte, Gómez-Ariza & Bajo
- (3.010) Beckwé, Deroost & De Lissnyder
- (3.011) Soares, Montserrat, Iriarte, Almeida, Simões, Costa, França & Machado
- (3.012) Wojciechowski, Dryll & Rudzińska-Wojciechowska
- (3.013) Dufau

#### • Attention •

- (3.014) Anzulewicz, Taraday & Walentowska
- (3.015) López-Ramón, Castro, Roca & Lupiáñez
- (3.016) Pavan, Castelli, Dal Bosco & Galfano
- (3.017) Arduino, Veronelli, Vallar & Girelli
- (3.018) Martín-Arévalo & Lupiáñez
- (3.019) Kalogeropoulou, Vivas & Woodruff
- (3.020) Occelli, Esposito, Venuti, Arduino & Zampini
- (3.021) Brochard, Tassin & Zagar
- (3.022) Morales, Facal, González, Díaz, Ansorena, Alonso & Urdaneta

#### • Executive Control •

- (3.023) Houtman, Van der Borgh, Fias & Notebaert
- (3.024) Spieser, Casini, Hasbroucq & Burle
- (3.025) Jaafari, Descoust, Frasca, Rigalleau & Vibert
- (3.026) Chang, Lin, Huang, Huang, Tzeng & Hung
- (3.027) Mrozowicz
- (3.028) van 't Wout, Monsell & Lavric
- (3.029) Allen & Martin
- (3.030) Czernochowski & Saße

#### • Multisensory Integration + Motor Control •

- (3.031) Vallet & Shore
- (3.032) Nattkemper & Frensch
- (3.033) Valsø & Behne

#### • Human Learning/Implicit Learning •

- (3.034) Nelson, Navarro & P. Leon
- (3.035) Vázquez, Arriola & Alonso
- (3.036) Glicksohn & Cohen
- (3.037) Lai & Poletiek
- (3.038) Roczniowska, Sterczyński & Popławska
- (3.039) Homble, Vandenbossche, Soetens & Deroost
- (3.040) Sterczyński, Roczniowska & Popławska

#### • Memory •

- (3.041) Beato, Pulido, Pinho, Gozalo & Cadavid
- (3.042) Ressel & Sebastian-Galles
- (3.043) Jönsson & Kubik

- (3.044) Vranic & Tonkovic
- (3.045) Şahin & Tekman
- (3.046) Pigliautile, Nardo & Olivetti Belardinelli
- (3.047) Luna & Oliveira
- (3.048) Özkılıç & Tekman
- (3.049) Walser, Fischer & Goschke
- (3.050) Tanaka, Tanida, Sugimoto, Tsunemi, Shinoda, Yasuda, Kuzuguchi & Saito
- (3.051) Martín-Luengo, Luna & Migueles
- (3.052) Cheng, Lin, Liu, Hung & Tzeng
- (3.053) Migueles & García-Bajos

#### • Working Memory •

- (3.054) Salminen, Strobach, Sorg, Müller & Schubert
- (3.055) Katsuhara, Osaka & Osaka
- (3.056) Ginsburg, Van Dijck, Van Opstal, Majerus, Fias & Gevers
- (3.057) Dorchin & Meiran
- (3.058) Classon, Rudner & Rönnberg
- (3.059) Langerock, Vergauwe & Barrouillet

#### • Numerical Cognition •

- (3.060) Gebuis & Reynvoet
- (3.061) Estudillo Hidalgo, García-Orza & Damas-López
- (3.062) Damas-Lopez & Garcia-Orza
- (3.063) Guillaume, Nys & Content
- (3.064) Defever, Sasanguie, Vandewaetere & Reynvoet
- (3.065) García-Orza, Perea, Abu Mallouh & Carreiras

#### • Reasoning and Problem Solving •

- (3.066) Varona-Moya & Cobos
- (3.067) Vargas, Moreno Rios & Castro
- (3.068) Maloney
- (3.069) Oberholzer, Trench & Minervino
- (3.070) Gubbins & Byrne
- (3.071) Rodríguez-Gualda & Moreno Ríos
- (3.072) Johnson & Tubau

#### • Music Perception •

- (3.073) Castro & Lima
- (3.074) Alonso Cánovas, Molina, F. Estévez, Martínez & J. Fuentes
- (3.075) Giorgio, Olivetti Belardinelli & Imberty

#### • Speech Perception / Auditory Perception •

- (3.076) de la Mora & Toro
- (3.077) Schmitz & Sebastián-Gallés
- (3.078) Bayard, Tilmant, Leybaert & Colin
- (3.079) Peperkamp & Brazeal
- (3.080) Collet, Leybaert, Serniclaes & Colin
- (3.081) Macken & Jones

#### • Orthographic Processing •

- (3.082) Zimmerman, Geller & Gomez
- (3.083) Uchiyama, Seki, Tanaka & Koeda
- (3.084) Schubert & Rapp
- (3.085) Di Bono & Zorzi
- (3.086) Massol, Midgley, Holcomb & Grainger

**SUNDAY EVENING**

**Poster Session 3 (3.001-3.091): 17:20-19:20**

**· Language Acquisition / Cognitive Development ·**

- (3.087) Andiarrena, Duñabeitia, Gorostiaga, Aranbarri, Lertxundi, Arriola, Basterrechea, Fano, Ibarluzea & Balluerka
- (3.088) Lobier, Dubois & Valdois
- (3.089) Arias-Trejo & Alva Canto
- (3.090) Imaz & García Mayo
- (3.091) Sauval & Casalis

**· Language Comprehension ·**

- (3.092) Pérez Muñoz, Macizo, Paolieri & Bajo
- (3.093) Speed & Vigliocco
- (3.094) Takahashi, Maionchi-Pino, Magnan & Kawashima
- (3.095) Mertens, Kemp & Garry
- (3.096) Gautreau, Hoen & Meunier
- (3.097) Volpe & Esposito
- (3.098) Mancini, Molinaro, Avilés & Carreiras

**· Language Production ·**

- (3.099) Hutson, Damian & Spalek
- (3.100) Arcara, De Marchi, Lacaita, Semenza, Jarema & Mondini
- (3.101) Crowther
- (3.102) Fischer-Baum & McCloskey
- (3.103) Konopka & Meyer
- (3.104) Ernestus, Stivers & de Ruiter

**· Bi/Multi-lingualism ·**

- (3.105) Román, Rodríguez-Pujadas, Ventura-Campos, Sanjuán, González & Ávila
- (3.106) Ibáñez, Morales & Bajo
- (3.107) Paolieri, Morales, Dussias, Cubelli & Bajo
- (3.108) Mulder, Dijkstra & Schreuder
- (3.109) Baus, Costa & Carreiras
- (3.110) Bellocchi, Contento, Ceccarelli & Burani
- (3.111) Declerck, Philipp & Koch

## KEYNOTE LECTURE 1

Thursday 19:30-20:30

### **The flavor modality**

DANA M SMALL

*The John B Pierce Laboratory and Yale University*

When we “taste”, we also touch the food or drink in our mouths and sense its odor via retronasal olfaction. The term flavor describes this multimodal experience. The aim of this lecture will be to describe how the independent sensations of taste, touch and smell converge to create unitary flavor percepts and how, through experience, the brain encodes these “flavor objects” and their associated physiological significance to guide eating behaviors. Psychophysical and neuroimaging data will be presented to support the existence of a binding mechanism, possibly residing in the somatomotor mouth area, that underlies illusory processes that bring taste, touch and smell into a common spatial receptive field to facilitate integration. It is argued that activation of these illusory mechanisms result in flavor perceptions and in the encoding of these independent sensory inputs as flavor objects within insular cortex. These flavor objects are then associated with the post-ingestive consequences of feeding to result in flavor preference formation.

## KEYNOTE LECTURE 2. THE BROADBENT LECTURE

Friday 12:00-13:00

### **Working memory and language processing: An updated multiple-components view**

RANDI MARTIN

*Rice University, USA*

Language comprehension and production depend on the ability to maintain and manipulate information in working memory. Behavioral and neuroscientific evidence support the contention that there are separable capacities for retaining phonological, semantic, and syntactic information during sentence processing. An updated version of Martin, Lesch and Bartha’s (1999) multiple-components model of verbal working memory will be presented which is a blend of multi-store and embedded process models. An emphasis will be placed on my recent work examining the processes acting on working memory representations during language comprehension, including the retrieval of information outside the focus of attention and the resolution of interference between competing representations at the lexical, semantic, and syntactic levels. The commonalities and differences between these processes for word lists and sentences will be considered, drawing on findings from studies of from brain-damaged patients, from functional neuroimaging, and from individual differences in healthy young subjects.

## KEYNOTE LECTURE 3. THE BERTELSON AWARD

Friday 16:20-17:20

### **Functional organization of executive functions: asymmetries along the x-axis**

ANTONINO VALLESI

*International School for Advanced Studies (SISSA)*

This talk will focus on the fractionation of cognitive functions within prefrontal cortex. In the preamble, I will detail the working hypothesis that some complementary and computationally diverse executive processes are dissociable not only functionally but also anatomically along the left-right axis of the prefrontal cortex and its connected networks. In particular, criterion setting – the capacity to set up novel task rules or associations between stimuli and/or responses – is more left-lateralized; monitoring – the process of continuously tracking probabilistic structures in the internal or external environment to optimize behavior – is instead more right-lateralized. Several lines of empirical evidence, including neuroimaging, neuropsychological, behavioral and developmental data, will be presented to support this model.

## **KEYNOTE LECTURE 4**

**Saturday 12:00-13:00**

### **The interactive account of brain activation during reading.**

CATHY J PRICE

*Wellcome Trust Centre for Neuroimaging, UCL*

Reading is one of the most sophisticated human skills. It requires unique cognitive processing but how is it special at the neural level? Lesion and functional imaging studies have highlighted the important contribution of the left ventral occipito-temporal cortex. Damage to this area impairs reading more than other language skills. Activation in this area is higher for reading than auditory language tasks; and increases in response to word-like stimuli when children are learning to read. This set of results suggest a brain area that becomes selective to visual word forms but such an explanation can not explain why the same left ventral occipito-temporal area is also activated by a range of other tasks that do not involve orthographic processing. In my talk, I will discuss how distributed and interactive neural processing can explain the complicated response functions in the left occipito-temporal cortex and the reading impairments that result from left occipito-temporal damage.

## **KEYNOTE LECTURE 5. CONFERENCIA SEPEX**

**Sunday 13:20-14:20**

### **Music in the Brain: Pitch, Plasticity, Imagery and Emotion**

ROBERT ZATORRE

*Montreal Neurological Institute, McGill University and BRAMS laboratory*

How does the brain allow us to perceive music? How do we imagine musical sounds? Why does music elicit emotion? Neuroscientists are increasingly interested in such questions because music can be a powerful way to reveal the inner workings of the nervous system. The lecture will touch on three topics. First, we discuss functional and structural brain imaging data which identify specializations for pitch perception in right auditory cortex. These specializations are relevant to plasticity because they can also be modified by musical training. Second, we deal with studies of musical imagery. Using experimental tasks which require active retrieval and imagery of melodies, we can identify auditory cortical regions recruited both by real and imagined music. The final topic, music and emotion, is of interest because emotion is such an integral part of music. We have concentrated on musical pleasure; findings from these studies indicate that strong positive emotion in music seems to be mediated via the mesolimbic dopaminergic system, typically concerned with biological reward and motivation. Further, we can dissociate distinct dorsal and ventral striatal contributions to anticipatory vs. experiential components of music processing, respectively.



**SYMPOSIUM PROGRAM**  
**Friday Morning**

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**SY\_(01-07). 08:30-10:30**

**SYMPOSIUM 1 (SY\_01). Room 2**

**Prediction and integration during language comprehension**

MARTIN, C.<sup>1</sup>, NIEUWLAND, M. S.<sup>2</sup> & COSTA, A.<sup>1,3</sup>

<sup>1</sup>*Department of Technology – UPF*, <sup>2</sup>*BCBL*, <sup>3</sup>*ICREA*.

The purpose of this symposium is to present recent advances in psycholinguistics that deal with prediction and integration during language comprehension, two processes that are crucial for rapid and efficient language comprehension. Prediction allows comprehenders to probabilistically pre-activate words (or discourse topics) that are likely to appear in an unfolding sentence. Integration deals involves combining semantic information as contained by sentences with world knowledge and indexical information, such as the identity of the speaker. We will present 6 recent studies with the common aim of revealing the contributions of prediction and integration to how people arrive at the intended meaning of utterances. These studies all employ online measures of written and spoken language comprehension, such as eye-tracking and event-related potentials (ERPs). First, we will discuss how comprehenders build predictions and abandon them when faced with disfluencies in spoken language. Building on the fact that predictions during online language comprehension can lead to the activation of event representations, we will then present evidence that these representations contain general knowledge information associated with the linguistic input, beyond what is immediately relevant for processing the current linguistic input. We will also discuss how the presentation of a concurrent visual scene affects predictions. We will see how ERP responses are modulated by the emotional valence of predictable words, and by predictability from either a factual or a counterfactual context. Finally, we will focus on whether monolingual and bilingual speakers rely on predictive mechanisms in language comprehension in equal amounts.

**(SY\_01.1)**

**What the comprehension of spontaneous speech tells us about prediction**

CORLEY, M.<sup>1</sup>, MACGREGOR, L.<sup>2</sup> & DONALDSON, D.<sup>3</sup>

<sup>1</sup>*University of Edinburgh*, <sup>2</sup>*MRC Cognition and Brain Sciences Unit*, <sup>3</sup>*University of Stirling*.

The human language comprehension system must be robust to the fact that spontaneous speech is riddled with false starts, repetitions, and disfluent hesitations, at an estimated rate of 6 per 100 words (Fox Tree, 1995). Where predictions are made, they must be updated or abandoned as necessary in the face of these disfluencies. Here, we contrast two ways in which prediction could be affected by disfluency. The first is "algorithmic", in the sense that the listener makes use of full information about shared knowledge and the speaker's state (e.g., Arnold et al., 2004, 2007) in order to predict what is most likely to be mentioned following a disfluency. However, this view is largely based on evidence from Visual World experiments in which one of a small set of candidate images will ultimately be named. An alternate, "heuristic",

view derives from a series of ERP experiments (Corley et al., 2007; MacGregor et al., 2009, 2010) in which the magnitude of an N400 response to unpredictable vs. predictable words is attenuated when the target words follow a disfluency, and targets which occur post-disfluency are more likely to be accurately identified in a later recognition test. Based on this evidence, we argue that listeners do not make specific predictions where the evidence is not good (e.g., where the speaker is disfluent). As a consequence, more attention is allocated to the speech signal, rendering it more memorable, and preventing subsequent acoustic anomalies from further engaging attention (Collard et al., 2008). Once fluent speech resumes, listeners must get 'back on track', and we offer a tentative memory-control account of a distinct post-disfluency late positivity (MacGregor et al., 2009, 2010). By focusing on spoken language, we emphasize the interplay of predictive, attentional, and memory processes in robustly comprehending the speaker's intended message.

**(SY\_01.2)**

**Generalized Event Knowledge is Activated during Online Language Comprehension**

MCRAE, K.<sup>1</sup>, METUSALEM, R.<sup>2</sup>, KUTAS, M.<sup>2</sup>, URBACH, T. P.<sup>2</sup>, HARE, M.<sup>3</sup> & ELMAN, J. L.<sup>2</sup>

<sup>1</sup>*University of Western Ontario*, <sup>2</sup>*University of California, San Diego*, <sup>3</sup>*Bowling Green State University*.

People possess a wide range of knowledge regarding real-world events, and recent research has demonstrated that this knowledge plays an important role in guiding prediction and integration during incremental language comprehension. However, the nature of event knowledge activation during online language comprehension is not fully understood. The present study focused on the degree of generality of online event knowledge activation. One possibility is that activation is limited to elements of an event that meet the constraints imposed by the local linguistic context (i.e., the concept predicted to occur at a specific point in the linguistic stream). It is also possible that activation extends more generally to knowledge associated with the event, regardless of local contextual fit. The present study addressed this issue by analyzing event-related brain potentials (ERPs) recorded as participants read three-sentence scenarios describing common real-world events. The final sentence of each scenario contained a target word that was either expected, anomalous and unrelated to the event described, or anomalous but related to the event. Analyses of ERPs elicited by these target types showed differences among the three conditions. The N400 was smallest for the expected word, and largest for the anomalous, event-unrelated word, replicating previous effects of prediction during language comprehension. For the condition that is novel in the present study, a zero-cloze anomalous word that is consistent with the event/scenario, the N400 was both larger than for the expected word, and smaller than for the anomalous, event-unrelated word. These results demonstrate that during the course of comprehension, comprehenders activate general knowledge associated with the described event, even when the specific concept is not an appropriate continuation of the linguistic input at that precise point in time. Thus, generalized event knowledge is available to immediately influence language

processing, and it drives predictive processing during language comprehension.

### (SY\_01.3)

#### **Prediction during Situated Language Processing**

JOERGENSEN, G. & ALTMANN, G. T. *University of York*.

It is generally accepted that prediction plays a fundamental role during language comprehension (as well as during language production and indeed, cognition more generally). Here, we discuss some of the constraints on the predictive process afforded by visual contexts (past and present). A range of studies suggests that when a sentence unfolds in the context of a concurrent scene, the predictions that are generated as the sentence unfolds reflect the structure of the event described by the sentence. Moreover, those predictions reflect an underlying assumption that the participants in the event will be drawn from the concurrent context, with the more plausible participants attracting more attention than the less plausible participants. In a series of eye-tracking studies we explored the role of plausibility in the generation of such predictions, and the manner in which the scene constrained those predictions. Surprisingly, we found that removing the visual scene immediately prior to the unfolding language appeared to remove the assumption that participants in the event would be drawn from the visual context (even though the critical manipulation was simply whether the scene was concurrent, or preceded the language by a few seconds). The data constrain accounts of sentence comprehension by placing limits on the nature of the predictive process in different contexts, and on the role of experience in modulating contextual constraint. The data have implications also for the relationship between the predictive processes that result in the activation of representations anticipating future language input, and the integrative processes that map actual language input onto those previously activated representations.

### (SY\_01.4)

#### **Expect the Worse and You Will Never Be Disappointed: a Language Comprehension Event-Related Potentials Study**

MORENO, E. M. *Universidad Complutense de Madrid*.

Expectations are crucial in everyday life. People respond to good and bad outcomes not only based on the emotional valence of the outcome but also based on what they had 'in mind', what they expected. Language comprehension electrophysiological studies have shown that brains respond to words in context depending on allowed expectations that are made based on semantic memory and world-knowledge constraints. However, personality traits, cognitive bias, and defensive pessimism strategies might go beyond pure factual semantic and world-knowledge constraints and determine what might have been expected in a particular context at a particular point in time. Using the N400 component of event-related potentials as an index of word expectation, we explored how individuals reacted when processing some a priori highly expected emotionally negative and positive word endings in scenarios in which both types of expectations could be violated at random. Violations included switches to unexpected opposite emotional word endings and nonsense. Our results reveal that despite having a similarly high cloze probability, expected positive endings

were processed as more 'surprising' than negative ones. Either the negative predictions were rather strongly made or individuals were somehow reluctant to make strong positive predictions in preparation for them to become untrue. By contrast, post-N400 frontal effects elicited by all types of emotionally opposite outcomes were similar regardless of the direction of the emotional switch. Thus, our brainwave study suggests that humans selectively adjust the strength of self-allowed positive and negative expectations before a verbal input comes in. During language comprehension tasks, just as in other life situations, individuals aim to encounter pleasant 'surprises' and minimize the consequences of emotional setbacks.

### (SY\_01.5)

#### **If the real world were irrelevant, so to speak: An ERP study on counterfactual comprehension**

NIEUWLAND, M. S. & MARTIN, A. E. *Basque Center on Cognition, Brain and Language*.

Counterfactual comprehension provides an interesting test-case for studying the interaction between real-world knowledge and discourse context because counterfactuals may require keeping in mind both what is true and what happens to be false. Recent event-related potential (ERP) and eye-tracking results suggest that real-world knowledge briefly interferes with counterfactual comprehension, consistent with two-stage accounts of discourse comprehension. In an ERP experiment, we tested whether real-world interference upholds when incoming information is highly predictable from the counterfactual context. Participants read 120 counterfactually true/false statements ("If N.A.S.A. had not developed its Apollo Project, the first country to land on the moon would be Russia/America") and real-world true/false statements ("Because N.A.S.A. developed its Apollo Project, the first country to land on the moon has been America/Russia"). Based on results from independent pre-tests, counterfactual and real-world statements were matched for critical word expectancy and average truth-value rating. Our hypothesis involved N400 ERP amplitude, which indexes early semantic processing and is sensitive to subtle variations in discourse-semantic fit. If real-world knowledge interferes with counterfactual comprehension despite this strong context, then critical words in counterfactually true statements should evoke larger N400s than counterfactual false statements and real-world true statements. In contrast, if incoming words are mapped onto the most relevant interpretive context without delay and without initial regard to real-world truth-value, then false statements should elicit an N400 effect compared to true statements, for counterfactual and real-world statements alike. Our results support this latter hypothesis: counterfactually false sentences elicited an N400 effect compared to counterfactually true sentences, identical to the N400 effect for real-world sentences. These results argue against interference from real-world knowledge during counterfactual comprehension. Instead, they suggest that incoming words are mapped onto discourse context without any delay if they are sufficiently plausible and predictable given this context, whether factual or counterfactual.

**(SY\_01.6)****How do early and late bilinguals predict words during sentence reading?**MARTIN, C.<sup>1</sup>, THIERRY, G.<sup>2</sup>, KUIPERS, J.<sup>2</sup> & COSTA, A.<sup>1,3</sup><sup>1</sup>*Universitat Pompeu Fabra*, <sup>2</sup>*Bangor University*, <sup>3</sup>*Institució Catalana de Recerca i Estudis Avançats*.

The goal of the present study was to investigate if being bilingual affects the way people predict words to come when they read sentences. Using Event-Related Potentials (ERPs), DeLong and collaborators have shown that reading a predicted word at the end of a sentence elicits smaller N400 amplitudes than words that are not predicted, albeit being semantically congruent with the sentence context. Interestingly, prediction effects were also observed on the article preceding the final word, i.e., the N400 was more negative for the article 'an' when the most expected final word started with a consonant, and inversely for the article 'a' (DeLong et al., 2005). In this study, we investigated prediction effects in early English-Welsh bilinguals, late Spanish-English bilinguals and English monolinguals. Participants were asked to read English sentences while undergoing 64-channel ERP recording. Sentences ended with a predicted noun starting with (a) a vowel or (b) a consonant; a non-predicted noun starting with (c) a vowel or (d) a consonant. In monolinguals, we found a significant prediction effect both on the final noun of the sentence and the preceding article. The N400 modulation elicited by the article was similar in early bilinguals and monolinguals. The final noun failed to modulate the N400 in early bilinguals but elicited a significant P600 effect for non-predicted final nouns. As for late bilinguals, no prediction effect was observed on the article while the final noun produced a typical N400 integration effect. We interpret these results as evidence that early bilinguals predict the noun ending a sentence as monolinguals do. This prediction effect has a cost as early bilinguals show a late integration effect on the final noun of the sentence. On the contrary, late bilinguals do not predict words to come during sentence reading.

**SYMPOSIUM 2 (SY\_02) Room 3****Contingency and causality: From cognitive theories to clinical reasoning, social stereotypes, pseudoscience, and legal issues**MATUTE, H.<sup>1</sup> & COBOS, P. L.<sup>2</sup>. <sup>1</sup>*Deusto University*, <sup>2</sup>*Malaga University*.

From time to time a concept that has been largely studied in the cognitive laboratory reaches a level of maturity where it can be profitably extrapolated to one or several areas of applied research. This is what is happening right now with the areas of contingency learning and judgments, and causal learning and reasoning. The presenters in this symposium are all experimental cognitive psychologists that are currently trying to extrapolate their expertise on how causal and contingent relationships are acquired and used to several areas of social interest. Simultaneously but independently of each other, they have focused their efforts on applied settings that are as diverse as clinical reasoning, social stereotypes, legal issues, and the reduction of superstitious and pseudoscientific beliefs in knowledge-based societies. This symposium brings them together and shows how common (and sometimes discrepant) cognitive theories

of contingency learning and causal learning and reasoning can transfer to the outside world and have an impact in our society.

**(SY\_02.1)****The temporal sequence of symptoms also matters: Further evidence of the use of causal theories in clinical psychologists**COBOS, P. L., FLORES, A., LÓPEZ, F. J., GODOY, A. & GONZÁLEZ-MARTÍN, E. *University of Malaga*.

Previous studies have shown that clinical psychologists' causal theories about DSM-IV disorders determine the weight of diagnostic criteria in the diagnosis of such disorders. Specifically, the presence or absence of causally central symptoms responsible for the appearance of many other symptoms have a greater impact on the diagnosis of DSM-IV disorders than causally peripheral symptoms that are the ultimate effects of other symptoms or are not connected at all. This has been shown to occur even with symptoms that, according to DSM-IV, should be equally considered for diagnosis purposes. Our study provides further evidence of clinicians' use of causal theories of DSM-IV disorders in several ways. First, we show that what matters is not only which symptoms are present or absent, but also the temporal order in which symptoms appear in a client. When the temporal order is consistent with a well known causal theory of a disorder, clinicians spend less time reading sentences reporting the symptoms than when the temporal order is inconsistent with the causal theory. This result shows that subtle causal reasoning processes are also at work when clinicians face a reading comprehension task. Second, we show that the temporal order of symptoms together with more explicit information about causal links between them affects clinicians' diagnostic judgements as well as judgements on treatment efficacy and treatment selection. Finally, when inconsistent clinical reports were read, clinicians took longer to make all these judgements than when consistent clinical reports were given. Altogether, our results provide strong and converging evidence that clinical psychologists use causal theories of DSM-IV disorders when processing the information given through clinical reports.

**(SY\_02.2)****Causal reasoning in repeated judgment and choice**HAGMAYER, Y. *University of Goettingen*.

Most theories of repeated decision making do not take causal considerations into account. The two most prominent theories assume that people either learn about exemplars or abstract linear rules from the observations made (e.g., Juslin et al., 2003). Causal model theories, by contrast, claim that people acquire and use knowledge about the causal structure underlying a decision problem to decide on interventions (Sloman & Hagmayer, 2006). An experiment was conducted combining paradigms on multiple cue and causal learning. Participants were confronted with a fictitious medical system consisting of four factors contributing to an outcome. Participants' assumptions about the causal relations between the four factors were manipulated by instruction in three groups. In a learning phase participants received identical learning input about the state of the four factors and the value of the outcome before and after an intervention on one of the factors. The learning input consisted of 110 trials and was equally compatible with all causal assumptions.

In two test phases (before and after the learning phase) participants were requested to estimate the value of the outcome based on the observed factors, choose one of two interventions, and predict the value of the resulting outcome. Learning input and test cases were constructed to allow differentiating the three theoretical accounts. The results showed that participants considered causal structure even after extensive learning experience. Depending on their causal assumptions, participants preferred different interventions. To further analyze the data, an exemplar model, a linear model and a causal-model model were fitted to participants' answers. The model assuming that participants induce a causal model and update its parameters based on the learning input predicted participants' judgments and choices best. These findings indicate that people may also use causal reasoning as a decision making strategy.

#### (SY\_02.3)

##### **An algorithm and its implementation for minority group stereotype formation**

MURPHY, R. A. *University of Oxford.*

The Illusory Correlation in psychology refers to a class of phenomenon in which people judge relationships to exist where some normative measures suggest none does. This effect has been suggested to reflect a bias in information processing. I will discuss several experiments with specific relevance to how we develop our beliefs about minority social groups. According to some theories our dislike of minority groups is a natural by-product of an attentional processes biased towards unusual events (Hamilton & Gifford, 1974). A cognitive associative account originally developed to account for Pavlovian conditioning (Rescorla and Wagner, 1972), that also predicts a range of correlation and causal learning phenomenon, predicts that any bias is temporary and pre-asymptotic. We report two sets of experiments one designed to test the effect of more experience, and a second designed to assess the effect of changes in event rates. A related prediction of the associative account is that this learning is the result of an error correction principle guided by a negative evaluative response which, according to several theories of localized brain function, should result in certain neural signatures. We discuss an experiment with fMRI responses to explore this prediction.

#### (SY\_02.4)

##### **Speculating from absent evidence: A Bayesian network approach**

LAGNADO, D., HARRIS, A. & CULLEN, V. *University College London.*

The extent to which people speculate from absent evidence is an important issue for legal theory and practice. It also presents challenges to psychological theories of causal reasoning. This paper proposes a Bayesian Network (BN) analysis of inference from the absence of evidence. We claim that the inferences people draw depend on their causal models of the case, and their explanations for the absence. Thus the same information about absence can be treated as incriminating, exonerating or neutral depending on which factors are considered as most likely explanations for that absence. An empirical study supported this analysis. Sixty participants were given an identical murder case, and saw the same incriminating evidence.

They were all informed of potential eyewitnesses to the crime who were not presented at court. The reasons for this absence were manipulated in three between-subject conditions: participants received 'incriminating', 'exonerating' or neutral explanations. As predicted, judgments of guilt were modulated by the explanations given for the absence of eyewitnesses: judgments of guilt increased with incriminating reasons and decreased with exonerating reasons. Moreover, BN analyses based on participants' verbal explanations matched their probability of guilt judgments. These findings have implications for psychological models of causal reasoning, and for legal decision making.

#### (SY\_02.5)

##### **Illusion of control when the participant is a mere observer**

MATUTE, H., YARRITU CORRALES, I. & VADILLO, M. A. *Deusto University.*

The illusion of control is at the heart of superstition and pseudoscience. It consists of overestimating the degree of control that we have over desired outcomes that are actually occurring independently of our behavior. This illusion is stronger when the outcome occurs frequently and the participant is personally involved in trying to obtain it. The traditional social psychology explanation assumes that this is due to a need to protect self-esteem. In consequence, it predicts that there should be no illusion when there is no threat to self-esteem, a prediction that is contrary to many instances of superstition and pseudoscience in real life. By contrast, a cognitive explanation assumes that the illusion of control is caused by the response-outcome coincidences that take place when the participant is involved in trying to obtain the outcome. We conducted two experiments in which another participant or a fictitious patient played the role of the agent, with the actual participants being mere observers. The agent could administer or not a given medical treatment. The outcome (healing) occurred frequently though independently of the treatment, that is, it followed a pre-programmed sequence. Participants observed the sequence of events and developed the illusion that there was a causal relationship between the behavior and the outcome. This illusion was strongest when the agent was responding at a higher rate. That is, personal involvement (of the agent) increased the illusion in the observer. Self-esteem of the observer was not at risk, so this cannot explain the results. We conclude that personal involvement increases the illusion because it increases responding, which biases exposure to the contingency information that is needed in order to accurately estimate the degree of causal relationship between any two events.

#### SYMPOSIUM 3 (SY\_03) Auditorium

##### **Visual-word recognition: The state of the art**

PEREA, M. *Universitat de València.*

The area of visual-word recognition is a very active field in cognitive psychology and cognitive neuroscience, and a number of computational models have been proposed in the past years (including some models from the speakers in this symposium). In past ESCOP conferences, there have been other symposia in this same area (organized by Jonathan Grainger and Colin Davis since the ESCOP

meeting in Granada), and we believe that the proposed talks will be of interest to the other participants of the ESCOP.

#### (SY\_03.1)

##### **Dissociating encoding and decisional components in visual-word recognition: A diffusion model account**

GOMEZ, P.<sup>1</sup>, PEREA, M.<sup>2</sup> & MORET-TATAY, C.<sup>2,3</sup>. <sup>1</sup>*De Paul University, Chicago, USA*, <sup>2</sup>*Universitat de València, Valencia, Spain*, <sup>3</sup>*Universidad Católica de Valencia, Valencia, Spain*.

Although the diffusion model has been quite successful at accounting for lexical decision data (e.g., Ratcliff, Gomez, & McKoon, 2002), there is a central assumption of the model that has not been systematically explored: the distinction between the encoding time (Ter parameter), and the quality of the evidence (drift rate). A common criticism of the diffusion model approach is that "everything goes to drift rate". We present a series of experiments that attempt to validate the model by employing manipulations that presumably affect encoding but not drift rate. We present data from masked priming experiments as well as from manipulations that affect the perceptual encoding of the words (e.g., stimulus rotations, stimuli presented with different inter-letter spacings).

#### (SY\_03.2)

##### **Three languages, thousands of words, one model: Simulating the DLP, ELP, and FLP**

NORRIS, D.<sup>1</sup> & KINOSHITA, S.<sup>2</sup>. <sup>1</sup>*MRC Cognition and Brain Sciences Unit, Cambridge, UK*, <sup>2</sup>*MACCS, Macquarie University, Australia*.

We report simulations of the lexical decision data from the English, French and Dutch Lexicon Projects - a total of over 60,000 words. The simulations use a noisy channel version of the Bayesian Reader. We focus on the different pattern of neighbourhood effects found in the three languages. For example, the English Language Project exhibits larger neighbourhood effects than the Dutch or French Projects. However, interpretation of the differences is complicated by differences in experimental procedures. The simulations suggest that there are genuine differences in lexical structure between the three languages and that these are further amplified by the use of different nonwords in the three Projects.

#### (SY\_03.3)

##### **The first findings on the basis of the British Lexicon Project**

BRYLSBAERT, M., KEULEERS, E. & DIEPENDAELE, K. *Ghent University, Ghent, Belgium*.

We have collected a new database of lexical decision times for English words and non-words, in which two groups of British participants each responded to 14,365 monosyllabic and disyllabic words and the same number of non-words for a total duration of 16 hours (divided over multiple sessions). This database, called the British Lexicon Project (BLP), fills an important gap between the Dutch Lexicon Project (DLP) and the English Lexicon Project (ELP), because it applies the repeated measures design of DLP to the English language. The high correlation between the BLP and ELP data indicates that a high percentage of variance in lexical decision datasets is systematic variance rather than noise, and that the

results of word recognition megastudies are rather robust with respect to the selection and presentation of the stimuli. Because of its design, BLP makes the same analyses possible as DLP, offering researchers with a new interesting dataset of word processing times for mixed effects analyses and mathematical modeling. In this talk we present the outcome of the first analyses we made.

#### (SY\_03.4)

##### **An investigation of the role of grapheme units in word recognition**

LUPKER, S. J.<sup>1</sup>, ACHA, J.<sup>2</sup>, DAVIS, C. J.<sup>3</sup> & PEREA, M.<sup>4</sup>. <sup>1</sup>*University of Western Ontario, London, Canada*, <sup>2</sup>*Basque Center on Cognition, Brain and Language (BCBL), Donostia, Spain*, <sup>3</sup>*Royal Holloway University of London, Egham, UK*, <sup>4</sup>*Universitat de València, Valencia, Spain*.

In most current models of word recognition, word units are assumed to be activated by letter units. An alternative possibility is that word units are activated by grapheme units, that is, that graphemes, rather than letters, are the building blocks of reading. If so, there must be representational units for letter pairs like "ch" and "ph" in the system. We examined this idea in four masked priming experiments. Primes were created by transposing, replacing entirely or removing one component of either multi-letter graphemes or two adjacent letters that each represented a grapheme, with both English and Spanish stimuli. In none of the experiments was there any evidence of differential priming effects depending on whether the two letters being manipulated formed a single grapheme or formed two separate graphemes. These data are most consistent with the idea that multi-letter graphemes have no special status at the earliest stages of word processing and, therefore, that word units are, indeed, activated by units for individual letters.

#### (SY\_03.5)

##### **ERP evidence for mental rotation of letter strings in an alphabetic decision task**

DUÑABEITIA, J. A., MOLINARO, N. & CARREIRAS, M. *Basque Center on Cognition, Brain and Language (BCBL), Donostia, Spain*.

Recently Duñabeitia, Molinaro and Carreiras (2011, Neuroimage) showed that readers perceive mirror-words as if they were correctly oriented at initial stages of word recognition processes. In order to further examine whether word enantiomorphs (lateral reversals of words in a mirrored style) are processed as canonical word representations during early stages of visual processing, we conducted a masked priming alphabetic decision experiment while recording participants' electrophysiological brain responses to letter and pseudo-letter strings briefly preceded by correctly oriented and mirrored repetition or control masked primes. Participants were simply asked to identify whether or not the displayed strings were made of existing or invented characters by pressing buttons on a response box. On the one hand, our results showed an N250 masked priming effect for related (normally oriented and mirrored) primes, as compared to the unrelated control conditions (i.e., a mirror priming effect), when the targets were real words made of existing letters. On the other hand, the correctly oriented identical primes elicited a N250 masked repetition priming effect that was significantly different from the effect elicited by mirrored repetition primes

(a canonicity effect) for word targets. Besides, effects associated to the mirroring of the letters in the masked primes were observed in the N100 and N/P150 components. These results highlight the ability of the human visual system to tolerate mirror reversals when processing known printed materials.

#### (SY\_03.6)

##### **Printed Words: These Extraordinary Visual Objects**

GRAINGER, J. Aix-Marseille University & CNRS, Marseille, France.

In this talk I will present an overview of recent research examining the role of visual factors in printed word perception, and the extent to which basic processes in visual word recognition mimic basic processes in visual object identification (Dehaene's "neuronal recycling hypothesis"). The wide variety of research that I will summarize adopts a common strategy involving the systematic comparison of processes involved in identifying printed words and other kinds of visual object, and comparing letter string processing with the processing of strings of other types of visual stimuli such as symbols and digits. Specifically, I will summarize research on: 1) Crowding and letter-in-string identification (in collaboration with M. Chanceaux); 2) The role of visual short-term memory in letter string processing (in collaboration with M. Ktori); 3) Processing speed of words and objects measured with the saccade-choice paradigm (in collaboration with M. Chanceaux, S. Thorpe, and F. Vitu,); 4) Event-related potentials (ERPs) generated by line drawings of common objects and words written in alphabetic and logographic scripts (in collaboration with C. Yum and P. Holcomb); and 5) Computational investigations of the neuronal recycling hypothesis (in collaboration with T. Hannagan).

#### **SYMPOSIUM 4 (SY\_04) Room 6**

##### **Number processing: core deficits and recent developments in cognitive intervention**

GOEBEL, S. M.<sup>1</sup> & KAUFMANN, L.<sup>2, 3</sup>. <sup>1</sup>Department of Psychology, University of York, UK, <sup>2</sup>Institute of Applied Psychology, UMIT-Private University for Health Sciences, Medical Informatics and Technology, Hall in Tyrol, Austria, <sup>3</sup>Department of Pediatrics IV, Medical University Innsbruck, Innsbruck, Austria.

Number processing is crucial for everyday life and professional endeavors. Our current understanding of the cognitive foundations of numerical and arithmetic difficulties, however, is scarce. So far, there are only very few empirically validated numeracy interventions. The aim of this symposium is to bring together researchers working on (i) cognitive foundations of numerical cognition and (ii) theoretically motivated interventions of numerical and arithmetic difficulties. Silke Goebel is going to present data on core cognitive deficits in adults with arithmetic difficulties of developmental origins, focusing on adaptive and non-adaptive strategy-use. The presentation by Bert Reynvoet will focus on the priming distance effect in children and adults with and without arithmetic difficulties. Furthermore he will present findings on the individual differences in the priming distance effect and its relationship to math ability. Denes Scuzs will report behavioral and ERP findings related to the development of the magnitude representation and

spatial-numerical associations in elementary school children. The last three talks will present novel intervention approaches for the remediation of numerical and arithmetic difficulties. First, Silvia Pixner will give an overview of intervention approaches for multiplication facts for primary and secondary school aged children. Their multimodal training establishing number-colour associations resulted in significant improvements in arithmetic. Second, promising findings of an embodied cognition approach for intervention of numerical and arithmetic difficulties in kindergarten children will be presented by Hans-Christoph Nuerk. Finally, Minna Hannula-Sormunen will present data of a one-year intervention program for 4-year-old children with numeracy difficulties.

#### (SY\_04.1)

##### **Finger counting, tally marks and adaptive strategy use in two adults with developmental arithmetic difficulties**

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In recent years the research into numerical and arithmetic difficulties in children has increased substantially. However, relatively little is still known about number processing and arithmetic performance patterns of adults with a life-long history of numerical and arithmetic difficulties. Clearly, longitudinal studies are needed to investigate the outcome of childhood numerical and arithmetic difficulties in adult life. Currently however, given the absence of those studies, investigating adults with pure numerical and arithmetic difficulties could also tell us more about developmental pathways. We will present data from two adults with severe arithmetic difficulties. Both adults are university students with above average cognitive skills who have experienced difficulties with number processing and arithmetic since childhood. RM is a pure case with no impairments in other cognitive domains. She uses tally marks and finger counting for simple addition and multiplication tasks. AC also uses elaborate strategies to solve arithmetic problems that are commonly used by fact retrieval. In contrast to RM, AC shows arithmetic difficulties in the context of developmental dyslexia. First we will compare and contrast in detail the strategies used by those two adults for single digit addition, subtraction and multiplication. Second we will then compare their performance on symbolic and non-symbolic number comparison tasks and spatial-numerical tasks to the performance of age and IQ-matched controls.

#### (SY\_04.2)

##### **Magnitude representations in children and adults with and without arithmetic difficulties**

REYNVOET, B.<sup>1</sup>, DEFEVER, E.<sup>1</sup> & GOEBEL, S. M.<sup>2</sup>.

<sup>1</sup>Department of Psychology, University of Leuven, Belgium, <sup>2</sup>Department of Psychology, University of York, UK.

Today, it is generally assumed that children and adults with arithmetic difficulties have a defected internal magnitude representation and/or have problems associating symbols to this internal magnitude representation. However, most of the evidence is obtained in

comparison tasks and recently it has been argued that comparison data may reflect more general decisional mechanisms instead of representational characteristics. We re-evaluated these hypotheses underlying arithmetical difficulties with the priming paradigm. The priming distance effect is considered as a direct measure of the underlying magnitude representation. We will present data on individual differences in the priming distance effect in children and adults and their relation with mathematical ability. The results show relations between the size of the priming effect and mathematical ability. These results will be discussed against the hypotheses underlying arithmetic difficulties.

#### (SY\_04.3)

**The development of the magnitude representation and spatial-numerical associations with symbolic number in 6 to 8 year-old children: behavioural and ERP evidence**  
SZUCS, D.<sup>1</sup>, WHITE, S.<sup>2</sup> & SOLTESZ, F.<sup>1</sup>. <sup>1</sup>*Department of Experimental Psychology, University of Cambridge, Cambridge, UK*, <sup>2</sup>*Queensland University of Technology, Brisbane, Australia*.

Learning symbolic Arabic digits in early childhood requires the integration of both magnitude and spatial information with symbolic number notation. In two studies we investigated this integration process in detail during the first three years of primary school in 6, 7 and 8 year-old normally developing children. Study 1 used event-related brain potentials to determine the speed of access to magnitude information from Arabic digits in a situation when number meaning was not relevant; in the physical size judgment task of the numerical Stroop paradigm. ERPs provided a practically real-time index of the speed of access to magnitude information uncontaminated by response organization processes. This speed characterized the strength of association between magnitude information and symbolic digits. All age groups accessed magnitude information with similar speed. This suggests that access to basic magnitude information was mature very early during schooling. Study 2 took a step further and examined not only automatic access to magnitude but also automatic access to spatial information from symbolic digits within the same sample of children. Previous research has separately investigated the development of these components. However, developmental trajectories of symbolic number knowledge cannot be fully understood when considering components in isolation. Hence, we integrated these lines of research. The physical judgment task of the numerical Stroop paradigm demonstrated that automatic access to magnitude was present from Year 1 and an automatically evoked distance effect signaled that a refined processing of numerical information had developed. Additionally, a parity judgment task where number meaning was again, irrelevant, showed that the onset of the Spatial-Numerical Association of Response Codes (SNARC) effect occurs from 8 years of age (Year 2 of school). These findings uncover the developmental timeline of the integration of magnitude and spatial information during the early learning of Arabic digits in normally developing children.

#### (SY\_04.4)

**Physical-spatial training of number magnitude representation: congruency of response and stimulus increases training effects**

NUERK, H.<sup>1,2</sup>, FISCHER, U.<sup>1</sup>, MOELLER, K.<sup>1,2</sup> & CRESS, U.<sup>1</sup>. <sup>1</sup>*Knowledge Media Research Center, Tuebingen, Germany*, <sup>2</sup>*Institute of Psychology, Eberhard Karls University, Tuebingen, Germany*.

In recent years, the predictive value of children's early basic numerical competencies for their future arithmetic abilities has received growing interest. One of these basic numerical skills is the spatial representation of magnitude (mental number line representation). However, while correlative relationships are now well established, the causal links are weak, i.e., intervention studies training spatial-numerical relationships are still scarce. Therefore, we designed a new spatial-numerical training program that was supposed to increase accuracy of kindergarten children's mental number line representation. We tried to achieve this by associating both responses and presentation of the stimuli with the spatial orientation (left to right) of the mental number line representation. More precisely, children were trained in a magnitude comparison task employing an embodied cognition approach. They had to respond by a full-body spatial movement (i.e., step left or step right) on a digital dance mat while stimuli were presented along a left-to-right oriented number line in the experimental condition. This spatial-numerical training was more effective than a non-spatial control training (without a full-body response and without presentation of a number line) in enhancing children's performance in both a number line estimation task and a subtest of a standardized mathematical achievement battery (TEDI-MATH). These results suggest that training the mental number line by spatial congruency of a numerical stimulus and full-body response is successful and can increase numerical capabilities even in transfer tasks. Studies that are currently in progress will a) expand the current results to other new digital media (such as interactive whiteboards) and b) identify the specific constellations of response and presentation factors responsible for the greater effectiveness of the spatial-numerical training employing an embodied cognition approach.

#### (SY\_04.5)

**A one-year intervention for 4-year-old children with low numerical skills**

HANNULA-SORMUNEN, M.<sup>1</sup>, RASANEN, P.<sup>2</sup>, MATTINEN, A.<sup>2</sup>, KAJAMIES, A.<sup>1</sup> & LEHTINEN, E.<sup>1</sup>. <sup>1</sup>*Department of Teacher Education, University of Turku, Finland*, <sup>2</sup>*Niljo Maki Institute, Finland*.

Here we present a quasi-experimental intervention study on a new remedial program for four to five year-old children with difficulties in learning basic numerical skills. 'Teddy Bear Math' (TBM) program (Mattinen, Rasanen, Hannula & Lehtinen, 2008; 2010) is a systematically progressing one-year curriculum on basic number skills for children with difficulties in early numerical skills. The program is built on training of children's metacognitive skills contains weekly small group sessions at day-care settings, bridging numerical activities to daily life, as well as materials for cooperation with parents. TBM is based on general enrichment programs (Feuerstein et al., 1980; Greenberg, 2000; Haywood, Brooks & Burns, 1992) and

to the ideas of socially constructed learning (e.g. Rogoff, 1990; Vygotsky, 1978) in which all activities were introduced to the children in variety of games and everyday contexts of a teddy bear family. Numerical training started from dealing with approximate numbers and very small exact numbers and progressed to counting up to ten items, adding, subtracting and comparing of exact numbers. Design of the one-year longitudinal study with pre-intermediate-post and delayed post-tests included an experimental group (n = 9) taking part in TBM and an age and skill matched control group (n=9) taking part in a listening comprehension program, which shared the same instructional structure and metacognitive training as TBM. Participants' (mean age 4 yrs 4 months) spontaneous focusing on numerosity, cardinality recognition and number sequence production skills were under the median of 4-year-old children's skills. Results show that the experimental group outperformed the control group in cardinality recognition skills. The TBM program, which is tightly integrated to everyday contexts, is effective in remediating young at-risk children's numerical skills, and thus show that there is a great deal of potential in developing programs that may help children early enough to prevent failure in later mathematics.

#### SYMPOSIUM 5 (SY\_05) Room 4

##### **Learning novel grammars, vocabularies and orthographies: developmental and neural perspectives**

TAYLOR, J. *MRC Cognition and Brain Sciences Unit, Cambridge, UK.*

One of the most impressive aspects of human language is our ability to learn both item-specific and generative or rule-governed knowledge. However, the mechanisms underlying these processes have been hard to establish through natural language studies in which many factors confound comparisons of regular/irregular and familiar/unfamiliar items. Six papers investigate the cognitive and neural mechanisms that support the acquisition of item-specific and generative knowledge, asking how systematicity and meaningfulness influence within- and cross-modal learning. Answering these questions will help resolve long-standing theoretical debates (e.g. between localist/distributed accounts of cognition), have implications for curriculum design (what are the merits of learning abstract rules vs. context/meaning in reading or second language learning?), and advance us towards the goal of discovering the cognitive and biological foundations of language and literacy acquisition. The studies presented all use artificial language learning paradigms to investigate acquisition and generalization of orthography, vocabulary and syntax. Our innovative methods give complete control over exposure to the statistics of the languages being learned and enable us to examine language learning as it unfolds, complementing and extending existing developmental and cognitive neuroscience research. Papers one to three explore the factors affecting children's learning, starting with the acquisition of new symbol-sound pairings (Robin Litt), followed by novel written words (Fiona Duff), and ending with new grammars (Elizabeth Wonnacott). Paper four uses a multimodal learning paradigm to investigate word segmentation and word-referent mapping in adults (Toni Cunillera). Finally, papers five and six combine artificial language learning with brain imaging techniques to

explore the similarities/differences between the neural systems supporting newly learned artificial and native grammars (MEG experiments - Annika Hulten), and orthographic versus object-label learning (fMRI experiments - Jo Taylor). In sum, we show how convergent evidence from development and neurobiology provides crucial evidence for understanding reading and language acquisition.

#### (SY\_05.1)

##### **What can your child's paired associate learning tell us about his reading ability?**

LITT, R., NATION, K. & WATKINS, K. *University of Oxford, UK.*

Previous research has established a relationship between poor reading and Paired Associate Learning (PAL), a task in which participants learn stimulus-response mappings. Whether this relationship results from differences in verbal learning, or the ability to establish orthography-phonology mappings, remains unclear. The current study investigated the hypothesis that children with dyslexia have specific impairments in crossmodal (visual-verbal, verbal-verbal), but not unimodal (verbal-verbal, visual-verbal) PAL. Forty-five children (15 dyslexic, 15 CA controls, 15 RA controls) aged 8-11 were matched for non-verbal intelligence and tested across four PAL conditions each with 6 stimulus pairs: Visual-verbal, verbal-verbal, visual-verbal, and verbal-verbal. Novel abstract symbols and nonwords were used, eliminating the role of previous learning/knowledge and allowing us to simulate the earliest stages of letter-sound learning. PAL was tested over four weeks, with one PAL condition per week to minimize interference between conditions. On day one of each week, participants completed a computerized PAL task, consisting of two presentation trials and five test trials with feedback. The next day, participants completed a delayed recall and yes/no recognition task. Data were analyzed using mixed factorial ANOVAs (comparing group and performance across conditions), and multiple regression (examining the relationship between PAL and reading ability). Children with dyslexia performed equally as well as CA controls in the nonverbal condition (visual-verbal), but significantly lower in conditions with a verbal component (visual-verbal, verbal-verbal, verbal-verbal). Performance patterns were similar to RA controls. Contrary to the hypothesis, performance was not selectively impaired in crossmodal PAL. However, the finding of impaired verbal-verbal PAL, which required no verbal output, suggests that verbal response demand alone cannot explain the findings. Two alternative hypotheses, one of verbal domain deficits, and the other of an additive effect of verbal task demands and crossmodal PAL are discussed.

#### (SY\_05.2)

##### **The role of children's phonological and semantic knowledge in learning to read words**

DUFF, F. & HULME, C. *University of York, UK.*

This paper presents two experiments that focus on the relationship between oral language skills and learning to read single words in 5- to 6-year-old children. According to theories of reading development, both phonological and semantic knowledge about a word should predict how easily children learn to read it. However, few developmental studies have considered item-level rela-



tionships when assessing the impact of linguistic knowledge on learning to read. Furthermore, in relation to oral pre-exposure paradigms, it remains unclear as to whether semantics exerts any influence on learning beyond the effect of phonology. In Experiment 1 children learned to read real but unfamiliar words varying in spelling-sound consistency and imageability. Consistency affected performance on early trials while imageability affected performance on later trials. Individual differences among children in phonemic awareness on the trained words were related to learning, and knowledge of a word's meaning predicted how well it was learnt. These results confirm, across participants, the importance of phonological skills for learning to read; but crucially suggest that within-participants, item-level semantic knowledge facilitates learning to read single words. In Experiment 2, phonological and semantic knowledge of nonwords was manipulated prior to word learning. Familiarization with a word's pronunciation facilitated word learning, but there was no additional benefit from being taught to associate a meaning with a nonword. In view of Experiment 1, it is argued that semantic knowledge does influence the process of learning to read single words, but that more naturalistic methodologies may be needed in order to detect this effect in oral pre-exposure paradigms.

#### (SY\_05.3)

##### **Constraining generalization in artificial language learning**

WONNACOTT, E. *University of Oxford, UK.*

Successful language acquisition involves generalization, but learners must balance this against the acquisition of lexical constraints. For example, native English speakers know that certain noun-adjective combinations are impermissible (e.g. strong winds, high winds, strong breezes, \*high breezes). Another example is the restrictions imposed by verb sub-categorization, (e.g. I gave/sent/threw the ball to him; I gave/sent/threw him the ball; I donated/carried/pushed the ball to him; \* I donated/carried/pushed him the ball). How do children learn these exceptions? (Baker, 1979). The current work addressed this question via a series of Artificial Language Learning experiments with 6 year olds. The results demonstrated that children are sensitive to distributional statistics in their input language and use this information to make inferences about the extent to which generalization is appropriate (cf. Braine, 1971; Wonnacott, Newport & Tanenhaus, 2008). In particular, there was evidence that children assessed whether the choice of linguistic structures depended upon the particular words with which they had occurred, and this affected their learning of arbitrary exceptions. The results are interpreted in terms of a rational Bayesian perspective on statistical learning (Perfors, Tenenbaum & Wonnacott, 2010).

#### (SY\_05.4)

##### **Bridging the gap between speech segmentation and word-to-world mappings: Evidence from an audiovisual statistical learning task**

CUNILLERA, T. *University of Barcelona, Spain.*

In a recent study conducted by Cunillera, Laine, Càmarà and Rodríguez-Fornells (2010) we raised the question of how second language learners are able to segment words

and map them to a meaning. Can these two processes occur simultaneously? We explored this unresolved issue by using a new multimodal learning paradigm (see Cunillera et al., 2009) that tracked the first steps in learning new words and their mappings to visual referents. It encompassed a continuous audiovisual stream in which transitional probability of syllables was the only acoustic cue available to segment the stream into words, and a visual stream of object images that accompanied the novel words. The object images were systematically varied in terms of constancy of word-picture association and meaningfulness. The results of the experiments indicated good word-referent mapping and word segmentation after short exposure to the audiovisual stream, and suggest that i) mapping words with pictures is more effective when the visual referents are meaningful objects, ii) in word segmentation, the consistency of the word-picture association affects segmentation performance, iii) the effect of associative strength on segmentation performance was most prominent with meaningful objects, and iv) detection of temporal contiguity between multimodal stimuli may be useful in second-language learners not only for facilitating speech segmentation, but also for detecting word-object relationships in natural environments. All in all the present results suggest that word segmentation and word-referent mapping are closely related processes: word segmentation is affected by the consistency of the mapping relationship and both segmentation and mapping can be accomplished under the same short exposure.

#### (SY\_05.5)

##### **Sentence-level speech production: Evidence from a newly learned miniature language and L1**

HULTEN, A.<sup>1, 2</sup>. <sup>1</sup>*Brain Research Unit, Low Temperature Laboratory, Aalto University, Finland,* <sup>2</sup>*Department of Psychology and Logopedics, Åbo Akademi University, Turku, Finland.*

The human ability to share novel ideas and thoughts with one another stems from characteristics of human language: the powerful combination of words and syntax enables us to understand and produce an unlimited array of utterances. Applying the rules of syntax, we build up sentences from their lexical constituents and their meanings, arriving to the compositional semantics of the whole sentence. Intriguingly, a person who speaks several languages may shift between different sets of rules as languages may greatly vary in their grammatical structure. The underlying neural implementations of these processes are far from resolved. In the present study, healthy adult volunteers learned a miniature language (Anigram) with a grammar markedly different from that of their mother tongue (Finnish), in four daily training sessions. Thereafter, during magnetoencephalography scanning, participants generated sentence-level description of a pictured event. Sentence vs. word sequence generation was tested separately for each language. The task was divided into a planning phase (picture presentation) and a cloze test (corresponding words overlaid on the picture) that ended with a prompt to generate the final word. Processing of the two languages differed only during the planning stage, as stronger activation for Anigram in the left angular and inferior parietal cortex, interpreted as an increased working memory load for the preparation of novel language output. Production of the

sentence-final word, calling for retrieval of rule-based inflectional morphology, was accompanied by increased activation in the left middle superior temporal cortex and did not differ between the languages. Furthermore, the results suggest a prominent role for right hemisphere temporal regions in terms of integrative processing and in discriminating between word sequences and sentences. The study has implications for models of language learning and provides a new approach for the study of the neural mechanisms of sentence-level speech production.

#### (SY\_05.6)

##### **Learning object names activates the visual word form area more than learning to read: Evidence from artificial language learning and fMRI**

TAYLOR, J.<sup>1</sup>, RASTLE, K.<sup>2</sup> & DAVIS, M. H.<sup>1</sup>. <sup>1</sup>*MRC Cognition and Brain Sciences Unit, Cambridge, UK*, <sup>2</sup>*Royal Holloway University of London, UK*.

Dehaene and colleagues propose that the left fusiform gyrus (LFG) contains a specialised visual word form area (VWFA) representing abstract orthographic units. Conversely, Price and others argue that the LFG processes both visual objects and words, attributing word-specific responses to task-related top-down modulation. We combine an artificial language paradigm with fMRI, providing a unique opportunity to explore ventral-temporal specialisation whilst learning novel words and objects. Examining learning maximises task differences: words must be decoded using systematic spelling-sound mappings whereas objects must be arbitrarily associated with their names. Twenty healthy adults learned new names for 24 novel objects and to read 24 new words written in novel symbols, whilst in an MRI scanner. Learning consisted of interleaved phases of training (paired visual-spoken forms) and testing (read words/name objects). Participants learned the trained items (words-69%, objects-68% correct) and generalized their orthographic knowledge to untrained words (62% correct). Relative to unimodal listening/viewing, cross-modal associative learning of visual-spoken form pairings activated bilateral superior parietal cortices, fusiform gyri and left hippocampus ( $p < .01$  whole-brain corrected). These regions active for learning objects and words were used as a search volume for subsequent analyses. The LFG (including VWFA) was more active when learning object-name associations than when learning to read words. The reverse contrast revealed activation in bilateral superior parietal cortices. During a final test phase, covert word reading versus object naming showed the same patterns of dissociation in LFG and superior parietal areas, with additional activation for words compared to objects in a left mid-occipital region previously associated with pseudoword reading. The weaker involvement of the LFG in orthographic relative to object-label learning perhaps challenges the idea that this region is specialised for reading. Conversely, strong involvement of parietal regions in orthographic learning suggests a focus for future neuroimaging research on learning to read.

#### SYMPOSIUM 6 (SY\_06) Room 5

##### **Functional characteristics of instructed and practiced task-sets**

LIEFOOGHE, B.<sup>1</sup>, WENKE, D.<sup>2</sup> & DREISBACH, G.<sup>3</sup>. <sup>1</sup>*Ghent University*, <sup>2</sup>*Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig*, <sup>3</sup>*University of Regensburg*.

Goal-directed behavior is often assumed to be based on a task-set, which is a representation of the control settings for processes such as stimulus identification, response selection and response execution. Although task-sets play an important role in many theories of goal-directed behavior, their functional characteristics remain rather vague. The present symposium will focus on research with a direct interest on the functional characteristics of task-sets that are newly formed on the basis of task instructions, on the one hand, and of task-sets of tasks that have already been practiced on the other hand.

#### (SY\_06.1)

##### **Functional Characteristics of the instruction-based task-rule congruency effect**

LIEFOOGHE, B.<sup>1</sup>, WENKE, D.<sup>1,2</sup> & DE HOUWER, J.<sup>1</sup>. <sup>1</sup>*Ghent University*, <sup>2</sup>*Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig*.

The present study investigated the functional characteristics of task-sets that were never applied before and that were only formed on the basis of instructions. We tested if such task-sets could elicit a task-rule congruency effect, which consists of the automatic activation of responses in the context of another task. A series of experiments indicate that task-sets, which are formed on the basis of instructions, can elicit a task-rule congruency effect. A finding challenging recent accounts of this effect. Additional experiments further investigated the functional properties of this instruction-based task-rule congruency effect. Implications for research on task-set formation and for research on the implementation of instructions are considered.

#### (SY\_06.2)

##### **Object selection in declarative working memory is analogous to response selection in procedural working memory**

OBERAUER, K., SOUZA DA SILVA, A., DRUEY, M. & GADE, M. *University of Zurich*.

We propose that working memory (WM) is a system for making available representations that are relevant for cognition and action. Declarative WM makes available the objects of (cognitive) actions, whereas procedural WM holds representations of the planned actions themselves, that is, task sets. We assume that declarative and procedural WM operate by analogous mechanisms. We present four experiments testing this hypothesis, focusing on selection of items in declarative WM and of responses in procedural WM. In sequences of speeded choice tasks, selecting the same response on successive trials speeds up responding. This response repetition benefit is turned into a cost when people switch the task from one trial to the next. We show analogous pattern for the selection of items in declarative WM. Repeated access to the same digit in working memory resulted in a benefit, which turned into a cost when people switched between two lists in successive trials, and the same digit had to be accessed in different positions in the two sets. The final experiment shows the same pattern of

repetition costs and benefits in a task-switch paradigm designed in exact analogy to the declarative WM task. The results are explained by the inhibition of items and responses when de-selected, together with temporary strengthening of bindings of items and responses to their retrieval cues.

#### (SY\_06.3)

##### **Task sets are modality specific**

STEPHAN, D. & KOCH, I. *RWTH Aachen University*.

Current theories of cognitive control assume that a task set is needed to perform a certain task. Thus, it reflects the mental representation of the task and involves the necessary cognitive processes, the representation of the set of the relevant stimuli, the required responses and the mapping between these stimuli and responses. In general, task sets are described to be abstract and amodal. We report experiments in which we systematically examine the influence of modality specific factors on task sets using task switching methodology. More specifically, we examined the role of compatibility of input and output (I-O) modality mappings in task switching. Our experiments included switching between auditory-vocal and visual-manual tasks (compatible) and between auditory-manual and visual-vocal tasks (incompatible). Overall, the resulting switch costs were smaller when participants switched between compatible tasks compared to when they switched between incompatible tasks. Reduced switch costs in compatible tasks may be due to special linkages between input and output modalities, whereas incompatible tasks increase cross-talk, presumably due to dissipating interference of correct and incorrect response modalities. These special linkages are part of the task set. Our data suggest that task sets are modality specific rather than being entirely abstract and amodal!

#### (SY\_06.4)

##### **Task Shielding and its relaxation during task switching**

DREISBACH, G.<sup>1</sup> & WENKE, D.<sup>2,3</sup>. <sup>1</sup>*University of Regensburg*, <sup>2</sup>*Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig*, <sup>3</sup>*Ghent University*.

Task sets in terms of two-choice categorization rules help shielding against distraction from irrelevant stimulus attributes. During task switching, this task shielding should temporarily be relaxed in order to prevent the perseveration of the previous task, on the downside making the system more vulnerable towards the intrusion of irrelevant information. Participants had to switch between a digit and a letter categorization task. An irrelevant stimulus feature (Experiment 1: Color, Experiment 2: Font) varied randomly, orthogonal to the task. The presence or absence of an interaction of the irrelevant feature (switch vs. repetition) and the response (switch vs. repetition) was taken as evidence for the absence or presence of task shielding, respectively. Replicating previous results, no feature X response interaction was found on task repetitions, indicating successful task shielding. On task switches however, the feature X response interaction was significant, reflecting the assumed relaxation of task shielding during task switching.

#### (SY\_06.5)

##### **Cognitive control and other instructions: An associative learning perspective**

VERGUTS, T. *Ghent University*.

A first step toward formulating cognitive control in terms of associative learning was taken by Botvinick et al. (2001), who used the Cohen et al. (1990) Stroop model to account for extant cognitive control phenomena such as the Gratton effect. Here, task demand representations bias bottom up task processing, thus overcoming irrelevant sources of information (i.e., cognitive control). However, an explanation of a key aspect of cognitive control is lacking: How are task demand representations implemented on the fly such as to bias task processing? I take the associative learning approach a step further and show how task representations and its biasing of task processors can be conceptualized as fast implementation of instructions, produced by Hebbian learning (Verguts & Notebaert, 2009). This view is instantiated in a computational model. Empirical data consistent with the model are discussed.

#### (SY\_06.6)

##### **Instructed and practiced Flanker and Gratton effects**

WENKE, D.<sup>1,2</sup>, LIEFOOGHE, B.<sup>2</sup> & DE HOUWER, J.<sup>2</sup>. <sup>1</sup>*Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig*, <sup>2</sup>*Ghent University*.

Functional similarities between practiced and merely instructed S-R mappings were explored using an Eriksen Flanker task. We compared the overall Flanker compatibility effect (FCE) and its sequential modulation (i.e., the Gratton effect) in a practiced condition with an instructed condition. Four new S-R mappings were instructed on each block of trials. In the practiced condition, each instructed stimulus could appear as target and as flanker. In the instructed condition, two stimuli only served as targets, whereas the other two exclusively appeared as flankers. We found significant FCEs in both the instructed and the practiced condition. Moreover, the Gratton effect was similar in the two conditions: It only showed in target/response repetition trials, but not in alternation trials. Our results suggest that instructions alone can induce bindings between S- and R features that lead to automatic response activation when instructed stimuli appear as flankers in a functionally similar way as practiced flankers.

#### SYMPOSIUM 7 (SY\_07) Room 1

##### **From unconscious processing to metacognition: Are we explaining consciousness yet?**

CLEEREMANS, A. *Université Libre de Bruxelles, Bruxelles, Belgium*.

This symposium, consisting of six presentations by leaders in the field, is dedicated to the complex relationships that exist between unconscious information processing, consciousness, and metacognition. Theoretical perspectives on these relationships are strongly contrasted, with some theories of consciousness assuming that it is constitutive of conscious representations that one be aware of possessing them; while other theories assume that subjective experience has little to do with one's ability to engage in metacognitive judgements. Two presentations are specifically dedicated to exploring this question. Based on brain imaging studies, Hakwan Lau argues that

metacognitive reports reflect subjective sensory awareness and that such reports should thus be preferred to forced-choice discrimination as measures of awareness. Cleeremans reports on computational modeling work aimed at exploring the idea that consciousness results from a cognitive system's unconsciously learning to redescribe its own activity to itself. The following empirical papers then illustrate the scientific fruitfulness of metacognitive theories of conscious awareness and challenge traditional perspectives. Scott & Dienes suggest that associative learning of visual stimuli is possible without conscious perception. Dienes asks whether unconscious learning of artificial grammars is possible (and concludes that it is). Norman challenges the idea that strategic control requires awareness by showing how people can control the expression of learned knowledge without awareness of the knowledge itself. Jiménez & Mendez, finally, explore the interactions between conscious expectancy and congruency effects to develop a dynamic, interactive view of cognitive control in which conscious and unconscious processes play equally important roles.

#### (SY\_07.1)

##### **Metacognitive reports reflect subjective sensory awareness**

LAU, H. *Columbia University, New York, USA.*

Metacognitive reports of perception (such as visibility judgments or confidence ratings) are reflected by activity in the prefrontal cortex. Critics of prefrontal theories of consciousness argue that such findings are specific to metacognition, and are irrelevant to the primary aspects of sensory awareness. Here I argue that these metacognitive reports can capture some of our deepest intuitions regarding sensory awareness. Our experiments using psychophysics and brain imaging showed that under the lack of attention, metacognitive judgments were inflated, such that subjects rated their subjective sense of perception to be higher than was warranted by the underlying processing capacity. This explains why we may subjectively feel that we see vividly the whole visual scene in front of it, even though inattentional blindness and change blindness studies showed that we are only good at processing a few items at a time, and that peripheral vision has relatively poor color sensitivity and spatial resolution. The explanation is that we do not actually see all the items in front of us in colorful details. We only think/judge that we are seeing them because of a biased metacognitive mechanism. Whereas philosopher Ned Block argues that visual phenomenology may be too rich to be captured by self-reports, our findings suggest that self-reports can shed important light on the issue, if we use the right kind of measure - metacognitive reports instead of forced-choice task performance.

#### (SY\_07.2)

##### **Metacognitive networks**

CLEEREMANS, A., PASQUALI, A. & TIMMERMANS, B. *Université Libre de Bruxelles, Bruxelles, Belgium.*

Here I explore the idea that consciousness is something that the brain learns to do rather than an intrinsic property of certain neural states and not others. Starting from the idea that neural activity is inherently unconscious, the question thus becomes: How does the brain learn to be conscious? I suggest that consciousness arises as a

result of the brain's continuous attempts at predicting not only the consequences of its actions on the world and on other agents, but also the consequences of activity in one cerebral region on activity in other regions. By this account, the brain continuously and unconsciously learns to redescribe its own activity to itself, so developing systems of meta-representations that characterise and qualify the target first-order representations. Such learned redescriptions, enriched by the emotional value associated with them and informed by our constant interactions with others, with ourselves, and with the world, are constitutive of conscious experience. Learning and plasticity are thus central to consciousness, to the extent that experiences only occur in experiencers that have learned to know they possess certain first-order states and that have learned to care more about certain states than about others. This is what I call the "Radical Plasticity Thesis". In a sense thus, this is the enactive perspective, but turned both inwards and (further) outwards. Consciousness involves "signal detection on the mind"; the conscious mind is the brain's (non-conceptual, implicit, embodied) theory about itself. I illustrate these ideas through neural network models that simulate the relationships between performance and awareness in different tasks, including Artificial Grammar Learning and the Iowa Gambling Task.

#### (SY\_07.3)

##### **Associative learning achieved without conscious perception**

SCOTT, R. & DIENES, Z. *University of Sussex, Brighton, UK.*

Implicit learning paradigms reliably demonstrate associative learning without conscious awareness of the association being learnt. However, while the relationship between stimuli may be unconscious the stimuli themselves are consciously perceived. We examine if associative learning can be achieved without conscious perception. Face stimuli are employed to capitalise on the large cortical resource dedicated to face processing. Repeated back masking is used to extend unconscious exposure to approximately 2 seconds. Participants' subjective perceptual thresholds were identified using sample images. Whole face pairs or scrambled face pairs were presented and back masked with a random block pattern. Participants indicated whether the faces were whole or scrambled and rated their confidence. Exposure duration was progressively reduced until zero confidence was reported on ten consecutive trials. Training involved sub-threshold exposure to a randomly selected 20 of 30 face pairs. Exposure consisted of two sets of 20 repeats of the image presented below the identified threshold and masked with a random pattern. Each pair included one male and one female face. Participants reported if the male face was on the left or the right and indicated their confidence. If confidence was above zero the exposure duration was further reduced and the given face pair excluded from the test phase. At test participants rated the correctness of 30 pairs of faces: 10 unchanged from training, 10 with the position of the faces swapped, and 10 new pairs. Judgments regarding the location of the male face during training were at chance ( $M=.51$ ,  $SE=.02$ ,  $t(17)=.31$ ,  $p=.760$ ,  $CI_{95\%} .47-.55$ ). Nonetheless, the correctness ratings given to swapped face pairs ( $M=1.76$ ,  $SE=.10$ ) were significantly lower than those for unchanged pairs ( $M=1.99$ ,  $SE=.11$ ,  $t(20)=3.04$ ,  $p=.006$ ).

Sensitivity to the change in configuration of stimuli only previously seen subliminally provides evidence that associative learning can be achieved both unconsciously and without conscious perception.

#### (SY\_07.4)

##### **Does unconscious learning of artificial grammars exist?**

DIENES, Z. *University of Sussex, Brighton, UK.*

One of the key domains investigating the difference between conscious and unconscious processes is implicit learning. Within the implicit learning literature, the key papers defining the “believers” position that unconscious learning exists, and its nature, were published by Arthur Reber in the 1960s and 1970s. The paper defining the sceptics’ position, and still one of the most closely argued papers sceptical of implicit learning, is Dulany, Carlson and Dewey (1984) (DCD). I will present fresh data which, for the first time in 25 years, attempts to replicate DCD, and test alternative interpretations of their results. Reber exposed people to strings of letters, unbeknownst to subjects generated by a finite state grammar, and then asked people to classify new strings as obeying the rules or not. People could do so at above chance levels despite being unable to describe the rules. Reber argued people had acquired unconscious knowledge. DCD repeated the procedure but asked people to underline the part of the string that made it grammatical or non-grammatical. Treating these underlinings as conscious rules, he showed rule validity predicted correct classification almost perfectly. Thus, DCD argued that all the knowledge was conscious. DCD assumed that forced underlining of part of a string amounted to asserting a rule. But, for example, wondering or completely guessing where to underline is not to assert anything. I repeated DCD’s procedure but in addition asked people to report the basis of their underlining: They completely guessed, they relied on intuition, they used a rule, and they used recollection. People predominantly said they guessed (37%) or used intuition (30%). Further, underlinings only partially accounted for classification. Importantly, the underlinings largely expressed unconscious knowledge, by a metacognitive measure shown to dissociate qualitatively different types of knowledge.

#### (SY\_07.5)

##### **Strategic control over unconscious structural knowledge**

NORMAN, E.<sup>1</sup>, SCOTT, R.<sup>2</sup>, JONES, E.<sup>1</sup>, PRICE, M.<sup>1</sup> & DIENES, Z.<sup>2</sup>. <sup>1</sup>*Faculty of Psychology, University of Bergen, Norway*, <sup>2</sup>*University of Sussex, Brighton, UK.*

Strategic control over the application of knowledge is traditionally regarded as indicating conscious access to that knowledge (Jacoby, 1991). The current study challenges this assumption by providing evidence from artificial grammar learning (AGL) indicating that unconscious structural knowledge of two grammars can be strategically controlled. In two AGL experiments all participants were trained on two different grammars. Instructions as to which grammar to apply varied randomly between individual trials of a subsequent test phase. The nature of each grammar was disguised by random variation in irrelevant properties of individual string elements. Whether structural knowledge of the grammars was conscious or unconscious was measured in two different ways. In Experiment 1 (N=72) participants reported their decision strategy after each classification

response, and reported their degree of awareness of the nature of the rule in a post-experimental questionnaire. In Experiment 2 (N=72) participants made two judgements after each classification response: They reported (a) their decision strategy, and (b) which stimulus property their decision was related to. In Experiment 1, strategic control was found even among participants who expressed unawareness of the nature of the grammar rule, e.g., who reported that the rule was related to colours when in fact colours were irrelevant to the grammar. These participants showed an advantage for trials attributed to “implicit” decision strategies, i.e., random choice, familiarity, or intuition. In Experiment 2, participants also showed strategic control for “implicit” classifications. This was the case even for implicit classifications attributed to irrelevant stimulus properties, e.g. attributing a judgment to an intuition related to colours when in fact colours were irrelevant to the grammar. Findings are interpreted within the framework of “fringe consciousness” (Norman et al., 2007), and as exemplifying the dissociation between consciousness of judgement knowledge versus consciousness of structural knowledge (Dienes & Scott, 2005).

#### (SY\_07.6)

##### **Is it what you expect, or all that you do? Dissociations between conscious expectancies and the control of automatic tendencies**

JIMÉNEZ, L. & MÉNDEZ, A. *Universidad de Santiago, Spain.*

Congruency effects arise when the processing of an irrelevant dimension facilitates responding to another dimension of the stimulus (e.g. Stroop effect). This effect has been described as automatic, in that it is obtained even when people are trying not to rely on the irrelevant word meaning. However, this congruency effect can be dynamically modulated by context factors such as the nature of the previous trials. The sequential congruency (SC) effect thus refers to the fact that this effect of congruency grows larger after a congruent trial than after a non-congruent trial. The SC effect has been taken as a paradigmatic case of control of automatic tendencies, and it has received considerable attention in the literature on cognitive control. In this talk, we will discuss on the nature of this SC effect, which has been attributed to the effect of overt repetition expectancies, to repetition priming, or to a dynamic regulation of control produced as a result of a continuous monitoring of the conflict produced over the previous trials. We will report on a series of experiments in which we controlled for the effects of repetition priming, and dissociated participants’ expectancies from the SC effect. Specifically, we relied on the gambler’s fallacy to show that expectancies can grow in a direction opposite to that predicted by the SC effect. We also manipulated the learning of sequential contingencies to produce either implicit or explicit “expectancies”, and analyzed the interaction between these learned effects and the effects of SC. The results are discussed in terms of a view of control as arising continuously from the processing of the context at a hierarchy of levels, and in which conscious expectancies are seen more as a single piece of the whole picture, rather than as the top layer playing the starring role of metacognition.

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**SYMPOSIA PROGRAM**  
**Friday Afternoon**

**PLENARY SYMPOSIUM (SY\_08) Auditorium.**

**14:20 – 16:00**

**Where is Embodiment going?**

SEMIN, G. R. *NL*.

This plenary symposium is intended to occupy a special significance as an event supported collaboratively by ESCOP and the APS and part of a broader undertaking namely enhancing an integrative view of human functioning. The psychological sciences address phenomena whose understanding requires a multilevel, cross-disciplinary analysis of mind, brain and behavior in social context. The proposed symposium focuses on a perspective that has captured the imagination of scholars across diverse disciplinary perspectives in psychology, namely embodiment. There is an increasing interest in understanding how relatively invariant ecological, existential, material and biological conditions contribute to human functioning. In particular, the issue of how biologically given constraints shape human functioning in contexts that are socially situated has captured considerable attention in psychology. This development, also identified often under the umbrella of embodiment, has arisen in its current form in opposition to a traditional representational approach in psychology, namely conceptualizations of human functioning in terms of a closed loop of symbols or an internal model of the world. These recent developments in embodiment research have yielded an incredibly varied and fascinating collection of research findings inspired by different general frameworks. However, there is a growing and justified concern about the theoretical underpinning of these fascinating results and the mechanisms that are driving them. The promise that this emerging perspective raises is to be found in its potential to cut across a wide range of disciplinary visions and its integrative potential for psychology. The four contributors to this collaborative undertaking between ESCOP and APS present different instances of this growing interface between psychological disciplines.

**(SY\_08.1)**

**Where embodiment is going: Deeper into the body and further into culture.**

GLENBERG, A. *Arizona State University, USA.*

Initial data from two projects suggest that understanding psychological processes in terms of embodiment can be significantly extended. One project investigates the embodied basis of statistical learning, which is the ability to learn from observation alone complex statistical regularities in the transitions between stimuli. According to the Neuromuscular Tuning theory a) people imitate stimuli by using neural mechanisms to drive muscular changes, b) imitating sequences of stimuli induces plastic changes in the brain so that transitions between successive neural and muscular states are produced efficiently, and c) people discriminate between high and low conditional probability transitions on the basis of the efficiency of imitating the stimuli: The brain has been tuned to transition smoothly between the practiced high conditional probability stimuli. More speculatively, this efficiency may be related to the brain's consumption of glucose: When glucose is low, the brain values efficiency and hence easily discriminates between tuned and

untuned sequences; when glucose is abundant, the brain doesn't care as much about efficiency, and the ability to discriminate between the sequences deteriorates. Thus embodied cognition goes deep enough to reflect low-level bodily processes related to energy regulation. The second project brings an embodied analysis to cultural differences. Some cultures encourage the development of interdependent selves, so that people see themselves as strongly connected, even overlapping, with members of their in-group. Other cultures encourage development of independent selves. Our research demonstrates that interdependent personalities literally see themselves as closer to in-group members than out-group members. Furthermore, this difference in perception seems to reflect expected ease, or efficiency, of interaction. In fact, when we experimentally manipulate ease of interaction, pairs who have interacted easily see themselves as literally closer to each other than pairs who have had more cognitively demanding interaction. Thus, embodied cognition extends into social and cultural interactions.

**(SY\_08.2)**

**Embodied cognition 2.0**

HOMMEL, B. *Leiden University, N.L.*

The recent years have provided increasing empirical evidence that human cognition is grounded in sensorimotor experience and, thus, embodied. This can be considered a proof of principle, an important step in laying the foundations for the study of embodied cognition-Embodied Cognition 1.0 if you will. But what are the next steps to take? I will consider three major empirical and theoretical challenges that the study of embodied cognition is facing. First, we need to move from demonstrating that sensorimotor processes are somehow involved in cognition to showing and explaining that and how cognition actually emerges from sensorimotor processes. Second, and relatedly, we need to explain how cognitive (i.e., covert) actions are derived from overt actions, that is, whether, to what degree, and how cognitive mechanisms emerge through the interiorization of sensorimotor action. And third, we need to demonstrate that, and understand how different bodies and sensorimotor opportunities really produce different cognitions and cognitive operations. This endeavor to build Embodied Cognition 2.0 is likely to require collaboration and empirical and theoretical integration across subdisciplines and disciplines, ranging from cognitive neuroscience, cognitive psychology, developmental psychology, and cognitive robotics to social psychology, linguistics, and cognitive anthropology.

**(SY\_08.3)**

**Wiping the slate clean: How we wash off guilt, doubts, luck, and other traces of the past**

SCHWARZ, N. & LEE, S. W. *University of Michigan, USA.*

Talk about morality often draws on metaphors of physical cleanliness, indicating that thought about "moral purity" is grounded in "physical purity". Empirically, moral transgressions give rise to a desire to clean the body part involved in the transgression (e.g., to rinse one's mouth after lying on voicemail, but to wash one's hands after lying on email) and doing so attenuates the experience of guilt and the need to make amends. Going beyond the moral domain, recent work shows that physical cleansings can also remove traces of past

behaviors that have no moral connotations. For example, cleaning one's hands with an antiseptic wipe (as part of an alleged product test) is sufficient to eliminate post-decisional dissonance effects after making a difficult choice and to attenuate the impact of sunk cost on later decisions. The influence of physical cleansings is not limited to past experiences that people may want to wipe off (such as bad luck) but also extends to positive traces they'd rather keep (such as good luck). For example, gamblers bet more after a series of wins than after a series of losses -- yet washing their hands as part of a "product test" eliminates the impact of previous good as well as bad luck on subsequent risk taking. Current studies explore the moderators and mediators of "clean slate" effects.

**(SY\_08.4)**

**The embodiment of abstract concepts and words: Why emotion matters**

VIGLIOCCO, G. *UCL, U.K.*

Within an embodiment framework, it has been argued that abstract concepts and words are learnt and represented as metaphorical extensions from our concrete knowledge. Thus, for example, exchanging ideas is seen as extension from exchanging objects and therefore is thought to be grounded on the same motor and perceptual processes. The alternative dominant view considers abstract concepts as not embodied, linked primarily to linguistic processes. Leaving open the possibility that such mechanisms play some role, we present a novel embodied view of abstract representation according to which our abstract knowledge would be grounded in our emotional states. In a nutshell, we argue that the distinction between concrete and abstract concepts is between concepts that are primarily grounded in our sensorimotor experience with the external world (concrete) and those also grounded in our inner emotional states (abstract). Such grounding in emotional states could have a key role in making abstract concepts learnable, given that these concepts are disadvantaged on a large number of other dimensions (such as e.g., familiarity, imageability, and age of acquisition, all of which favour concrete concepts and words). I will present results from series of studies that support this view. In particular, I will review recent work and present new results showing that: (a) abstract words tend to have statistically more affective associations than concrete words (not just for words directly referring to emotional states); (b) this difference in terms of affective associations has processing consequences such that, once all other factors are taken into account, subjects are faster in processing abstract words; (c) abstract word processing engages the neural system engaged in emotion processing and (d), emotionally valenced abstract words tend to be learnt earlier than more neutral abstract words, leading to the suggestion that the affective grounding might help especially at the initial stages of development.



**SYMPOSIA PROGRAM**  
**Saturday Morning**

SY\_(09-14): 08:30-10:30

**SYMPOSIUM 9 (SY\_09) Room 2**

**Recent developments in the cognitive neuroscience of number processing**

REYNVOET, B.<sup>1</sup> & GEVERS, W.<sup>2</sup>. <sup>1</sup>*University of Leuven, <sup>2</sup>Universite Libre de Bruxelles.*

A gradual shift can be observed in theories on number processing. For several years, the dominant view has been that the representation of numbers is localized in the parietal cortex. Furthermore, this representation would take the form of a mental number line upon which numbers are oriented from left to right. Today, both the type of representation and its location are again matter of intense debate. For what regards localisation, instead of focusing on the parietal cortex, empirical evidence starts to point towards the frontal cortex as an important region in number processing. Relatedly, it becomes increasingly clear that the representation of numbers cannot be investigated independent from decision making processes. The aim of this symposium is to bring together researchers who, using a variety of different techniques and approaches, illustrate on these new developments in the domain of number processing. Seppe Santens will present computational networks modeling the behavior of subjects in numerical judgment tasks, focusing on the contribution of representational characteristics and decision making. Delphine Sasanguie will focus on similarities and dissimilarities between different cognitive markers of magnitude representation using a Transcranial Magnetic Stimulation (TMS) approach. Paola Previtali will present behavioral research that further investigates the role of working memory processes in the processing of numerical information. She will focus on the interaction between long and short term representations of number processing. Fabrizio Doricchi and Oliver Lindemann will talk about the relation between quantities and space. Fabrizio Doricchi will present findings obtained with right brain damaged subjects, whereas Oliver Lindemann is going to present behavioral studies and a fMRI study on this topic. Finally, Roi Cohen Kadosh will present a recent neuroscience technique called transcranial direct current stimulation aimed at improving the performance of subjects in numerical tasks.

**(SY\_09.1)**

**Judging Quantities**

SANTENS, S. & VERGUTS, T. *Dept. of Experimental Psychology, Ghent University, Belgium.*

To understand the cognitive nature of quantities such as number, researchers often investigate how participants perform e.g. magnitude (small / large) or parity (odd / even) judgments. However, computational modelling and behavioral studies conducted in our lab suggest that these tasks might tell us more about how we make decisions than about how we represent quantitative information. Our own work has focused on associations between number, space and physical size. We show how the results fit within our modelling framework.

**(SY\_09.2)**

**Magnitude representation or decision in the LIPS? Evidence from TMS**

SASANGUIE, D.<sup>1</sup>, REYNVOET, B.<sup>1</sup> & GOEBEL, S. M.<sup>2</sup>. <sup>1</sup>*Dept. of Psychology, University of Leuven, Belgium, <sup>2</sup>Dept. of Psychology, University of York, UK.*

Previous studies with Transcranial Magnetic Stimulation (TMS) have shown that stimulation of the parietal cortex can disrupt symbolic number processing. From those experiments alone, however, it cannot be concluded whether the stimulation interfered with representational or decisional stages of number processing as both magnitude processing and response selection have been linked to the parietal cortex. In this study, we conducted a priming task which enabled us to dissociate between representational and decisional effects. Sixteen adults were showed two sequentially presented single digits and had to decide whether they were larger or smaller than five, while being stimulated with repetitive online TMS (rTMS, for 500ms at 10Hz) over the left intraparietal sulcus (LIPS) or the vertex (control site). In addition, the onset of the stimulation was manipulated and was simultaneously administered with either the first or the second digit. The comparison distance effect (i.e. distance between the target and the standard) and the priming distance effect (i.e. distance between sequentially presented targets) were analyzed. Repetitive TMS over the LIPS slowed down the reaction times but the comparison distance effect remained significant. In contrast, the priming distance effect disappeared when the stimulation was administered together with the first stimulus. In general, these results suggest that stimulation over the LIPS interferes with magnitude representations and can delay decisions based on magnitude representations without affecting the decision processes.

**(SY\_09.3)**

**Working memory and number processing**

PREVITALI, P.<sup>1</sup>, GINSBURG, V.<sup>2</sup>, VERMEIREN, A.<sup>2</sup>, VAN DIJCK, J.<sup>3</sup> & GEVERS, W.<sup>2</sup>. <sup>1</sup>*Università degli Studi di Milano Bicocca, Italy, <sup>2</sup>Universite Libre de Bruxelles (ULB), Belgium, <sup>3</sup>Ghent University, Belgium.*

A well studied indication of the correspondence between numbers and space is the SNARC effect, the observation of an association between small numbers and the left hand side and between large numbers and the right hand side. Recently, a working memory account for these spatial numerical associations was proposed (Van Dijck & Fias, 2011). This account holds that the associations between numbers and space are short term representations that are build during task execution. The aim of our study was to test this assumption. A number of experiments are discussed that illustrate different aspects of the working memory account.

**(SY\_09.4)**

**The way we look at the Mental Number Line: evidence from the study of patients with right brain damage**

DORICCHI, F.<sup>1,2</sup>. <sup>1</sup>*Dipartimento di Psicologia 39, Università degli Studi di Roma "La Sapienza", Roma Italy, <sup>2</sup>Fondazione Santa Lucia - IRCCS, Roma Italy.*

At the turn of the 19th century, in two Nature issues Francis Galton (1880) first described the introspective reports of humans possessing the strong tendency to see

numbers “raising before the mind’s eye” in “definite and constant arrangements” upon spoken number presentation. Later studies demonstrated that in cultures with left-to-right reading, numbers are prevalently organised along a mental number line (MNL), with small magnitudes located to the left of larger ones. Recently, the possibility that such an introspective arrangement reflects an inherent spatial coding of number magnitudes in the human brain, was apparently endorsed by the bias toward higher numbers displayed by right brain damaged (RBD) patients during the bisection of number intervals, which has been taken as synonymous with spatial-attentional neglect for small numbers on the left side of the MNL. In contrast with this conclusion, we report the results of a series of investigations showing that the numerical bias displayed by RBD patients is functionally and anatomically dissociated from an equivalent attentional bias in visual space. Based on experiments designed to generate a mismatch in the “default” association of small numbers with the left side of space and of high numbers with the right side of space, we demonstrate that RBD have troubles in the mental manipulation of small number magnitudes independently from their mapping on the left or the right side of a mental layout. Parallel studies run in healthy adults and in childrens reveal new properties of the MNL, and support the conclusion that assuming a close phenomenological, functional and anatomical equivalence between orienting in visual space and orienting in mental number space is misleading.

#### (SY\_09.5)

##### **Numerical Magnitude Interference in Perception and Action**

LINDEMANN, O. & KRAUSSE, F. *Donders Institute for Brain, Cognition and Behaviour; Nijmegen The Netherlands.*

Our research aims to investigate the coupling between high-level cognitive processes, such as the reading of meaningful symbols, and low-level processes as involved in visual perception and the control of motor behaviour. The presented studies will focus on the mechanisms underlying the representation of magnitude information in these different domains and their neural substrates. Our behavioural experiments demonstrate that magnitude representations for numbers are functionally linked to size-related codes required for perception and action. This will be illustrated by two types of effects: a numerical size-congruity effect on visual search performances and non-spatial compatibility effects between number stimuli and motor responses. We present furthermore recent fMRI data that aim to explore the neural substrates of such a shared magnitude metric by comparing spatial (i.e., SNARC) and non-spatial number-response compatibility effects. All results will be discussed in the context of recent models on number processing and an embodied approach to mathematical cognition.

#### (SY\_09.6)

##### **Experience-dependent plasticity in the brains of Oxford mathematicians**

POPESCU, T., SADER, E., THOMAS, A., TERHUNE, D., COHEN KADOSH, K., DOWKER, A. & COHEN KADOSH, R.

*Department of Experimental Psychology, University of Oxford, UK.*

Experience-dependent structural plasticity has been shown to exist as a result of training in various areas of expertise (e.g. playing a musical instrument, juggling or taxi driving), however few of these involved higher cognitive functions such as mathematical cognition. In this study, we investigated the long-term effects of maths training on brain structure. We examined mathematicians and non-mathematicians academics at the University of Oxford; both groups were matched in terms of age, gender and number of years spent in full-time education. All subjects were tested on a broad battery of cognitive abilities (such as IQ, numerical tasks, working memory and social skills), and were MRI scanned in order to examine any anatomical differences between the groups and any correlations between these differences and cognitive performance. The results indicated that mathematical expertise is associated with: 1) better performance also in tasks that are not purely mathematical; 2) an increase as well as a decrease in grey matter in several brain areas. The current results provide insight into one of the less studied areas of cognitive neuroscience - the neurocognitive mechanisms of exceptional mathematical abilities. At the other end of the spectrum, having a clearer picture of how brain structure changes as a result of long-term training in mathematics can also prove important in gaining a better understanding of dyscalculia, a specific learning disability that affects the normal acquisition of numerical skills.

#### **SYMPOSIUM 10 (SY\_10) Room 1**

##### **Timing and Language**

DE DIEGO-BALAGUER, R.<sup>1,2</sup> & KOTZ, S.<sup>3</sup>. <sup>1</sup>ICREA, University of Barcelona and IDIBELL, Barcelona, Spain, <sup>2</sup>INSERM U955 and Ecole Normale Supérieure, Paris, France, <sup>3</sup>MPI for Human Cognitive and Brain Sciences, Leipzig, Germany.

Speech is an acoustically complex collection of sounds that need to be decoded into meaningful phonemes, syllables and words. Although it is obvious that sounds in speech are sequentially processed and precise timing is necessary for its perception and production, this temporal dimension has often been ignored in the study of language. Recent data and novel frameworks of speech processing are nevertheless emerging that highlight the importance of temporal processing at different levels of language processing. The proposed symposium will present work on different aspects of temporal processing in relation to language, including the cortical and subcortical networks implicated in auditory motor integration and timing, and the importance of temporal processing in healthy and pathological language acquisition. Virginia Penhune presents the importance of rhythmic processing in audio-motor integration relevant for musical and speech processing. Franck Ramus' data illustrates the effects of deficient sampling rate in the auditory cortex in the development of different deficits associated with dyslexia. Ruth de Diego Balaguer presents results indica-

ting that rhythmic information in prosody acts as an attentional cue to allocate attention selectively to the times they expect to hear critical speech segments and enhance language learning. William Iidsardi will focus his talk in the phonetic information encoded in an early auditory response. Finally, Sonja Kotz will present data supporting an integrative framework highlighting the involvement a cortical and subcortical network for temporal and predictive coding in speech processing.

#### (SY\_10.1)

##### **Auditory-motor interactions in musical rhythm perception and production**

PENHUNE, V. *Laboratory for Motor Learning and Neural Plasticity, Department of Psychology, Concordia University.*

The work that I will present in this talk was motivated by the observation that auditory and motor information appear to be preferentially coupled in both music and speech. This suggested to us that there might be preferential interactions between the auditory and motor systems of the brain. Based on this hypothesis, we have conducted a series of neuroimaging experiments designed to identify the brain networks involved in integrating auditory and motor information. To do this, we have examined performance of rhythm synchronization tasks in order to identify the features of auditory stimuli that facilitate motor response. My talk will review evidence from functional magnetic resonance imaging (fMRI) studies conducted to elucidate the neural basis for interactions between the auditory and motor systems in the context of musical rhythm perception and production. Our results show that auditory features of rhythmic stimuli exert a strong influence on motor performance, and that motor regions of the brain are sensitive to the temporal organization of auditory stimuli. Finally, I will propose a model for auditory-motor interactions in rhythm production that engage the posterior superior temporal gyrus, and the ventral and dorsal premotor cortex, as well as ventrolateral and dorsolateral prefrontal cortex. These findings will be also discussed in the context of models of auditory-motor integration for the perception and production of speech rhythms.

#### (SY\_10.2)

##### **Altered cortical entrainment to fast acoustic modulations reflect phonological and working memory deficit in dyslexia**

LEHONGRE, K.<sup>1</sup>, RAMUS, F.<sup>2</sup>, SCHWARTZ, D.<sup>3</sup>, PRESSNITZER, D.<sup>4</sup> & GIRAUD, A.<sup>1</sup>. <sup>1</sup>Inserm U960 - Ecole Normale Supérieure, Paris, France, <sup>2</sup>LSCP CNRS UMR 8554, Paris, France, <sup>3</sup>CRICM, CNRS UMR 7225, Inserm UMR-S 975, Paris, France, <sup>4</sup>UMR 8158 CNRS - U. Paris Descartes & DEC, Ecole Normale Supérieure, Paris, France.

Whether dyslexia primarily reflects an auditory, phonological or memory deficit has been intensely debated for the past 30 years. We hypothesized that an anomaly in phonemic sampling could account for both phonological and working memory deficits. We used a frequency tagging MEG paradigm and MRI structural imaging to assess cortical entrainment to acoustic modulations ranging from 10 to 80Hz, a property that reflects the cortical ability to sample sensory inputs. We expect dyslexic subjects to exhibit abnormal responses in the 30-40Hz frequency range that carries important phonemic

cues. While normal readers exhibited left-dominant auditory steady state responses around 30 Hz, dyslexic subjects only showed enhanced entrainment to modulation frequencies outside the phonemic range up to 80 Hz. The 30 Hz entrainment deficit in the left auditory cortex correlated positively with behavioral measures of phonological output processing, but negatively with those reflecting phonological input. In addition, entrainment to faster rates negatively correlated with verbal working memory capacity. In dyslexics, the left auditory cortex fails to selectively entrain to acoustic modulations conveying phonemic cues, but phase-locks to faster acoustic modulations. While the latter anomaly accounts for verbal working memory deficits in dyslexia, the former one accounts for distinct facets of the phonological deficit.

#### (SY\_10.3)

##### **Prosody facilitates language learning in adults by orienting attention**

DE DIEGO-BALAGUER, R.<sup>1, 2, 3, 4</sup>, LOPEZ-BARROSO, D.<sup>2</sup>, RODRIGUEZ-FORNELLS, A.<sup>1, 2</sup> & BACHOUD-LÉVI, A.<sup>3, 4, 5, 6</sup>  
<sup>1</sup>ICREA, <sup>2</sup>University of Barcelona and IDIBELL, Barcelona, Spain, <sup>3</sup>UPEC and IRBM, Créteil, France, <sup>4</sup>Ecole Normale Supérieure, Paris, France, <sup>5</sup>AP-HP Groupe Henri-Mondor Albert-Chenevier, Créteil, France, <sup>6</sup>Centre de référence Maladie de Huntington, Créteil, France.

Prosody is a rhythmic cue that has a critical role in speech processing. However, the mechanism by which prosodic information affects the way we treat the speech signal and influences learning is scarcely understood. In two different experiments we recorded event-related potentials (ERPs) and functional hemodynamic changes (fMRI) while participants were learning artificial languages with and without prosodic cues, implemented by the introduction of subtle pauses between words. Languages were built concatenating trisyllabic words with embedded rules (e.g. "puliku, pufaku, pureku") analogous to simple morphosyntactic dependencies (e.g. "is playing, is dancing, is talking"). The absence of prosodic cues induced a selective increase of activation in the left ventrolateral prefrontal cortex both for structured language and for random syllable streams where learning was not possible. In the ERP experiment, this effect arose very early in sensory processing in a negative increase around 100 ms after syllable onset (N1 component). Structured streams with prosodic cues showed an additional positive going increase around 200 ms (P2 component) associated to rule learning. This effect characterised also those participants that learned the rule in the absence of prosodic information displaying increased bilateral medial parietal cortex activation associated to the top-down attention system. Two conclusions could be derived from the present pattern of results: (i) prosody helps segmentation acting as a sensory cue that automatically triggers attention and (ii) it helps as a cue to reorient attention to timing information relevant for rule learning. This function fits well with the observation that in natural languages prosodic boundaries in speech coincide with syntactic boundaries.

**(SY\_10.4)****Phonetic information encoded in an early auditory response**

IDSARDI, W. *University of Maryland, USA.*

Speech comprehension and speaker recognition are generally accurate, fast and effortless. This suggests that we should be able to find robust neural correlates of the acoustic and phonetic information that listeners use to make these decisions. In this talk I will review a recent series of magneto-encephalographic (MEG) studies examining the timing and localizations of a major, early auditory cortical response, the M100 (also termed the N1m for its relation to the electro-encephalographic N1 response). This response occurs approximately 100ms after the onset of a well-defined acoustic event and various properties of this response are known to be correlated with phonetic properties of interest. For example, the latency of the M100 response varies with the frequency of both pitch (included inferred pitch, Monahan, de Souza & Idsardi 2008) and formant structure (Monahan & Idsardi 2010). In addition, the inferred location of the generator of the M100 within the auditory cortex (Scharinger, Merickel, Riley & Idsardi 2011; Scharinger, Poe & Idsardi 2011) forms a kind of tonotopic and articulo-topic map, with the anterior-posterior location reflecting the place of articulation (F2 and labial, coronal or dorsal), the superior-inferior axis reflects front vowel height and F1, and the medial-lateral axis reflects overall spectral gravity (e.g. rounding and F3) in vowels and in sibilants (Lago, Krrod, Scharinger & Idsardi 2010). In addition, the M100 also contains information relevant for other speech categories, including speaker identity and dialect affiliation (Scharinger, Monahan & Idsardi 2011).

**(SY\_10.5)****Effects of timing and rhythm in auditory and speech processing**

KOTZ, S. *Neurocognition of Rhythm in Communication Group, MPI for Human Cognitive and Brain Sciences, Leipzig, Germany.*

Cortical neural correlates of linguistic functions are well documented in the neuroscience and neuropsychological literature. However, the influence of non-linguistic functions such as rhythm and timing are still understudied in speech and auditory language research. This is surprising for several reasons as these functions (i) play a critical role during learning, (ii) have a compensatory function in brain diseases and developmental disorders, (iii) can reveal commonalities/differences between domains (e.g. music and language), and (iv) can further our understanding of subcortical contributions to auditory linguistic and non-linguistic functions. For example, basal ganglia and cerebellar circuitries are involved in beat perception, timing, attention, memory, language, and motor behaviour (see Kotz, Schwartze, & Schmidt-Kassow, 2009). I will discuss our recent speech processing framework (Kotz & Schwartze, 2010) which synthesizes evolutionary, anatomical, and neurofunctional concepts of auditory, temporal and speech processing. This framework will be supported by recent event-related potential (ERP), and functional magnetic resonance imaging (fMRI) data from healthy, patient, and L2 populations which demonstrate the impact of timing and rhythm in auditory, speech and language processing.

**Symposium 11 (SY\_11) Room 4****Perceiving transformed movements when using tools**

SUTTER, C.<sup>1</sup> & SUELZENBRUECK, S.<sup>2</sup>. <sup>1</sup>*Work and Cognitive Psychology, RWTH Aachen University, Germany,* <sup>2</sup>*Project Group Transformed Movements, IfAdo - Leibniz Research Centre for Working Environment and Human Factors, Dortmund, Germany.*

Modern technologies progressively create workplaces in which movement execution and observation are spatially separated. Challenging workplaces in which users act with technical equipment in a distant space are, for instance, laparoscopic surgery, teleoperation or virtual reality. When using a tool, proprioceptive/tactile feedback from the moving hand and visual feedback from the moving effective part of the tool do often not correspond or are even in conflict. This discrepancy would be a constant source of interference if proprioceptive/tactile and visual feedback would be equally important for controlling actions. The present symposium is aimed at discussing the underlying cognitive processes that enables us to cope successfully with sensorimotor transformations. Theoretical and empirical evidence will be presented from different perspectives and using various methodologies in behavioral and clinical studies: 1) the role of mechanical reasoning for the successful utilization of tools as well as the idea that humans spontaneously represent objects as potential tools to enhance their body's abilities will be discussed. 2) Experimental evidence will show that tool actions are controlled - to a greater extent - by distant action effects than by our body effects. This seems to be advantageous, as it allows for a much wider range of flexible sensorimotor adaptations and maybe more important, it gives us the feeling of being in control. 3) Furthermore, constraints of the visual predominance and its consequences on (re)mapping body space and distant space are outlined.

**(SY\_11.1)****Why do we use tools? Insights from neuropsychology and experimental psychology**

OSIURAK, F. *Laboratoire d'Etude des Mécanismes Cognitifs (EA 3082), Université Lumière Lyon 2, Lyon, France.*

Although humans are not unique in using tools, they are special in having established a culture which the use and manufacture of tools is a universal feature. Only humans possess a vast repertoire of tool-use skills, make one tool to create another, or spontaneously engage in tool use activities. A certain number of attempts have been made to model how humans perform tool behaviour. But, another important question, which has received very little attention from psychologists, is why humans use tools so frequently and spontaneously? In this talk, I shall address this intriguing issue. More specifically, after discussing studies in neuropsychology demonstrating that tool use might be supported by the ability to reason about object's physical properties, I shall present recent evidence that people may quite spontaneously represent objects as potential tools to enhance their body's abilities.

**(SY\_11.2)****Using tools to shape body and space representations**

FARNÈ, A.<sup>1,2</sup>, CARDINALI, L.<sup>1,2</sup>, BROZZOLI, C.<sup>3</sup> & ROY, A. C.<sup>4</sup>  
<sup>1</sup>INSERM U1028, CNRS UMR 5292, Lyon Neuroscience Research Centre, ImpAct Team, Lyon, France, <sup>2</sup>University Claude Bernard Lyon I, Lyon, France, <sup>3</sup>Department of Neuroscience, Brain, Body & Self lab, Karolinska Institutet, Stockholm, Sweden, <sup>4</sup>CNRS UMR 5230 Laboratoire sur le Langage le Cerveau et la Cognition, Lyon Neuroscience Centre, Bron, France.

Along the evolutionary history, humans have reached a high level of sophistication in the way they interact with the environment. We are able to modify, adapt and shape the world around us according to our needs. One important step in this process has been the introduction of tools, enabling humans to go beyond the boundaries of their physical possibilities. Behind the complex phenomenon of phylogenetic development of tool-use, we will focus some "low-level" aspects of cognition that highlight how tool-use plays a causal role in shaping both spatial and bodily representations. Indeed, updating representations of the body and its action-space is essential for efficient motor control during development and skilful tool-use in the adult life. The almost one-century-old hypothesis that tool-use induces plastic changes resulting in the tool being incorporated in the body representation is widely accepted, and intuitive enough to become a popular notion. Here, we will critically review the evidence supporting this hypothesis on the basis of the effects of tool-use on multisensory coding of peripersonal space, as documented in the normal and pathological brain. Recent findings and ongoing work from our laboratory will be presented and discussed as evidence supporting the incorporation of a tool in the body representation. In particular, we will present several experiments that reveal the effects of tool-use both on the kinematics of hand movements and the localisation of somatosensory stimuli on the body surface, as well as the conditions that are necessary for these effects to be manifest. These findings speak in favour of genuine, tool-use-dependent plasticity of the body representation for the control of action.

**(SY\_11.3)****Impaired tool use following brain damage**

HERMSDÖRFER, J., RANDERATH, J., GOLDENBERG, G., STADLER, W. & DIELER, A. *Department of Sport and Health Science, Technische Universität München.*

Lesions of the left hemisphere following a stroke may lead to impaired use of common tools and objects in activities of daily living. Deficits of ADL performance is one manifestation of apraxia that is also characterized by errors in pantomime or imitation. To decipher the underlying deficit, we examined the relationship between performance with the tool in hand in a natural-like situation (condition Use), with the tool only (Demo), and without the tool (pure pantomime: Panto). Performance of 23 patients with left brain damage (LBD), 10 patients with right brain damage (RBD), and control subjects were tested on the non-paretic ipsilesional hand. The tasks "hammering" and "scooping" were conducted in the condition Panto, Demo, and Use. Video analyses were performed as well as kinematic analyses of arm and hand trajectories. Evaluation of movement errors revealed a clear prevalence of movement abnormalities in LBD

patients and in the condition Panto as typically observed in apraxia. Compared to healthy controls the performance of LBD patients was however also impaired in the Use condition and factor analysis suggested communalities of the error patterns across the conditions. Similarly, the kinematic analyses revealed a gradient of errors from Panto to Use in LBD patients with significant correlations between characteristic movement variables such as movement direction and maximum velocity. The results show that in apraxic patients the lack of context is detrimental and presence of affordances is beneficial in using tools. A common factor seems to underlay aspects of the movement deficit independent of the condition of execution. The factor may be related to deficient tool manipulation knowledge, impaired mechanical reasoning, working memory deficits, errors of tool transformations (of the virtual or the real tool) and/or errors in considering the dynamic demands of the movement. Since variability is high and dissociations exist it is believed that multiple processes contribute to apraxia.

**(SY\_11.4)****Perception of and adjustments to gain changes**

SUELZENBRUECK, S.<sup>1</sup>, SUTTER, C.<sup>2</sup> & LADWIG, S.<sup>2</sup>. <sup>1</sup>*Project Group Transformed Movement, IfAdo - Leibniz Research Centre for Working Environment and Human Factors, Dortmund, Germany,* <sup>2</sup>*Work and Cognitive Psychology, RWTH Aachen University, Germany.*

The ideomotor principle holds that actors select, initiate and execute movements by activating the anticipatory codes of the movements' sensory effects. These may be representations of body-related effects and/or representations of more distal effects. When using tools effects in body space and distant space often do not correspond or are even in conflict. Previous studies have demonstrated that distal action effects dominate action control, while body-related effects play a minor role. In this talk we present a line of experiments in which we address the conditions and limitations of the distal predominance in action control. In a closed loop task of sensorimotor control different gains perturbed the relation between hand movements on a digitizer tablet and cursor movements on a display. Concerning motor control the data showed that the human brain adapt to small changes in visuomotor gain without being aware of the changes in gain or in one's own movement. When provided with explicit information about the occurrence of gain changes adjustments were stronger than implicit adjustments. The larger adjustments observed with cued gain changes resulted from both explicit and implicit motor adjustments occurring at the same time. We further observed that participants were generally extremely uncertain about the trajectory of their hand movements when using such tools. We discuss whether the low awareness of one's own movements originates from an insufficient quality of the humans' tactile and proprioceptive system or from an insufficient spatial reconstruction of this information in memory.

**(SY\_11.5)****Does tool use extend peripersonal space?**

HOLMES, N. P. *School of Psychology & Clinical Language Sciences, University of Reading, Reading, UK.*

The idea that tools are extensions of our body is an fascinating idea that appears in artistic, literary, philo-

sical, and scientific work. In the last fifteen years, this idea has been studied extensively in the cognitive neurosciences, with evidence from molecular, neurophysiological, neuroimaging, neuropsychological, and behavioural fields. In my talk, I will briefly review the main sources of evidence for and against the hypothesis that tool use extends a neural representation of the space surrounding the hands. I will argue both that the original neurophysiological data in monkeys do not show that tool use extends the representation of nearby space, and that subsequent behavioural data from humans are consistent with multiple alternative explanations. I conclude that, after fifteen years, clear support for the hypothesis that tool use extends peripersonal space is still lacking.

#### (SY\_11.6)

##### **Visual-haptic integration in tool use**

WATT, S. J.<sup>1</sup>, DIEDRICHSEN, J.<sup>2</sup> & TAKAHASHI, C.<sup>1</sup>. <sup>1</sup>*School of Psychology, Bangor University, Wales*, <sup>2</sup>*Institute of Cognitive Neuroscience, UCL, London, England*.

We often see and feel the same object simultaneously, and so estimates of object properties are available from vision and haptics. Here we explore whether the brain integrates information from these two sensory modalities when we use tools to interact with objects. In normal grasping, the brain does not select one sensory modality and ignore the other. Instead, information from both signals is integrated (Ernst & Banks, 2002), and exploiting the redundancy in multiple signals results in better performance than would be possible from either signal alone. For visual-haptic integration to be effective, however, the brain must solve a 'correspondence problem': it should integrate information referring to the same object, and it should NOT integrate information referring to different objects. This could be achieved by considering the similarity of signals in the two sensory modalities (Ernst, 2007; Körding et al., 2007). For example, if there is a large conflict between two size estimates, or they are separated in space, it is unlikely that they originate from the same object. Tools complicate this, however, because they systematically change the relationship between (seen) object size and the opening of the hand, as well as perturbing the spatial locations of each signal. We report several experiments showing that the brain does take these changes into account when using a tool: vision and haptics are integrated near-optimally, but only when it is appropriate to do so. We argue, therefore, that the brain combines visual and haptic information, not based on the similarity of sensory stimuli, but based on the similarity of the distal causes of stimuli, taking into account the dynamics and geometry of tools. We speculate that this is achieved by altering the forward model used to control arm movements, rather than by a specialised mechanism for tool use.

#### **SYMPOSIUM (SY\_12) Auditorium**

##### **Neurocognitive correlates of Cognitive Control**

COLZATO, L. *Leiden University, Cognitive Psychology Unit & Leiden Institute for Brain and Cognition, Leiden, The Netherlands*.

Frontal lobe circuits have a crucial role in the cognitive control of our thoughts and goal-directed behaviour. At least four control functions can be distinguished: "shifting" (also called "flexibility") between tasks, mental sets

and "updating" (and monitoring of) working memory (WM) representations, the "inhibition" of prepotent responses, decision-making and interference control. Apart from being empirically separable, they also seem to rely on different cortical structures. To give a complete overview of this complex phenomenon, this symposium will be interdisciplinary. Cognitive control will be presented from different perspectives and using different methodologies, behavioral, hormonal, pharmacological, clinical, genetic and brain-imaging studies.

#### (SY\_12.1)

##### **Estrogen modulates inhibitory control in healthy human females: Evidence from the inhibition of return paradigm**

COLZATO, L. *Leiden University, Cognitive Psychology Unit & Leiden Institute for Brain and Cognition, Leiden, The Netherlands*.

Animal studies point to a role of estrogen in explaining gender differences in striatal dopaminergic functioning, but evidence from human studies is still lacking. Given that dopamine is crucial for attentional flexibility, estrogen may have a specific impact on the inhibition of return (IOR) effect, which refers to the fact that people are slower to detect a target if it appears in a previously attended location. We compared performance on the IOR task with stimulus-onset asynchronies (SOAs) between attention cue and target of 150-1200 ms in young women across the three phases of their menstrual cycle (salivary estradiol and progesterone concentrations were assessed) and in young men, at different sessions separated by 10 days, according to the corresponding time interval in days between the different phases in women. First, women were higher magnitude of IOR in their follicular phase (FP), which is associated with higher estradiol levels dopamine turnover rates, than in their luteal or menstruation phase. Second, women showed higher magnitude of IOR than men only in the FP. Our results support the idea that striatal DA levels promote IOR, presumably by biasing the interplay between prefrontal and striatal networks towards greater cognitive flexibility. The variation of estrogen levels across the menstrual cycle may account for our observations of gender differences in IOR, suggesting that such differences are variable and state-dependent but not structural.

#### (SY\_12.2)

##### **The role of cortico-striatal networks in flexible decision making**

FORSTMANN, B. U. *Cognitive Science Center Amsterdam, University of Amsterdam, the Netherlands*.

For many everyday life decisions, people face the dilemma that fast decisions tend to be error-prone, whereas accurate decisions tend to be relatively slow. In other words, people can choose to respond more quickly at the cost of making more errors, a phenomenon known as the speed-accuracy tradeoff (SAT). In this talk I discuss the neural substrate of SAT using data from functional magnetic resonance imaging (fMRI), diffusion tensor imaging (DTI), and ultra-high resolution 7T MRI. In a series of experiments participants were presented cues that indicated different requirements for response speed. Application of the Linear Ballistic Accumulator model (LBA; Brown & Heathcote, 2009) confirmed that these

cues selectively affected response thresholds. Individual LBA parameters were then correlated with functional and structural MRI measures, revealing the involvement of the pre-supplementary motor area (pre-SMA) in concert with the striatum; this finding is consistent with the fact that excitatory signals from pre-SMA to striatum release the motor system from inhibition, thus facilitating faster but possibly premature actions. The present results suggest that individual differences in both brain function and brain structure translate to individual differences in the efficacy with which people change response thresholds.

#### (SY\_12.3)

##### **The yin and yang of cognitive control: evidence from behavioral-genetics studies**

HOMMEL, B. *Leiden University, Cognitive Psychology Unit & Leiden Institute for Brain and Cognition, Leiden, The Netherlands.*

Increasing evidence suggests that cognitive control emerges from the interplay between two dopaminergic pathways: a (mesocortical) prefrontal and a (nigro-)striatal pathway. I will summarize and try to integrate a number of recent behavioral-genetics studies from our lab that used various tasks (like task-switching, inhibition of return, stop-signal, and attentional blink tasks) to characterize how the two pathways operate and interact. Taken together, these studies demonstrate a kind of double-dissociation between the functional responsibilities of these pathways: Whereas the prefrontal pathway takes care of the maintenance of goals and the update of goal-related information, the striatal pathway supports cognitive flexibility.

#### (SY\_12.4)

##### **The effect of dopamine agonists on risk behavior in Parkinson's disease patients with and without impulse control disorder**

VAN DEN WILDENBERG, W. P. *Universiteit van Amsterdam, Amsterdam Center for the Study of Adaptive Control in Brain and Behaviour (ACACia), Psychology Department, Amsterdam, The Netherlands.*

Dopamine agonist treatment is associated with the emergence of impulse control disorder (ICD) in Parkinson's disease (PD). Agonists preferentially alter mesocorticolimbic dopamine pathways, which modulate risk-taking behavior. We hypothesized that dopamine agonists would increase risk-taking behavior in PD, especially among a vulnerable subset of patients who developed ICD concomitant with dopamine agonist use. PD patients with agonist-induced ICD (PDICD; n=22) and PD controls without ICD (PD-C; n=19) performed a variant of the Balloon Analogue Risk Task (BART) in which participants allowed balloons to inflate to earn higher rewards while risking the chance that the balloon would pop. The probability that balloons would pop was manipulated to assess sensitivity to negative consequences. Patients were tested separately in "on" and in "off" dopamine agonist states. In the off dopamine agonist state, PD-ICD and PD-C groups risked a similar number of balloon inflations to earn rewards. In the on agonist state, PD-ICD risked significantly more balloon inflations than PD-C to obtain rewards. Both groups risked fewer balloon inflations when the risk of balloon popping was higher and on trials immediately following a popped balloon. PD pa-

tients with ICD show a propensity toward risky decisions when on their dopamine agonist medication. The increase in risktaking appears driven by efforts to obtain higher rewards rather than by a reduced sensitivity to the effects of negative consequences. These findings suggest that changes in risk processing as a result of dopamine agonist use may underlie clinical symptoms of ICD. Our results also add behavioral support to the emerging view that the clinical expression of ICD reflects converging genetic, environmental, and pharmacological influences on dopamine and mesocorticolimbic function.

#### (SY\_12.5)

##### **Exogenous and endogenous strategies in dual task performance**

COHEN, A. & ISRAEL, M. *The Hebrew University, Department of Psychology, Jerusalem, Israel.*

Although it has been known for a long time that dual task performance is affected by strategic processes, research in recent decades focused on structural causes for dual task deficit. Consequently, dual task costs in paradigms such as the Psychological Refractory Period (PRP) paradigm have been attributed to structural causes. We present experiments that show that there exist powerful task-based strategic processes. Some such strategies are executed intentionally, but some strategies are triggered exogenously (i.e., without intention) and may cause costs even in situations where the two tasks could be performed without costs. We show that such exogenous strategies rather than structural reasons may lead to the PRP effect. We end with a discussion on the dual nature of strategic (flexible) processes that are performed exogenously (inflexibly).

#### (SY\_12.6)

##### **On the impact of individual differences between key nodes of response inhibition**

JAHFARI, S. *Cognitive Science Center Amsterdam, University of Amsterdam, the Netherlands.*

How does the brain regulate the need for control? Recent literature has identified key cortical and sub-cortical areas involved in response inhibition and proactive control in anticipation of a stop. At the same time, several studies have shown that dopamine in the prefrontal cortex (PFC) modulates core cognitive processes such as working memory and executive control. For example, the genetic variability of the catechol-O-methyltransferase (COMT) gene has been related to cognitive flexibility for individuals with low levels of dopamine in the PFC (val/val homozygotes), and to cognitive stability for individuals with high levels of dopamine in the PFC (val/met homozygotes). However, little is known about the impact of response strategies on proactive control, or how the variability of dopamine in the PFC might help explain the observed individual differences. During this talk, I will present some initial fMRI connectivity data on brain networks essential for the process of cognitive control, and discuss some recent findings suggesting that genetic differences in the COMT val158 polymorphism affect the behavioral- and key neural indices that underlie proactive control and response inhibition.

## SYMPOSIUM 13 (SY\_13) Room 5

**Orthographic variation and brain processes: A non-alphabetic perspective**

LEE, C.<sup>1,3</sup>, LEE, J.<sup>2,3</sup> & TZENG, O. J.<sup>1,3</sup>. <sup>1</sup>*Brain and Language Laboratory, Institute of Linguistics, Academia Sinica,*

<sup>2</sup>*Department of Educational Psychology, National Taiwan Normal University,* <sup>3</sup>*Laboratories for Cognitive Neuroscience, National Yang-Ming University, Taiwan.*

Languages vary significantly in how graphemic symbols are mapped onto spoken languages. Yet, studies have shown very similar brain circuits are activated in readers across different writing systems. It is imperative to know how the orthographic variation determines cross-language differences in the grain size of lexical representations and the neural mechanisms for reading. Chinese is classified as a logographic writing system. Chinese characters represent morphosyllabic rather than phonemic information. The first talk provides evidence for the early sublexical phonological priming and discusses how the orthographic and phonological processes are weighted differently in reading Chinese. In the second talk, a series of ERP experiments demonstrates the interplay between orthographic density and phonetic consistency in the different stages of lexical processing and suggests that Chinese readers pick up subtle statistical regularities about orthographic as well as phonological patterns. Meanwhile, the pervasive homophony among Chinese characters implies the importance of the graphic form in selecting meaning and avoiding homophonic confusion. The third talk will demonstrate the homophone density effect in the brain to highlight the feedback processing in visual word recognition. The fourth talk will demonstrate that the characteristics of the Chinese writing system affect not only the reading process of Chinese characters but also the mechanisms that support verbal short-term memory. A series of behavioral and neuroimaging experiments reveal clear contribution from orthographic processing to retention of Chinese characters. The fifth talk provides eye-movement findings on how Chinese readers utilize the intrinsic properties (i.e., orthographic and phonological codes) and the extrinsic property (i.e., word predictability) of characters and words in reading sentences. In the last talk, a conspiracy theory of reading, based upon the affordance theory and the orthographic equilibrium hypothesis, is proposed to map the cerebral reading circuit based upon data generated from the educated eyes to the educated brain.

## (SY\_13.1)

**Two-Way Mapping between Phonology and Orthography in Reading Chinese?**

LEE, J.<sup>1,3</sup>, CHANG, T. T.<sup>2,3</sup> & SHEN, W. Y.<sup>1,3</sup>. <sup>1</sup>*Department of Educational Psychology, National Taiwan Normal University,* <sup>2</sup>*Institute of Neuroscience, National Yang Ming University,* <sup>3</sup>*Laboratories for Cognitive Neuroscience, National Yang-Ming University, Taiwan.*

The role of phonology in reading has long been emphasized in the study of alphabetical languages. In contrast, the role of phonology in reading Chinese, a logographic writing system, has been debated. The issues of whether phonology is necessary for Chinese reading and whether the contribution of phonology to Chinese is as great as that to alphabetical languages remain open. Although previous studies have revealed the role of phonology in

Chinese reading, the emphasis was placed on the high demand of visual-spatial processing in orthographic analysis and on the addressed phonology of syllabic (whole-character) units. In this talk, I will present evidence of early sublexical priming of phonological processing from an ERP experiment. I will also present the brain activation revealed in an fMRI experiment that is associated with orthographical analysis in reading Chinese when both semantic and phonological contribution is minimized. An attempt will be made to integrate the roles of early phonological and late orthographic information in reading Chinese by proposing the feed-forward and feed-backward processes. I will argue that, in comparison with reading alphabetic languages, reading Chinese does not involve different processing. However, reading Chinese places different weights on various stages from reading alphabetic languages due to the characteristics of the Chinese writing system.

## (SY\_13.2)

**The neighborhood effects in Chinese visual word recognition**

LEE, C.<sup>1,2</sup>. <sup>1</sup>*Brain and Language Laboratory, Institute of Linguistics, Academia Sinica,* <sup>2</sup>*Laboratories for Cognitive Neuroscience, National Yang-Ming University, Taiwan.*

Researches on word recognition have clearly shown that a word's identification is affected by its neighborhood properties and suggest the visual word recognition relies on the co-activation among orthographic, phonological and semantic units. Languages vary in orthographic depth which may determine cross language differences in the grain size of lexical representations, the reading strategies developed, and the rate at which children acquire reading skills. Chinese is often classified as a logographic writing system. The reading unit, character, represents morphosyllabic rather than phonemic information. It is an intriguing question of how Chinese readers establish the efficient mapping between orthography and phonology in learning to read Chinese. In this talk, a series of neuroimaging and behavioral studies will demonstrate how Chinese readers capture the statistical mapping consistency between character and sound and the neural correlates responsible for the Chinese orthography-to-phonology transformation. Meanwhile, the ERP data reveals the consistency effect in three different time windows, N170, P200 and N400, especially for reading phonograms with large orthographic neighborhood (phonetic combinability) and suggests the interplay between orthographic density and the mapping from orthography to phonology in the different stages of lexical processing. This is further supported by the developmental data which shows the vocabulary size determines when and how the knowledge of phonetic consistency is acquired in learning to read. Based on these cross-linguistic evidences, it appears that the statistical learning approach holds that Chinese readers pick up subtle statistical regularities about orthographic as well as phonological patterns reflected in the early language inputs. Although the functional units underlying the reading mechanism may vary due to the orthographic depth, similar functional operation is assumed.



## (SY\_13.3)

**Homophone Effect in Chinese Reading and its Neural Representation**

KUO, W.<sup>1, 2</sup>, LEE, C.<sup>1, 3</sup>, LEE, J.<sup>1, 4</sup> & TZENG, O. J.<sup>1, 3</sup>.  
<sup>1</sup>Laboratories for Cognitive Neuroscience, National Yang-Ming University, Taiwan, <sup>2</sup>Institute of Neuroscience, National Yang-Ming University, Taiwan, <sup>3</sup>Brain and Language Laboratory, Institute of Linguistics, Academia Sinica, <sup>4</sup>Department of Educational Psychology, National Taiwan Normal University.

In recent years, the role of phonology to orthography feedback consistency in visual word recognition has been a major challenge to the current models for reading. To tackle this issue is sometime problematic for the alphabetic writing system due to its nature of the high degree of coupling between grapheme and phoneme. Chinese, as an ideographic writing system, has approximately 1300 syllables which correspond to around 5000 characters. The pervasive homophony of Chinese implies the importance of a graphic form for selecting meaning and escaping homophony in reading Chinese. Most importantly, many Chinese homophone mates can be completely different in their orthographic patterns which provide a ground for a better understating of the feedback processing in visual word recognition. The present fMRI study manipulates the homophone density and character frequency in a lexical decision task. The reaction time data reveal the homophone density effect in reading low-frequency characters, and this psychological effect was mirrored in the left inferior temporal-occipital junction which a brain area emphasized for word from processing. The implication of how an orthographic form could benefit from the feedback connection from its homophonic mates will be discussed.

## (SY\_13.4)

**Orthographic contribution to verbal short-term memory of Chinese characters: Evidence for the close relationship between linguistic knowledge and retention**

WU, D.<sup>1, 2</sup> & LIN, E. Y.<sup>1, 3</sup>. <sup>1</sup>Laboratories for Cognitive Neuroscience, National Yang-Ming University, Taiwan, <sup>2</sup>Institute of Cognitive Neuroscience, National Central University, Taiwan, <sup>3</sup>Institute of Neuroscience, National Yang-Ming University.

Previous literature of short-term memory (STM) indicates that verbal materials are dominantly retained in phonological representations while other linguistic information (e.g., orthography, semantics) only contributes to verbal STM minimally if not negligibly. However, accumulating evidence suggests that retention of verbal materials is jointly supported by multiple linguistic components correspondent to orthographic, phonological, and semantic representations in long-term memory. That is, the underlying mechanisms of verbal STM are closely related to those of long-term linguistic knowledge. Similarly, the organization and processing of verbal STM should reflect the characteristics of a specific language to be retained. Because logographic characters of Chinese are visually more complex than alphabetic letters, the correspondence between orthography and phonology is less transparent, and there are abundant homophones, reading and remembering Chinese should rely more on information additional to phonology than reading and remembering alphabetic languages. In behavioral experiments with a probed recognition task, participants' STM of

Chinese characters was clearly affected by orthographic similarity of to-be-remembered stimuli, irrespective of phonological similarity of the materials. Experiments with functional magnetic resonance imaging further revealed that remembering homophonic or orthographically similar characters was associated with higher activation in a left-lateralized network including the brain regions that are sensitive to orthography, consistency, and homophone computation of Chinese characters (i.e., the middle and inferior frontal gyri, the insula, the middle temporal gyrus, and the junction of the fusiform gyrus). Remembering orthographically similar characters also involved bilateral superior and inferior parietal lobules, which might be associated with visuo-spatial processing of STM. The findings from our investigations provide converging evidence for the indispensable contribution of orthographic representations to verbal STM of Chinese characters. These results also suggest that linguistic characteristics of a specific language not only determine the processing mechanisms of that language but also delineate the organization of verbal STM for that language.

## (SY\_13.5)

**Eye Movement Guidance in Reading Chinese Sentence**

TSAL, J.<sup>1, 2</sup>. <sup>1</sup>Department of Psychology, National Chengchi University, <sup>2</sup>Laboratories for Cognitive Neuroscience, National Yang-Ming University, Taiwan.

In contrast to alphabetic scripts, the structural and functional units of Chinese written system are less transparent for word recognition in reading sentence. First, Chinese character is the basic written unit of the spoken language and usually maps onto morphemes and syllables. At the sub-lexical level, approximately 80% of the characters are phonetic compounds that are made up of a semantic radical and a phonetic radical. Comparing to letters of alphabetic languages, Chinese characters encompass richer information of orthography, phonology, and semantic in a packed region. Second, over 76% of Chinese words are compounds of characters and many characters can stand alone as individual words or be the constituent of compound words. The relationship of character meaning to the meanings of words containing them is often not apparent. Extracting word in sentence is even more difficult since there is no visual space separating words. Therefore, Chinese readers need to make use of the rich lexical information and contextual constraint, in order to correctly recognize characters and extract words from the character string in a sentence. We report eye movement experiments of sentence reading to address the special features of Chinese written system. One is the parafoveal preview benefits of orthographic and phonological codes. The other is the word predictability and word frequency effects. The eye movement data provide the evidence that Chinese readers utilize the intrinsic properties (i.e. orthographic and phonological codes) and the extrinsic property (i.e. word predictability) of characters and words in the process of reading. These factors not only contribute to Chinese reading but also show their influence in early lexical processing.

## (SY\_13.6)

**Mapping the Literate Eyes to the Educated Brain in an Non-Alphabetic Script: What Have We Learned over the last three Decades' Research on Reading Chinese**

TZENG, O. J.<sup>1,2</sup>. <sup>1</sup>*Brain and Language Laboratory, Institute of Linguistics, Academia Sinica*, <sup>2</sup>*Laboratories for Cognitive Neuroscience, National Yang-Ming University, Taiwan*.

One important aspect of learning to read a printed text, in which a series of graphic symbols are arranged to represent the key features of the corresponding spoken language, is learning to move the eyes to search for relevant information from the text. The question is what information is available in the prints that would help the readers to accomplish the act of successful reading. Physically, there is the graphic information and its spatial layout. Linguistically, there is phonetic information embedded in the script/speech mapping relationship and morphological information which characterizes the meaning components in the prints. More importantly, there is orthographic information which prescribes the transitional probability from graphic component to the next within a character (letter) and/or transitional probability from one character (letter) to the next within a word. Results in our laboratories clearly demonstrate that an educated reader picks up graphic, phonological, morphological, and semantic information, supported by a language-based short-term memory, in early processing. Since no word boundary is provided in a Chinese text, because all printed characters are spaced equally, examining how to gather "word"-related information parafoveally during eye-fixation in order to facilitate subsequent reading in a Chinese text would shed light for how the reading circuit is organized within the brain. Important progress has been made over the past three decades. Three sets of experimental data related to the neurophysiological processes have been generated under different kinds of experimental paradigms and with different types of brain imaging techniques. Are they consistent, compatible, confirmatory, complimentary, or in conflict among one another, with respect to their implied underlying cognitive neuropsychological processes? A conspiracy theory of reading, based upon both the affordance theory and the orthographic equilibrium hypothesis, is proposed to map the cerebral-reading circuit based upon data generated from the educated eyes to the educated brain.

**SYMPOSIUM (SY\_14) Room 3****Affective modulation of cognitive control processes**

SCHUCH, S. & KOCH, I. *Institute of Psychology, RWTH Aachen University, Aachen, Germany*.

Cognitive control processes enable human beings to adapt flexibly to changes in situational context and task demands. Traditionally, cognitive control has been studied using experimental paradigms such as task switching, or the family of conflict tasks (e.g., Simon, Stroop, Flanker paradigms, etc.). Recently, empirical markers of cognitive control in these paradigms have been found to be influenced by affective states. These findings suggest that the underlying cognitive control processes are modulated by emotional factors. This symposium brings together leading experts on the interface of cognitive control and affect.

## (SY\_14.1)

**The influence of considered positive emotions on inhibition**

KATZIR, M., EYAL, T., MEIRAN, N. & KESSLER, Y. *Ben Gurion University of the Negev, Beer-Sheva, Israel*.

Successful self-control (i.e., adherence to a long-term goal in the face of an interfering short-term goal, or temptation) relies on the ability to inhibit temptations. This research explores the effect of considered positive emotional events on inhibition. We propose that the influence of considered emotions on inhibition depends on whether the emotion corresponds to a long-term goal (i.e., pride) or a short-term temptation (i.e., joy), because considering emotions primes their corresponding goals. In a series of experiments we find that considering a joyful event harms inhibitory processes compared to considering a prideful event. These findings suggest a possible mechanism underlying the role of considered positive emotions in pursuit of goals that require self-control.

## (SY\_14.2)

**Humor regulates cognitive control: a neural mechanism**

VAN STEENBERGEN, H., BAND, G. P., HOMMEL, B., ROMBOUTS, S. A. & NIEUWENHUIS, S. *Leiden Institute for Brain and Cognition & Leiden University Institute of Psychology, Leiden, The Netherlands*.

Positive emotional states are known to reduce the impact of cognitive demands and information-processing conflict on human behavior, but the underlying neural mechanism of this modulation is unknown. We used functional magnetic resonance imaging (fMRI) to examine how pleasure induced by funny cartoons regulates behavioral control and neural adaptations to cognitive conflict. Humor activated hedonic hotspots in the basal ganglia, which attenuated the rostral anterior cingulate cortex (ACC) response to conflict. This reduced subsequent conflict adaptation as observed in behavior and monitoring-related dorsal ACC activation. Our observations reveal the neural mechanism by which positive emotions regulate adaptive goal-directed behavior.

## (SY\_14.3)

**Reward-based adaptive binding in cognitive control**

BRAEM, S.<sup>1</sup>, VERGUTS, T.<sup>1</sup>, ROGGEMAN, C.<sup>2</sup> & NOTEBAERT, W.<sup>1</sup>. <sup>1</sup>*Ghent University, Ghent, Belgium*, <sup>2</sup>*Karolinska Institutet, Stockholm, Sweden*.

In a recent model by Verguts and Notebaert (2008, 2009), cognitive control effects such as the conflict adaptation effect and the task switch cost are captured in terms of adaptation by binding. It has recently been shown that positive affect increases binding (Colzato, van Wouwe, & Hommel, 2007; Waszak & Pholulandeth, 2009). If reward strengthens task-relevant associations, it can be expected that conflict adaptation and the task switch cost will increase after reward, but not after punishment. In a series of experiments we have put this hypothesis to the test combining both a standard flanker task and a task switch paradigm with reinforcement signals. Both experiments confirmed our predictions. Moreover, individual differences, as measured by the Behavioural Activation Scale, show that the more sensitive people are to rewards, the more reward strengthens task-relevant associations.

**(SY\_14.4)****Affective modulation of cognitive flexibility**

FROEBER, K. & DREISBACH, G. *University of Regensburg, Regensburg, Germany.*

There is increasing evidence that positive affect increases cognitive flexibility. However, results in the field are rather inconsistent. We therefore wanted to investigate the role of arousal for this positive affect effect to occur. To this end, a very simple response-priming task with centrally presented predictive cues was used. Cue-validity was 66%, and each trial was preceded by an affective picture (negative/high arousal, neutral, positive/high arousal, positive/low arousal). Results confirmed increased cognitive flexibility under positive affect: the cue-validity effect after positive pictures with low arousal (but not so with high arousal) was significantly reduced. Furthermore, a main effect Picture was found reflecting significantly higher overall reaction times (RTs) after negative pictures as compared to positive pictures of the same arousal. This general RT increase after negative pictures cannot be explained by arousal alone because high arousal in combination with positive pictures actually decreased RTs. It follows that affect and arousal should be controlled for when affect effects are investigated.

increased inhibitory control. We investigated this idea applying different task-switching paradigms. We will present data showing that (1) the asymmetry between the dominant and non-dominant task in a Stroop-like paradigm is more pronounced under stress, (2) the costs of switching back to a recently abandoned task (n-2 repetition costs) are increased under stress. These findings are consistent with the idea that stress increases the difference in activation between relevant and irrelevant tasks, that is, that stress leads to increased inhibitory control. The present results will be discussed in relation to other empirical findings and theoretical approaches.

**(SY\_14.5)****Task switching in dysphoria: The specific effects of dysphoric rumination on task selection**

OWENS, M. & DERAKSHAN, N. *Department of Psychological Sciences, Birkbeck University of London, London, UK.*

Executive dysfunction in dysphoria and dysphoric rumination is often reflected as perseverative behaviour, and may result in performance deficits on measures of cognitive flexibility. For the present study participants were required to switch between two randomly ordered spatial location tasks in which the position of a target within a 2x2 grid was determined according to a horizontal or vertical dimension. The congruency effect found in task switching was replicated such that interference from a currently irrelevant task was associated with slower responses and greater selection of the wrong task. Dysphoric ruminators displayed poor filtering of the currently irrelevant task relative to non-ruminators which in turn resulted in a specific task selection deficit, and a bias to perform the easier horizontal task. Results suggest difficulty choosing an appropriate response promoted application of the most salient task regardless of relevance. Our findings extend previous research that have linked impaired inhibition of irrelevant information with cognitive inflexibility in dysphoric rumination, and are discussed in terms of proposals which argue for an independent contribution of dysphoric rumination to cognitive deficits observed in dysphoria.

**(SY\_14.6)****The influence of stress on inhibitory control**

SCHUCH, S. & KOCH, I. *RWTH Aachen University, Aachen, Germany.*

How stress affects cognition has long been a focus of research. Of particular interest is how stress alters cognitive control processes, which allow humans to flexibly adapt their behaviour to changing situational constraints. One theoretical idea that has been put forward is that stress leads to increased selectivity of attention, and to

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**SYMPOSIA PROGRAM**  
**Saturday Afternoon**

SY\_(15-20): 14:20-16:00

**SYMPOSIUM 15 (SY\_15) Room 2**

**Bilingual word and sentence processing: Electrophysiological investigations**

TOKOWICZ, N.<sup>1</sup> & VAN HELL, J.<sup>2</sup>. <sup>1</sup>*Department of Psychology and Learning Research and Development Center, University of Pittsburgh, Pittsburgh, PA, USA,* <sup>2</sup>*Department of Psychology and Center for Language Science, The Pennsylvania State University, University Park, PA, USA.*

A great deal of research is concerned with the extent to which second language (L2) learners and bilinguals process L2 in a way that is similar to native speakers. In this area of research, electrophysiological methods such as event-related brain potentials (ERPs) and magnetoencephalography (MEG) are being used increasingly more often, partly owing to the observation that such methods are sometimes more sensitive to detecting L2 knowledge than behavioral methods. This symposium brings together five presentations involving research examining second language processing. The symposium focuses on word and sentence processing, and includes a wide range of languages (Arabic, Basque, Dutch, English, French, Spanish, and Swedish), methodologies (ERP, MEG, self-paced reading, grammaticality judgments, eye tracking, and recall), and proficiency levels (ranging from beginning L2 learners in a training study to highly proficient bilinguals). The findings from this broad range of studies form a springboard to pinpoint the similarities and differences in bilingual processing and to establish parameters for future research. Specifically, Davidson reports MEG data suggesting that first language (L1) and L2 subsequent memory have distinct neural features. Midgley et al. report ERP data showing that switching into L1 has a greater effect than switching into L2. Tokowicz et al. report data from several studies showing that cross-language similarity affects L2 morphosyntactic processing using converging methods (ERP, self-paced reading, and eye tracking). Brenders et al. report ERP data showing that child beginning L2 learners are sensitive to violations of morphosyntax even when their behavioral data do not display sensitivity. Rossi et al. provide ERP data demonstrating that L2 learners are sensitive to violations of number but not gender. In all, these studies show that L1 and L2 are sometimes processed similarly and sometimes differently, and delineate factors that may determine when processing is likely to be similar.

**(SY\_15.1)**

**Electrophysiological characteristics of encoding and retrieval for second language vocabulary**

DAVIDSON, D. *Basque Center on Cognition, Brain, and Language, Donostia, Spain.*

The subsequent memory paradigm has been used extensively in lexical memory research to examine how the electrophysiological features of encoding and retrieval practice are related to subsequent recall, but the characteristics of this process are not yet clear for learners of a second language (L2). We examined the paired-associate learning of Spanish-Basque translation pairs in a subsequent memory paradigm using magnetoencephalography.

Native Spanish-speaking participants (n=18) heard noun pairs presented as a list in an encoding phase, followed by retrieval practice in an explicit cued recall phase. This encoding-retrieval procedure was repeated four times per list. The results showed that recall for the words in the pairs improved with retrieval practice, as expected. A sensor-level analysis of the mid-latency (400-700 ms) evoked activity to the probe word in the recall phase showed a larger amplitude response to later-forgotten, compared to later-remembered probes, akin to a subsequent forgetting effect. In addition, the amplitude of the response to the Spanish words was greater than that of the Basque words. The results suggest that the electrophysiological characteristics of L2 subsequent memory are distinct from classical subsequent memory effects, which has been observed mainly in response to native language stimuli.

**(SY\_15.2)**

**Auditory language switching effects in second language learners**

MIDGLEY, K.<sup>1, 2</sup>, HOLCOMB, P. J.<sup>1</sup> & GRAINGER, J.<sup>1, 2</sup>. <sup>1</sup>*Department of Psychology, Tufts University, Medford, MA, USA,* <sup>2</sup>*Centre National de la Recherche Scientifique, Université de Provence, Marseille, France.*

Whether in production or comprehension, bilinguals can and do freely switch between their two languages. What are the processing costs and underlying neural mechanisms associated with these language switches? We investigated this by presenting, in the auditory modality, common, single-word non-cognates in English and French to 24 native French speakers who were learning English at university. Critical items were either "switch" items, for which the language differed from the two previously-presented words (CLAVIER - POMME - BEACH) or they were "non-switch" items, in which case the language remained the same across the previously-presented words (WINDOW - FIGHT - DRINK). Event-related potentials were recorded from 32 scalp electrodes to each critical, final item (BEACH compared to DRINK). Consistent with previous research by our group we found a widespread language effect with larger negativities to words in L1 relative to L2 in an extended epoch starting at 150ms and continuing 600ms. As concerns language switching L1 items showed early effects of switching between 150 and 250ms with switch items producing more negative-going ERPs over left posterior regions than non-switch items. There were also later effects of language switching that were more widespread across the scalp and appeared to be centered on the classic N400 (switch items again more negative than non-switch). No effects of switching were found for L2 items. These results appear to be consistent with theories postulating a greater inhibition of the dominant L1 during L2 processing followed by a need for greater reactivation of L1 after a switch. The findings will be discussed within the framework of current models of bilingual language control.

## (SY\_15.3)

**Second language morphosyntactic processing: Evidence from eye tracking, self-paced reading, grammaticality judgments, and event-related potentials**

TOKOWICZ, N., TOLENTINO, L., WARREN, T. & TUNINETTI, A. *Department of Psychology and Learning Research and Development Center, University of Pittsburgh, Pittsburgh, PA, USA.*

In five experiments using converging methodologies, we examined the extent to which adult beginning learners of a second language (L2) are sensitive to violations of L2 (morpho)syntax. We examine this issue with respect to first language (L1)-L2 similarity under the Competition Model framework (e.g., MacWhinney, 2005). Constructions: (a) were formed similarly in L1 and L2; (b) were formed differently in L1 and L2 such that the relevant cues differed in the two languages; and (c) existed only in L2. In experiments 1-3, native English speakers in the beginning stages of learning Spanish as adults were tested using self-paced reading, event-related brain potentials (ERPs), and grammaticality judgments. The overall pattern of results suggests that beginning adult learners are sensitive to violations of constructions formed similarly in the two languages. The results for constructions formed differently in the two languages and that are unique to L2 are less consistent, with the different constructions demonstrating sensitivity in two experiments and the unique demonstrating sensitivity in only one. In Experiment 4, native English speakers were trained on the morphosyntax of Swedish to test whether particular instructional methods varying in their explicitness may be best suited to teaching similar, different, and unique constructions. Learners' ERPs differed as a function of instructional training; an interaction between instructional group and L1-L2 similarity indicated that instruction methods that direct learners' attention to critical aspects of input and provide rules may be particularly effective for instructing L2 features that are distinct from L1. In a fifth experiment, Arabic-English moderately-proficient bilinguals were presented violations of English syntax in constructions that were similar or different from Arabic while their eye movements were monitored using eyetracking. Preliminary results indicate that these bilinguals detect such violations very early in processing.

## (SY\_15.4)

**Morphosyntactic processing in a second language in novice learners and proficient bilinguals: Event-related potential and behavioral evidence**

BRENDERS, P.<sup>1, 2</sup>, VAN HELL, J.<sup>1, 3</sup> & DIJKSTRA, T.<sup>2</sup>. <sup>1</sup>*Behavioural Science Institute, Radboud University Nijmegen, Nijmegen, the Netherlands*, <sup>2</sup>*Donders Centre for Cognition, Radboud University Nijmegen, Nijmegen, the Netherlands*, <sup>3</sup>*Department of Psychology and Center for Language Science, The Pennsylvania State University, University Park, PA, USA.*

This study examined morphosyntactic processing in the second language (L2) in beginning L2 learners and proficient bilinguals. In two behavioral experiments (using self-paced reading and a grammaticality judgment task) and an ERP experiment, Dutch beginning classroom learners of L2 English (6th graders) and adult proficient Dutch-English bilinguals were presented with L2 sentences that contained verb inflection violations (present and past tense verb inflection and present progressive),

as well as their correct counterparts. The beginning L2 learners showed sensitivity to morphosyntactic violations in their ERPs (evidenced by (small) LAN or P600 effects), but did not (yet) show this sensitivity in the behavioral measurements (self-paced reading times and error rates in grammaticality judgment). The proficient bilinguals were sensitive to violations of verb inflections in L2 sentences on both behavioral and ERP measures. These results indicate that beginning child L2 learners show sensitivity to violations of L2 morphosyntactic structures in measures of brain activity, even when they do not yet display reliable sensitivity in their behavioral performance.

## (SY\_15.5)

**The processing of morpho-syntactic parameters in late English-Spanish bilinguals: Behavioral and neurophysiological signatures of L2 processing**

ROSSI, E.<sup>1</sup>, DUSSIAS, P.<sup>2</sup> & KROLL, J. F.<sup>1</sup>. <sup>1</sup>*Department of Psychology and Center for Language Science, The Pennsylvania State University, University Park, PA, USA*, <sup>2</sup>*Department of Spanish, Italian, and Portuguese and Center for Language Science, The Pennsylvania State University, University Park, PA, USA.*

The successful processing of complex morphosyntactic parameters in adult second language (L2) learners has been shown to be influenced by age of acquisition (Steinhauer et al., 2008). More recent evidence, based on neurocognitive measures such as fMRI and ERPs, suggests that proficiency plays a role in modulating L2 language processing (Van Hell & Tokowicz, 2010). To investigate this issue we compared the performance in L1 speakers of Spanish and proficient late English-Spanish bilinguals. We utilized a specific morphosyntactic structure that differs between English and Spanish. Spanish object clitics appear before a finite verb and are marked for grammatical gender and number. English pronouns appear after the finite verb and mark number alone. In Experiment 1, we examined the on-line processing of Spanish clitics in 20 L1 Spanish, and in 20 English-Spanish bilinguals while clitics were presented in the correct and incorrect position. Results showed that L1 speakers demonstrated sensitivity to a violation of clitic placement by producing longer RTs at the incorrect clitic site and at the following word. L2 learners showed a similar effect at the clitic site but no spillover effect. In Experiment 2 we investigated the neurophysiological bases of clitic processing using ERPs. Participants (16 L1 Spanish and 14 English-Spanish bilinguals) read sentences in which clitics varied in correctness for gender, number, or both. Results revealed that native speakers showed a larger positivity in the 500-700 ms window for gender and number violations, whereas L2 speakers show a larger positivity specifically for number violations. Taken together, the results suggest that there are not hard constraints that prevent late bilinguals from accessing grammatical information in the L2. Rather, the cognitive load imposed by the L2 may constrain the ability to use that information predictively and may also modulate the signature of language processing at the neurophysiological level.

## SYMPOSIUM 16 (SY\_16) Room 1

**Memory consolidation: Surprisingly pervasive effects on language, at multiple levels**

DUMAY, N.<sup>1</sup> & SAMUEL, A. G.<sup>1, 2, 3</sup>. <sup>1</sup>*Basque Center on Cognition, Brain and Language. San Sebastian, Spain,* <sup>2</sup>*Ikerbasque, Spain,* <sup>3</sup>*Stony Brook University, New York, USA.*

In this 90-min symposium, four speakers and one discussant examine a range of memory consolidation effects during language learning. Consolidation is not just about making new representations more resistant and easily accessible. Rather, it seems that after the initial exposure to new linguistic stimuli, critical processes take place offline, and in particular during sleep, that substantially change the way we represent the newly acquired information. Kathleen Rastle and Matthew Davis look at the acquisition of new word suffixes and their meaning and ask whether consolidation is required for learners to be able to generalize the use of these new suffixes to other, novel word contexts. Nicolas Dumay and Jeffrey Bowers focus on spoken word form acquisition. By manipulating the exposure and test voices, they examine whether lexical consolidation strips off the surface details of newly learned words, thereby making them more abstract. Gareth Gaskell also investigates lexical learning and tries to understand why certain aspects of this process are immediate while others require overnight consolidation. He reports a critical role for speed of memory retrieval in distinguishing consolidation effects. Howard Nusbaum assesses the beneficial impact of sleep on phonetic learning, and, in particular, in recovering fading perceptual skills. He places phonetic consolidation effects within a broader range of such phenomena, and demonstrates that consolidation plays a powerful role in communication in other species as well. Arthur Samuel will discuss the range of consolidation phenomena, and their implications.

## (SY\_16.1)

**Does linguistic generalisation require consolidation?: The case of artificial morpheme learning**

RASTLE, K.<sup>1</sup> & DAVIS, M. H.<sup>2</sup>. <sup>1</sup>*Department of Psychology, Royal Holloway, University of London, UK,* <sup>2</sup>*MRC Cognition and Brain Sciences Unit, Cambridge, UK.*

The generalisation of morphological knowledge is at the core of our language abilities. Our experience with a limited set of morphologically-complex words (e.g. unscrew) allows us to abstract knowledge about the components of those words (e.g. un-) that is critical for the interpretation and creation of new words (e.g. untweet). This research examined the role of consolidation in the acquisition of this morphological knowledge using an artificial language paradigm in which undergraduate participants were trained on novel suffixes (e.g. -nept) presented in novel word contexts (e.g. sleepnept). Participants were tested immediately after training or two days after training on a variety of tasks including a speeded auditory repetition test that assessed performance on trained items as well as items comprising an untrained suffix, an untrained stem or both (e.g. sleepnept vs. sleepnule, or sailnept vs. sailnule). Results of the auditory repetition task showed an advantage for trained items immediately after training, as these were repeated significantly faster than items with trained stems but untrained suffixes. Critically, this advantage generalised

to untrained items comprising the novel suffixes (e.g. sailnept) but only in the group of participants tested two days after training. This study demonstrates that participants can acquire morphological representations in a laboratory context that are sufficiently robust to generalise to the interpretation of novel exemplars. It also suggests that this process of linguistic generalisation may require a period of overnight consolidation consistent with complementary systems theories of lexical learning.

## (SY\_16.2)

**Does lexical consolidation make words more abstract?**

DUMAY, N.<sup>1</sup> & BOWERS, J. F.<sup>2</sup>. <sup>1</sup>*Basque Center on Cognition, Brain and Language. San Sebastian, Spain,* <sup>2</sup>*School of Experimental Psychology, University of Bristol, UK.*

Learning new words involves consolidation. After one night's sleep, not only is explicit knowledge about the novel words enhanced, but the new words also now compete with similar-sounding existing words (Dumay & Gaskell, 2007) during word recognition. The present study assessed whether lexical consolidation strips off surface details of newly learned words, producing more abstract representations. We manipulated the speaker's voice between exposure and test. Participants learnt one set of novel competitors (such as 'shadowks' for 'shadow') seven days before the test, and another set immediately before the test. Each word was learnt in a male or a female voice, and was tested in either the same or the other voice. Cued recall ('shadow--?') and phoneme monitoring (Is there an /s/ in 'shadowks?') showed stronger memory (i.e., more accurate/faster responses) for the seven-day old items and, if anything, an enhanced voice effect (i.e., better performance in the same voice condition) after seven days. Crucially, our most indirect measure of lexical competition showed that only the seven-day old items (as expected) engaged in lexical competition, but only when the input preserved the voice in which they had been encoded. These findings indicate that consolidation does not make word representations more abstract: voice specific details do not just survive lexical consolidation; they are enhanced by it.

## (SY\_16.3)

**Learning new vocabulary: Why the delay?**

GASKELL, G. *Department of Psychology, University of York, UK.*

Evidence is accumulating that the acquisition and retention of novel words involves an extended process of consolidation, with some immediately observable lexical effects, and some more protracted sleep-associated characteristics. This profile of acquisition suggests that language learning is constrained by more general properties of memory, and is consistent in broad terms with a complementary systems approach. However, it is less clear what defines a delayed property and why. Here, I will discuss two possible models. In the first, immediate and delayed components of a new word representation are distinguished by the level of integration between recent and remote memories of lexical items. In the second, the key distinguishing feature is the speed of retrieval of the recently learned lexical representation. Recent evidence from word learning studies of both form and meaning will be evaluated against these two models, and I will argue that the speed-of-retrieval model provides the best fit to the existing data.

**(SY\_16.4)****Sleep consolidation of phonetic learning**

NUSBAUM, H. *Center for Cognitive and Social Neuroscience, Department of Psychology, The University of Chicago, Chicago, IL USA.*

Language learning is marked by two broad characteristics: (1) Learning generalizes to new patterns and situations, and (2) learning is robust, showing little performance variability over time. There is substantial plasticity in adult learning phonetic patterns, and there is evidence of both of these characteristics. Recently we investigated how sleep contributes to the long-term stability of phonetic learning through consolidation (Fenn et al., 2003). The basic paradigm compares posttest to pretest recognition performance after a single training session. By varying duration of a retention interval and inclusion of sleep (immediate, 12 hours awake, 12 hours with sleep), we can assess the effect of sleep on consolidating phonetic learning. Moreover, by examining training and testing at different points in a day, we can control for circadian contributions. We found that after a 12 hour waking retention interval, there is a significant loss of performance compared to a posttest right after training. However, sleep restores this loss of performance. Moreover, sleep after training prevents subsequent loss the next day. We have subsequently demonstrated that this sleep consolidation is not specific to phonetic learning; sleep consolidates generalization learning in a complex sensorimotor task using videogames (Brawn et al., 2008). Using a nap paradigm, we have investigated how much sleep is necessary to consolidate learning. We have also examined how sleep consolidation may differ in rote and generalized learning of phonetic patterns. We have also developed an animal model using an auditory classification task for vocal communication (Brawn et al., 2010). This has provided the first behavioral evidence for sleep consolidation in non-human animals, showing a very similar pattern of consolidation to humans. Using this animal model, we have begun to investigate the nature of the loss of performance over a waking retention interval and how sleep may restore performance.

**SYMPOSIUM 17 (SY\_17) Room 3****Interactions Between Vision and Language: The state of the art**

LUPYAN, G. *University of Wisconsin-Madison.*

Historically, researchers have paid little notice to the ways in which language may not only change how visual experiences are reported, but actually change ongoing visual processing. In this symposium we present a broad range of empirical and computational evidence arguing for deep and transformative effects of language on visual processing. In learning a language we learn associations between arbitrary cues (words) and objects, actions, and relations. For example, we learn to associate the word “up” with a direction of motion, “lemon” with oblong yellow objects of a certain size, and “red” with a color category. With this word-to-world association in place, language influences visual processing in ways that are surprisingly robust and pervasive. Gerry Altmann will show that language affects oculomotor control as fast as neuroanatomy allows—within about 100 ms. Not only saccades, but pursuit eye movements are subject to rapid influences of (task-irrelevant) language. Eiling Yee will demonstrate how language can be used to probe the

unfolding in time of object representations, showing how different object attributes exert influences at different times during visual search. Michael Spivey will provide complementary evidence showing that the incremental delivery of information using language augments the process of visual search. Emre Ozgen will provide novel sources of evidence that color categorical perception is a product of perceptual reorganization. Gary Lupyan will show that hearing object words can enable more accurate detection of stimuli that are otherwise invisible. He will also demonstrate that linguistic cues activate visual representations more effectively than nonlinguistic cues. Together the research presented in this symposium calls for a renewed effort to understand the extremely rapid, pervasive, and deep interactions between language and vision. The interdisciplinary scope of this symposium—a combination of psychophysics and psycholinguistics—will present the audience with fresh perspectives on familiar phenomena.

**(SY\_17.1)****The Evocative Power of Words: Language modulates (even low-level) visual processing**

LUPYAN, G. *University of Wisconsin-Madison.*

Beyond making linguistic communication possible, words (verbal labels) affect nonverbal cognitive processes such as categorization, memory, and cognitive control. Can simply hearing a word also affect visual processing, and if so, how deep do such effects go? I will present findings from a variety of paradigms showing that verbal labels modulate ongoing perceptual processing even in low-level visual tasks such as simple object detection. Hearing a label can un-suppress an object made invisible through continuous flash suppression or backward masking (increasing visual sensitivity). Hearing an entirely redundant verbal label also facilitates the deployment of attention to all objects on a screen that match the label, in parallel. The long-term experience of using words in a referential manner appears to make them particularly effective in activating visual representations of the denoted object category. I will show a series of results comparing verbal and nonverbal cues in activating visual information, showing that controlling for familiarity, verbal cues activate visual information more effectively than nonverbal cues. This verbal advantage appears to arise because representations activated by verbal means are more categorical and more similar from subject to subject than representations activated without the overt use of language. In sum, performance on a wide range of visual tasks—tasks that have been presumed to be immune from linguistic influence—is in fact deeply affected by language. I will argue that these effects are best explained in terms of language as a form of top-down modulation (The Label Feedback Hypothesis).

**(SY\_17.2)****Roses are red. Jeans are blue. Frisbees are round, and triangles can be too.**

YEE, E.<sup>1</sup>, HUFFSTETLER, S.<sup>2</sup> & THOMPSON-SCHILL, S.<sup>2</sup>  
<sup>1</sup>*Basque Center on Cognition, Brain and Language,*  
<sup>2</sup>*University of Pennsylvania.*

When looking at an object (e.g., pizza), we become aware of not only what it looks like, in its current instantiation (a reddish triangular slice, let's say), but also what other forms that object can take (e.g., round), and what it is



used for (food). We describe several eye tracking studies that demonstrate that when searching for a named object, non-visible shape and function properties can guide visual attention - with different kinds of knowledge influencing visual attention at different times. Participants viewed multi-object displays and clicked on the picture corresponding to a heard word. In critical trials, the conceptual representation of one of the objects in the display was similar in shape, color, or function to the heard word. Importantly, this similarity was not apparent in the visual depictions (e.g. for the target "frisbee", the shape-related object was a triangular slice of pizza - a shape that a frisbee cannot take); preferential fixations on the related object were therefore attributable to activation of the conceptual representations on the relevant features. Shape-, color-, and function-related objects were preferentially fixated, but function effects occurred later than shape and color. These findings show that visual object recognition is a dynamically unfolding process in which function follows form, and that when searching for a named object, visual attention is influenced by top-down conceptual knowledge about the properties of other objects in the scene.

#### (SY\_17.3)

**Language-mediated eye movements: Interactions between language, attention, and oculomotor control**  
ALTMANN, G. T. *Department of Psychology, University of York, UK.*

The influence of language on eye movements is, to all intents and purposes, as fast as it could possibly be. Here, we consider exactly what this must mean in terms of the processes that support eye movement control and the processes and representations that are engaged by the language comprehension system. The first set of studies explores when the earliest linguistic influences of language can be observed on the oculomotor system. We find influences as early as 100 ms at which point they most likely reflect the cancellation of already-planned saccades, due to competition between covert attention towards an endogenously cued target (i.e. to where we were going to move our eyes) and covert attention towards an exogenously cued location (i.e. to where the language then told us to instead move our eyes); cf. the double-step paradigm. The second set of studies explored such competitive influences in the context of pursuit eye movements: Verbs denoting upward or downward motion (e.g. 'climb'/'dive') were presented auditorily as participants pursued a dot moving vertically or horizontally. When the directionality implied by the verb was congruent with the direction in which attention had to be deployed to track the target, eye velocity increased. When incongruent, it decreased. This interaction, between attention during pursuit and the task-irrelevant (but attentionally modulating) language, suggests a process in which language can activate representations which compete with those that regulate oculomotor control. Taken together, the data argue for a tight theoretical linkage between language comprehension, attention, and oculomotor control.

#### (SY\_17.4)

**Support for the perceptual re-organisation account of categorical perception effects.**

OZGEN, E. *Bilkent University.*

Recent evidence suggests that categorical perception (CP) effects in colour result from the activity of a linguistic code, rather than perceptual re-organisation (warping) as previous research suggested. I will review recent evidence from our labs that suggest otherwise. The first point of consideration is the erroneous use of colour metrics to test hypotheses. In one study, performance on low-level discrimination and a "high-level" task has been compared, to reach the conclusion that low-level discrimination does not show categorical effects, while high-level tasks, where linguistic codes can and must be used, do. But this study used two very different colour metrics to equate stimuli on the two tasks. We show that these results can be entirely attributed to the confound of colour space, and that depending on the space used, "CP effects" can also be observed in low-level discrimination. We also suggest a less commonly used metric that gives good results. Another line of support for the verbal coding hypothesis comes from the study of hemispheric asymmetries, which suggests that CP effects are lateralised to the left hemisphere, providing a direct link with language processing. However, evidence from our labs, suggests that at least on low-level discrimination, there are no hemispheric asymmetries in categorical effects. If anything, any hemispheric asymmetry seems to have more to do with cone sensitivity: there is a right hemisphere advantage for blue region discrimination, while no asymmetry is observed in the green region or on the blue-green boundary. It is possible that this "blue" effect is falsely interpreted as evidence for hemispheric asymmetry in CP. Finally, I will review evidence from our labs on the effects of category learning on colour discrimination thresholds. Category learning seems to selectively improve discrimination on the category boundary. This is consistent with a perceptual change account of CP.

#### (SY\_17.5)

**Vision, language and social interaction**

RICHARDSON, D.<sup>1</sup> & DALE, R.<sup>2</sup>. <sup>1</sup>*Department of Cognitive, Perceptual and Brain sciences at University College London,* <sup>2</sup>*Department of Psychology. The University of Memphis.*

Language is learnt and used as part of a social interaction. In a series of experiments we show that in the course of a linguistic interaction - a conversation or a joint task - conversants' visual attention becomes closely coupled. In our first experiment, two people had a conversation about a painting, and we manipulated the knowledge that they shared. Later, two people had a discussion, and we manipulated what they believed each other could see. In each case, we saw that the coupling of conversants' visual attention is sensitive to the knowledge that actually share and that they believed to be shared. Our final experiment used a tangram task, where two participants have the same set of abstract shapes, set out in different orders. One participant, must instruct the other to arrange their shapes so that the orders match. In the course of the task, participants must find a way to refer to these abstract shapes. We tracked the eye movements of two participants engaged in a computerized version of the task. We found the canonical

tangram effect: participants became faster at completing the task from round 1 to round 3. Also, eye-movements synchronize over time. We used cross recurrence to show that as participants' words coalesce, their actions approximate a single coordinated system.

#### SYMPOSIUM 18 (SY\_18) Room 6

##### **Recent advances in the research on strategy selection and execution in mathematics problem solving**

IMBO, I.<sup>1</sup> & LUWEL, K.<sup>2,3</sup>. <sup>1</sup>*Department of Experimental Psychology, Ghent University, Belgium*, <sup>2</sup>*Centre of Educational Research and Development, Hogeschool-Universiteit Brussel, Belgium*, <sup>3</sup>*Centre for Instructional Psychology and Technology, Katholieke Universiteit Leuven, Belgium*.

A growing body of research has shown that people use multiple strategies to solve a wide range of cognitive tasks, such as arithmetic, reading, decision making, currency conversion, et cetera. The present symposium brings together five contributions that focus on the selection and execution of cognitive strategies in mathematics problem solving. All contributions report on recent advances regarding strategic behavior in different mathematical tasks ranging from simple and complex addition and subtraction over computational estimation to determining numerosities. Two contributions focus on alternative methodologies for identifying individuals' strategies in addition to the classical verbal trial-by-trial verbal reports. The first talk presents the 'operand recognition paradigm' that allows identifying arithmetic strategies based on the degradation of memory traces. The second talk provides neurophysiological evidence indicating that different strategies activate different brain areas. This study revealed a strong association between the verbal strategy reports and the brain areas that were activated. A third contribution tackles a completely new issue in the study of strategy choices, namely within-item strategy switching. Within-item strategy switching refers to the extent to which individuals switch strategies after they have judged that a particular strategy might not be the most appropriate one for solving a specific problem. Two other contributions investigate a number of variables that might shed a better light on the way individuals select and execute cognitive strategies. One talk focuses on the role of culture, response language, and working memory, whereas the other one looks at intelligence-related differences in strategy selection and execution. Finally, the last talk also spends attention to a possible improvement in children's strategy selection and execution by contrasting two types of feedback, namely outcome feedback vs. strategy feedback.

#### (SY\_18.1)

##### **The operand recognition paradigm as a method to investigate individuals arithmetic strategies**

THEVENOT, C. *Department of Psychology, University of Geneva, Geneva, Switzerland*.

The rationale of the operand recognition paradigm (ORP) is to infer the arithmetic strategies used by individuals from the time they take to recognize the operands of a problem after they have solved it (Thevenot, Castel, Fanget, & Fayol, 2010). This rationale is motivated by the fact that algorithmic procedures degrade the memory

traces of the operands, whereas they remain intact after a solution process by retrieval of the result from long-term memory (Thevenot, Barrouillet, & Fayol, 2001). First, we will describe the main results obtained with the ORP on mental addition and subtraction. We will show that, whereas individuals with low and high abilities in arithmetic use the same strategies for small and large problems (i.e., retrieval and calculation procedures respectively), they differ in the way they solve medium problems (e.g.,  $8 + 5$  or  $13 - 8$ ). While higher-skilled individuals can retrieve the result of such problems from long-term-memory, lower-skilled individuals have to resort to reconstructive strategies. Second, we will present an alternative interpretation of our effects, which has been formulated by Metcalfe and Campbell (2010; in press). The authors suggest that the differences we obtain in recognition times between small and large problems could be due to difficulty-related switch costs rather than strategy use. We will explain why this alternative interpretation is a very bad candidate in order to account for our results.

#### (SY\_18.2)

##### **Neurophysiological validation of verbal strategy reports in mental arithmetic**

GRABNER, R. H.<sup>1</sup> & DE SMET, B.<sup>2</sup>. <sup>1</sup>*Institute for Behavioral Sciences, Swiss Federal Institute of Technology, Zurich, Switzerland*, <sup>2</sup>*Department of Educational Sciences, Katholieke Universiteit Leuven, Belgium*.

There is a long tradition of behavioral research showing that arithmetic problems are solved with various strategies including the retrieval of the correct solution from memory (fact retrieval) and the application of procedural strategies (e.g., transformation or counting). The applied strategies can be inferred from the size of the presented problems (e.g., small problems are frequently solved by fact retrieval) or can be directly assessed by means of trial-by-trial verbal strategy self-reports. However, the validity of these verbal strategy self-reports has been repeatedly questioned, and most investigations on the neural correlates of these strategies rely on the problem size rather than the strategy report approach. In the presented electroencephalography (EEG) study, we investigated the validity of both approaches by evaluating their association with the brain responses during mental arithmetic. To this end, 19 adults had to solve small and large addition and subtraction problems and to indicate the applied strategy (fact retrieval vs. procedure use) after each problem by means of verbal strategy reports. Analysis of event-related (de-)synchronization (ERD/ERS), a measure of task-related changes in oscillatory EEG activity, revealed a general convergence of verbal strategy reports and the problem size approach. Fact retrieval was accompanied by higher left-hemispheric theta ERS, while procedural strategies were reflected in higher widespread ERD in the lower alpha band and bilateral parietooccipital ERD in the upper alpha band. A direct comparison of the EEG data from both approaches showed a stronger association of the ERS/ERD data with the verbal strategy self-reports than with problem size. These findings suggest a higher sensitivity of verbal strategy self-reports to arithmetic strategies and thus provide the first neurophysiological evidence for the validity of verbal strategy self-reports.

**(SY\_18.3)****Within-item strategy switching in arithmetic in children, young, and older adults**

ARDIALE, E.<sup>1,2</sup> & LEMAIRE, P.<sup>1,2</sup>. <sup>1</sup>*Laboratoire de Psychologie Cognitive, Universités d'Aix-Marseille, Marseille, France*, <sup>2</sup>*Centre National de la Recherche Scientifique, France*.

We tested whether participants switched strategies while they are solving problems, and age-related changes in such within-item strategy switching. Children, young, and older adults performed a computational estimation task (e.g., provide estimates of  $58 \times 72$ , with either a rounding-down strategy,  $58 \times 72 = 50 \times 70 = 3500$ , or a rounding-up strategy,  $58 \times 72 = 60 \times 80 = 4800$ ). Participants had the possibility to switch strategies if they judge the current strategy not the most appropriate while solving each problem. Children (third, fifth, and seventh-graders), young and older adults were tested. The main findings showed that (a) all participants switched strategy within-item and chose the best strategy more often than chance, (b) when participants switched strategies they gave more accurate responses, (c) all participants tended to switch strategy most often when problem and strategy characteristics guided such strategy switching. Moreover, age-related differences were found regarding (a) mean proportions of strategy switches, (b) skills at switching strategy when most appropriate, and (c) relative costs/benefits associated with strategies. Implications of these findings concern not only formal models of strategy selection (e.g., they speak to interruption mechanism during strategy selection and strategy execution uniquely assumed by a computational model such as SCADS\*). They also concern age-related differences regarding cognitive flexibility underlying strategic behaviours.

**(SY\_18.4)****How do culture, computational skill and response language influence strategic math behavior?**

IMBO, I.<sup>1</sup> & LEFEVRE, J. <sup>2</sup>. <sup>1</sup>*Department of Experimental Psychology, Ghent University, Belgium*, <sup>2</sup>*Centre for Applied Cognitive Research, Carleton University, Canada*.

In a recent study, Imbo & LeFevre (2009) tested the effects of working-memory load on complex addition solving (e.g.,  $58 + 76$ ) in three different cultures (Belgians, Canadians, and Chinese). The Chinese participants were faster than the Belgians, who were faster and more accurate than the Canadians. The Chinese also required fewer working-memory resources than did the Belgians and Canadians. However, the Chinese chose less adaptively from the available strategies than did the Belgians and Canadians. In this talk, we present a follow-up study, in which we tested the effects of culture, response language, and computational skill on strategy efficiency and strategy adaptivity. Three groups of participants were tested on a computational estimation task (e.g.,  $42 \times 57 = ?$ ) in no-load and load conditions: 40 Belgian-educated adults who answered in their first language (Dutch), 40 Chinese-educated adults who answered in their first language (Chinese), and 40 Chinese-educated adults who answered in their second language (English). The Belgians, who had weaker computational skills than the Chinese, were less efficient in solving the estimation problems than the Chinese answering in their first language. The Chinese who answered in English were slower than the Chinese who answered in Chinese, and this

difference was larger for difficult strategies and under working memory load. Strategy adaptivity was lower in the Chinese groups than in the Belgian group. That is, the Chinese were less likely to choose the strategy that produced the best estimate, and especially so when their working memory was loaded. The efficiency results are interpreted in terms of the encoding complex model, whereas the explanation for the adaptivity results is based on cultural differences in educational history.

**(SY\_18.5)****Effects of intelligence and feedback on children's strategy adaptivity**

LUWEL, K.<sup>1,2</sup>, FOUSTANA, A.<sup>3</sup>, PAPADATOS, Y.<sup>3</sup> & VERSCHAFFEL, L.<sup>2</sup>. <sup>1</sup>*Centre of Educational Research and Development, Hogeschool-Universiteit Brussel, Belgium*, <sup>2</sup>*Centre for Instructional Psychology and Technology, Katholieke Universiteit Leuven, Belgium*, <sup>3</sup>*Department of Special Education and Psychology, University of Athens, Greece*.

A test-intervention-test design was used to investigate the effect of intelligence and feedback on the four parameters of children's strategic competence (i.e., repertoire, frequency, efficiency and adaptivity). Children of three intelligence groups (i.e., low, medium and high intelligent children) had to determine different numerosities of coloured blocks that were presented in a square grid. They could solve this task by either using an addition strategy by which the coloured blocks in the grid were added, or an insightful subtraction strategy by which the number of empty squares was subtracted from the total number of squares in the grid. In Test Session 1 (TS1), we assessed children's initial strategic competence. In the intervention session (IS), children were provided with feedback on each trial. Half of the children from each group received outcome feedback (OFB), which informed them about the accuracy of their answer, whereas the other half received strategy feedback (SFB), informing them about the appropriateness of the selected strategy. In Test Session 2 (TS2), we tested for possible effects of the provision of feedback on each of the four parameters of strategic competence. The three intelligence groups exhibited large differences on all strategy parameters in TS1. In TS2, there was a strong decrease in these group differences for all parameters due to the provision of feedback. Furthermore, it was found that SFB was somewhat more beneficial than OFB, especially for the parameters involving strategy selection. We can conclude that high intelligent children show a greater strategy flexibility than less intelligent children but that the provision of feedback can lead to a dramatic improvement in the (flexible) use of strategies in less intelligent children.

**SYMPOSIUM (SY\_19) Room 5****Reasoning as Memory**

THOMPSON, V.<sup>1</sup> & FEENEY, A.<sup>2</sup>. <sup>1</sup>*University of Saskatchewan, Saskatchewan, Canada*, <sup>2</sup>*Queen's University, Belfast, UK*.

As little as twenty years ago, reasoning researchers presented participants with unfamiliar tasks using artificial content, which were designed to minimize the role of knowledge, memory, and beliefs in reasoning and decision making. Today, the pendulum has swung the other

way- reasoning research is being enriched by, and becoming evermore coherent with mainstream cognitive psychological theorising. The aim of this symposium is to showcase the ways in which theories of reasoning are informed by basic memory processes. For example, there is a growing body of research addressing the relationship between recognition memory and the processes engaged to perform a reasoning task. This symposium brings together three of the participants in a recent debate on whether inferences can be made about developmental changes in reasoning on the basis of recognition memory data (Sloutsky, Feeney, and Hayes). In this symposium, Sloutsky will present eye tracking data that is directly relevant to the issues raised in that debate, Hayes will consider whether recognition memory and inductive reasoning processes may be modelled in the same terms, and Feeney will attempt to arbitrate between accounts of adult inductive reasoning in part on the basis of recognition memory data. To illustrate the importance of associative processes in reasoning, Markovits and colleagues will consider processes in semantic memory and how they relate to predictions about deductive and statistical reasoning ability. Inspired by the literature on metacognition and memory, Thompson will show how frameworks such as dual process theories of thinking may be informed by consideration of metacognitive processes. We have chosen the participants so that a variety of types of thinking and types of memory process will be discussed. Although participants have not been chosen on the basis of their nationality, we consider the international nature of the symposium to be one of its strengths.

#### (SY\_19.1)

##### **The development of induction: Insights from recognition memory**

SLOUTSKY, V. *Ohio State University, USA.*

Inductive generalization is a critical aspect of cognition because it allows using knowledge creatively in new situations. For example, upon learning that a cat is a carnivore, one would expect other cats to be carnivores too. Although many aspects of inductive generalization are present in non-human animals and exhibit early onset in humans, mechanisms of induction in humans and its developmental course are hotly debated. To examine mechanisms of induction across development, Sloutsky and Fisher developed the Induction-then-Recognition (ITR) task (Fisher & Sloutsky, 2005; Sloutsky & Fisher, 2004a, 2004b). Using ITR, Sloutsky and Fisher have argued that inductive inference undergoes a radical developmental transformation. According to this view young children base their induction on computation of perceptual similarity (if one cat is a carnivore, another cat should also be a carnivore because both cats look alike). In contrast adults, base their induction on determining if the two items belong to the same category (if one cat is a carnivore, another cat should also be a carnivore because both are members of the category 'cat'). Some participants of the present symposium have challenged these conclusions. In particular, Hayes, McKinnon, & Sweller (2008) and Wilburn & Feeney (2008) presented arguments suggesting that developmental differences between early and mature induction could be rather modest, with both groups basing their induction on the common category. They further argued that ITR might

have revealed developmental differences in visual attention rather than in induction. In this talk, I will present an overview of published research using ITR. I will then present new experiments in which 5- to 6-year-olds and adults performed ITR task, while their patterns of eye movements were recorded by an eye tracker. The patterns of eye movements support the idea of different mechanisms of induction in children and adults. At the same time, these findings are difficult to explain only by the development of visual attention.

#### (SY\_19.2)

##### **Common and distinctive mechanisms in reasoning and memory**

HAYES, B.<sup>1</sup> & HEIT, E.<sup>2</sup>. <sup>1</sup>*University of New South Wales, Australia,* <sup>2</sup>*University of California, Merced, USA.*

This presentation reviews recent findings from a research program examining relations between inductive reasoning and recognition memory. The first experimental series [Heit, E., & Hayes, B. K. (2011). Predicting reasoning from memory. *Journal of Experimental Psychology: General*, 140, 76-101] examined how well responses on an inductive reasoning task predicted responses on a recognition memory task. A common stimulus set (e.g., pictures of dogs) was presented for study followed by a test set containing old and new members of the same category. In the recognition condition people were instructed to memorize study instances and respond "yes" at test to old items. In the induction condition people were instructed that study items contained a novel property ("beta-cells") and to respond "yes" to test items that had this property. Across several experimental manipulations such as varying study time, presentation frequency, and the presence of stimuli from other categories, there was a high correlation between reasoning and memory responses (average  $r = .87$ ). A second series extended the study of memory-reasoning relations to more complex forms of induction involving meaningful properties. In this case study items were members of a conjunctive category (aquatic mammals) and different inductive properties primed attention to either the aquatic dimension or the mammalian dimension. The relation between reasoning and memory responses was reduced when meaningful properties were used in induction; especially when additional time was given for test decisions. These results point to a common mechanism of exemplar-similarity underlying inductive reasoning and recognition memory, although induction with meaningful properties involves additional rule-based processes. A mathematical model, GEN-EX (GENeralization from EXamples), derived from exemplar models of categorization, is presented, that predicts both reasoning and memory responses from pairwise similarities among the stimuli, allowing for additional influences of deterministic responding.

#### (SY\_19.3)

##### **Working memory, recognition memory and inductive reasoning**

FEENEY, A. & LECKEY, M. *Queen's University, Belfast, UK.*

Category-based inductive reasoning involves the generalisation of properties from a sample consisting of members of one or more premise categories to members of a conclusion category. People are known to be sensitive to the diversity and size of the set of premise categories so

that more diverse and larger samples result in stronger ratings of argument strength. Associative accounts of category-based induction explain both of these sensitivities in terms of a single parallel process that is fast and independent of working memory. Other accounts suggest that there may be multiple resource demanding processes in play. Feeney (2007) showed that sensitivity to both diversity and sample size is correlated with IQ, a finding that is problematic for associative accounts. Here we describe a study that directly investigated the role of working memory in sensitivity to diversity and sample size by placing some participants under cognitive load whilst they reasoned about pictorial premises. Because what people can remember about the contents of reasoning problems may have much to tell us about how they reason (see Sloutsky & Fisher, 2004) we employed an Induction-then-Recognition (ITR) paradigm where participants completed an unexpected recognition memory test after the reasoning task. Sensitivity to sample diversity but not to sample size was significantly affected by a secondary load. Sensitivity to sample size only was associated with faster reasoning times and with poorer recognition memory. These results suggest that sensitivity to sample size involves the application of a simple rule, whereas sensitivity to diversity requires more complicated similarity calculation. Thus, different inductive reasoning phenomena may require different explanations. We will discuss the implications of our results for dual process theories reasoning which predict, contrary to our findings, that correlations with IQ will often be accompanied by effects of a secondary load.

#### (SY\_19.4)

##### **Reasoning, possibilities, and semantic memory**

MARKOVITS, H., FORGUES, L. & BRUNET, M. *University of Quebec at Montreal, Montreal, Canada.*

Logical reasoning is implicitly taken to suppose use of algorithmic procedures that rely only on relatively abstract semantics. However, both Piaget (1987) and more recently, Byrne (2005), have pointed out that understanding logical reasoning cannot be done without taking into account people's ability to generate problem representations that involve cognitive possibilities. In the following, we first review evidence that in many cases, these possibilities require direct access to semantic memory traces. We then examine the idea that more flexible retrieval might characterize more logical reasoners using examples from both conditional reasoning and the Linda problem.

#### (SY\_19.5)

##### **Intuition vs Reasoning: The Role of Metacognitive Experiences in Controlling Analytic Thinking**

THOMPSON, V. *University of Saskatchewan, Saskatchewan, Canada.*

As little as twenty years ago, reasoning researchers presented participants with unfamiliar tasks using artificial content, which were designed to minimize the role of knowledge, memory, and beliefs in reasoning and decision making. Today, the pendulum has swung the other way- reasoning research is being enriched by, and becoming evermore coherent with mainstream cognitive psychological theorising. The aim of this symposium is to showcase the ways in which theories of reasoning are informed by basic memory processes. For example, there

is a growing body of research addressing the relationship between recognition memory and the processes engaged to perform a reasoning task. This symposium brings together three of the participants in a recent debate on whether inferences can be made about developmental changes in reasoning on the basis of recognition memory data (Sloutsky, Feeney, and Hayes). In this symposium, Sloutsky will present eye tracking data that is directly relevant to the issues raised in that debate, Hayes will consider whether recognition memory and inductive reasoning processes may be modelled in the same terms, and Feeney will attempt to arbitrate between accounts of adult inductive reasoning in part on the basis of recognition memory data. To illustrate the importance of associative processes in reasoning, Markovits and colleagues will discuss retrieval from semantic memory and how it relates to predictions about deductive and statistical reasoning ability. Inspired by the literature on metacognition and memory, Thompson will show how frameworks such as dual process theories of thinking may be informed by consideration of metacognitive processes. Collectively, these papers illustrate the "new paradigm" in reasoning that seeks to move away from reasoning research as an isolated enterprise to one that situates reasoning within the broader context of cognitive psychology.

#### **SYMPOSIUM 20 (SY\_20) Auditorium**

##### **Inside the Social Brain: Developmental, Linguistic, Cognitive and Brain Mechanisms**

CROSS, E.<sup>1, 2</sup> & BEKKERING, H.<sup>2, 3</sup>. <sup>1</sup>*Behavioural Science Institute*, <sup>2</sup>*Radboud University Nijmegen*, <sup>3</sup>*Donders Centre for Cognition*.

Humans are uniquely social creatures, living within communities characterized by complex social hierarchies and a rich network of interpersonal bonds. How we process information conveyed by the people and groups with whom we interact has interested anthropologists, sociologists, linguists and psychologists for decades. More recently, advances in neuroimaging have enabled scientists to capture a glimpse of the neural underpinnings that support aspects of social information processing. Research into the social brain is thus progressing rapidly as scientists find new and innovative ways to combine methodological approaches and theoretical perspectives to investigate how we perceive and perform in a social world. The aim of this symposium is to present a timely overview of four prominent research domains investigating the social brain. By considering developmental, linguistic, cognitive, and neural viewpoints, this symposium will offer a balanced and updated perspective on the behavioural and brain bases of social information processing.

#### (SY\_20.1)

##### **The developing social brain: Neuro-cognitive mechanisms underlying children's processing of others' actions**

BEKKERING, H.<sup>1, 2</sup>. <sup>1</sup>*Donders Centre for Cognition*, <sup>2</sup>*Radboud University Nijmegen*.

Humans learn a lot via social interactions and are often referred to as *Homo Imitans*. In this talk, I will present some recent neurocognitive findings, including eye-gaze and EEG-signals, that shine new light on the underlying neurocognitive mechanisms of processing others' actions

during the first years of life. In particular, this talk will focus on the activation of the observer's own motor system during the observation of others' actions when either observing the action, imitating the action, or acting together within a joint task setting.

**(SY\_20.2)**

**Communicating actions: more on the neural link between language and action**

RUESCHEMEYER, S. *University of York, UK.*

Language is a universal, pervasive and powerful tool for human social interaction. Therefore, a full-fledged understanding of the social brain must address the question of how language transports meaning between interlocutors. Recent studies have argued that understanding words results in activation of neural pathways involved in real-world experience with words' referents; thereby transforming abstract symbols (i.e., words) into concrete information (e.g., perceptual/action experience). However, as I will demonstrate in this talk, word comprehension activates perceptual and motor areas in a flexible and dynamic manner, which reflects the overall propositional content of an utterance, rather than the meaning of individual lexical items. The flexibility with which neural motor areas are activated by language is intuitive when thinking about language as a flexible and communicative system; however it opens questions about whether embodiment really reflects anything about the architecture of the mental lexicon.

**(SY\_20.3)**

**Control of shared representations and understanding other people's minds**

BRASS, M. *Department of Experimental Psychology, Ghent University, Belgium.*

There is converging evidence that the observation of an action activates a corresponding motor representation in the observer. It has been argued that such 'shared representations' of perception and action are crucial for action understanding and mentalizing. Research on shared representations, however, has widely neglected the fundamental role of self-other distinction when simulating motor events and mental states. I will provide brain imaging evidence demonstrating that mentalizing and self-other distinction activate common brain circuits. Furthermore, I will present recent data relating deficits in the control of shared representations to autism spectrum condition. In summary, our research suggests a strong functional link between the control of shared representations and our ability to understand other people's minds.

**(SY\_20.4)**

**Brain mechanisms for social interaction**

RAMSEY, R. *Université catholique de Louvain.*

Numerous brain regions have been implicated in "understanding" other people's actions, which has led to a vibrant debate in cognitive neuroscience. I suggest that this debate can be informed by placing more emphasis on a key function of the human brain: motor control. Whether attracting a friend's attention, shaking hands or ordering a drink, movement is our vehicle for social interaction. Thus, we interact with other people through moving our bodies. In this light, I suggest it can be helpful to view neural sensitivity to other people's observed actions within a framework of controlling how we inte-

ract with the world. To support this claim, I review recent brain imaging studies of action perception, social attention, inferential reasoning and mimicry.

**SYMPOSIUM PROGRAM**  
**Sunday Morning**

SY\_(21-26): 09:30-11:10

**SYMPOSIUM (SY\_21) Room 3**

**The emergence of lexical networks in the second year of life**

MAYOR, J. *Basque Center on Cognition, Brain and Language, Donostia, Spain.*

Recent evidence reveals that two-year-olds display effects of phonological, phono-semantic and semantic priming, similarly to adults. This symposium will provide converging evidence that lexico-semantic networks emerge between 19 months of age and 21 months of age. Natalia Arias-Trejo will present two semantic priming tasks with infants demonstrating evidence for lexico-semantic networks in 21- and 24-month old infants, and will discuss the absence of semantic priming effects in 18-month olds. She will suggest that entries in the 18-month old lexicon may be best characterised in terms of "lexical islands" that are not in competition with each other because they are unconnected. Nivedita Mani will report cascading phono-semantic priming effects at 24 months of age, a priming effect that can only derive from activation of words phonologically and semantically related to the prime label. This will show that hearing a word leads to the activation of related words during word recognition. This will expand on her previous results showing that 24-month olds' phonological priming effects are being modulated by the neighbourhood size of the target words, whereas no such evidence was found at 18 months of age. Julien Mayor will present simulations using the TRACE model of speech perception. Simulations of phonological priming results at 24 months of age will confirm the necessity of lexical competition from the modeling perspective so as to display an inhibitory priming effect. However, a re-analysis of White and Morgan's (2008) study, where 19-month olds show a graded sensitivity to the severity of word mispronunciations, will suggest that lexical competition must be absent at that age, an imbalance in cohort sizes across conditions otherwise interfering with the graded sensitivity effect. Kim Plunkett and Nuria Sebastian will discuss the implications of these findings for recent theories about first language acquisition and the formation of lexical networks.

**(SY\_21.1)**

**Lexical Priming Effects between 18 and 24 Months of Age**

ARIAS-TREJO, N.<sup>1</sup> & PLUNKETT, K.<sup>2</sup>. <sup>1</sup>*Facultad de Psicología, Universidad Nacional Autónoma de México, UNAM,* <sup>2</sup>*Dept. of Experimental Psychology, University of Oxford, United Kingdom.*

Exposure to prior related words facilitates subsequent word processing in school-age children and adults (Nation & Snowling, 1999; Neely, 1991). Infants are sensitive to word-world associations at least as early as their first birthday; however, virtually nothing is known about infants' knowledge of word-word associations which eventually form the basis of the network of meanings underlying the adult semantic system. We investigated infants' word associations using the Inter-modal Preferential Looking task. Experiment 1 measures 18- and 21-

month-olds' visual preferences for a target over a distracter object when exposed to pairs of semantically and associatively related or unrelated words. In order to evaluate the impact of the prime word itself, priming is also tested when the target object is not labelled. Experiment 2 compares two types of lexical-semantic relationship, associative and taxonomic at 21 and 24 months of age. The results indicated a semantic-associative priming effect for 21- but not for 18-month-olds. Eighteen-month-olds responded equally well to target names, regardless of their prior exposure to a related or an unrelated word. In contrast, 21-month-olds identified the target referent only in the condition in which they heard related-named pairs of words. Moreover, unrelated words interfered with linguistic target identification for 21-month-olds. Experiment 2 finds that both types of lexical relations, taxonomic and thematic, have been established at 24 months of age. These data indicate that words are associated in the early lexicon. Infants as early as 21 months of age establish a word-word relationship between semantic-associative word pairs. Furthermore, unrelated words inhibit referent identification. Older infants exhibited a priming effect in both associative and taxonomic conditions, pointing to the formation of lexical semantic networks driven by different relations. In conclusion, by their second birthday, infants have begun to construct a lexical-semantic system based on relations and have moved beyond an independent listing of lexical entries.

**(SY\_21.2)**

**Automatic Cascaded Lexical Activation in Priming Tasks**

MANI, N. *Georg-August Universität Göttingen, Germany.*

Does hearing a word lead to the activation of phonologically related words in the infant lexicon? Tests of lexical activation in adults and five-year-olds examines prime-target pairs that are phono-semantically related (cup (prime) - dog (target)) to each other. Here dog is semantically related to a cohort member of cup (cat). Since dog and cup do not share any sounds, the priming effects reported must derive from priming of words phonologically related to cup (cat, i.e., the sub-prime), and subsequent cascaded priming of words semantically related to cat. This paper investigates the patterns of phono-semantic priming displayed by younger children at 24-months of age. Twenty-four-month-olds were presented with a prime, followed by a standard target recognition task. During related trials, the target word was phono-semantically related to the prime. During unrelated trials, the target and the prime were not phonologically, semantically or phono-semantically related. Experiment 1 tested onset-overlapping phono-semantically related prime-target pairs (e.g., cup (prime) - [cat (sub-prime)] - dog (target)). Experiment 2 examined rhymo-semantically related prime-target pairs (hat (prime) - [cat (sub-prime)] - dog (target)) in order to examine the role of phonological overlap in driving lexical activation. In Experiment 1, infants looked longer at the target in unrelated trials compared to primed trials. When the phonological overlap between the prime and the sub-prime was increased in Experiment 2, infants now looked longer at the target in primed trials compared to unrelated trials. The contrast between Experiments 1 and 2 suggests an important role for phonological overlap (between the prime and the subprime) in driving the

pattern of results. Furthermore, these effects can only derive from activation of words phonologically and semantically related to the prime label, providing evidence that hearing a word leads to the activation of related words during word recognition.

#### (SY\_21.3)

##### **The emergence of lexical networks: Insights from TRACE simulations**

MAYOR, J. *Basque Center on Cognition, Brain and Language, Donostia, Spain.*

Recent evidence reveals that two-year-olds display effects of phonological priming (Mani and Plunkett, 2008), similarly to adults. When infants are primed with a picture whose name shares the same onset as the target (e.g., “bed” and “boot”) their looking time to the target is reduced, as opposed to when the prime is unrelated (e.g., “cat” and “boot”). This inhibition effect to be modulated by the neighbourhood size of the words tested, suggesting a lexical basis for the reported effects. In line with the successful comparison of TRACE with adults’ looking behaviour described in Allopenna et al. (1998), we model phonological priming experiments in infancy. TRACE’s mental lexicon was created by compiling typical lexicons for 24-month-olds from the British CDI, using token frequencies from the CHILDES database. In a first set of simulations, Mani and Plunkett’s (2008) study is modelled successfully; priming effects interact with cohort sizes. In the presence of lexical competition, priming can be either facilitatory or inhibitory, depending on neighbouring size. In contrast, when lexical competition is removed, only facilitation can be observed. We argue that only inhibitory effects in phonological priming can be taken as evidence for lexical competition whereas facilitation effects can be driven by sub-lexical priming effects both with and without lexical competition. A second set of simulation captures White and Morgan’s (2008) findings that 19 month-olds displayed a graded sensitivity to the severity of word mispronunciations. Crucially, TRACE only displays a graded sensitivity to mispronunciation severity, in absence of controlled cohort sizes, when lexical competition is suppressed. Together, these simulations suggest that lexical competition is absent at 19 months of age whereas it is present from 24 months of age. Further re-analyses and simulations will aim at identifying more precisely the age at which words start competing for recognition.

#### (SY\_21.4)

##### **Discussion**

PLUNKETT, K.<sup>1</sup> & SEBASTIAN-GALLES, N.<sup>2</sup>. <sup>1</sup>*Department of Psychology, University of Oxford,* <sup>2</sup>*Universitat Pompeu Fabra, Barcelona.*

Kim Plunkett and Nuria Sebastian-Galles will discuss the implications of the symposium’s contributions for recent theories about first language acquisition and the formation of lexical networks.

#### (SY\_21.5)

##### **Bilingual phonological priming: An ERP study investigating interconnectivity of activation in the bilinguals’ two lexicons at different points in development**

VON HOLZEN, K. & MANI, N. *University of Göttingen, Germany.*

Phonological priming effects operate across a bilinguals’ two languages – words in one language can prime words in the other language (Van Wijnendaele and Brysbaert; 2002). These results point to the interconnectivity of the bilingual’s two lexicons. However, these results are based on studies which present subjects with orthographic or auditory stimuli from both languages (Phillips et al., 2006). It is unsurprising that words in both languages are activated. In contrast Wu and Thierry (2010) tested participants in only their second language, and found unconscious priming effects due to word relationships to the participants’ first language. The current study tests participants in their dominant language to demonstrate unconscious priming effects due to word relationships in the participants’ second language. Subjects were presented with images of name-known objects as primes followed by auditorily presented target words which were phonologically related, unrelated or identical to the label for the prime image. We studied adult German-English bilinguals and children in a German-English bilingual program. ERPs to targets were measured to determine differences in activation between the different conditions. In the rhyming conditions, phonological similarity between prime images and target labels was manipulated within (i.e. German prime, German target) and across (i.e. English prime, German target) languages. Importantly, since the prime is an image, and the targets were only German words for adults and English words for children, this study presents subjects with stimuli from only one language. Nevertheless, adult N400-like amplitude revealed no differences in activation from prime image-target labels that were related within and across languages. However, the N400-like amplitude of children showed a differentiation of the rhyming conditions, although both conditions differed from the unrelated condition. This provides strong evidence of interconnectivity of a bilingual’s two lexicons as it develops, despite presenting subjects with stimuli from only one language.

#### SYMPOSIUM 22 (SY\_22) Room 5

##### **Do we need vision? The effects of visual impairment on the development of the cognitive system**

VECCHI, T.<sup>1</sup> & POSTMA, A.<sup>2,3</sup>. <sup>1</sup>*Department of Psychology, University of Pavia, Italy,* <sup>2</sup>*Experimental Psychology, Helmholtz Institute, Utrecht University, The Netherlands,* <sup>3</sup>*Department of Neurology, University Medical Centre Utrecht, The Netherlands.*

We are used to thinking about vision strictly in terms of “seeing with the eyes.” In fact, “to see” does not only require functioning eyes and optic nerves, but also functioning brain structures: blind individuals lack the visual input, but their “central hardware” is spared. This symposium is about the effects that blindness and, more generally, different types of visual deficit exert on the development and functioning of the human cognitive system. There are a number of critical questions that can



be addressed through the investigation of the nature of mental representations in visually impaired individuals. First of all, data can shed light on the relationship between visual perception, imagery and working memory, clarifying the extent to which mental imagery (and more generally, the development of the cognitive system) depends upon normally functioning vision. Studying intersensory mechanisms in the blind may also help disentangle the functional and neural relationships between vision and the other senses, and may clarify whether and how “supramodal” mechanisms are affected by the absence of one sensory modality. Furthermore, studying both the totally blind and severely visually impaired individuals helps to shed light on which specific aspects of visual experience (e.g., binocularity) are critical for a correct cognitive development. Finally, studying the blind offers the opportunity of knowing more about neural plasticity. In the absence of vision, the other senses work as functional substitutes and thus are often improved (i.e., sensory compensation). The investigation of the psychological characteristics of blind individuals highlights that human cognitive development is not only shaped by the nature and amount of sensory experience but also presents a number of innate mechanisms and cortical networks that are able to process information in a supramodal fashion. Blindness is not simply “less” vision, it is an other vision.

#### (SY\_22.1)

##### **Conceptual combination in blind and sighted subjects: Evidence for perceptual simulation**

STRUIKSMA, M. E.<sup>1,2</sup>, NOORDZIJ, M. L.<sup>3</sup>, BARSALOU, L.<sup>4</sup> & POSTMA, A.<sup>1, 5</sup>. <sup>1</sup>*Experimental Psychology, Helmholtz Institute, Utrecht University, Utrecht, The Netherlands*, <sup>2</sup>*Utrecht Institute of Linguistics OTS, Utrecht University, Utrecht, The Netherlands*, <sup>3</sup>*Department of Cognitive Psychology and Ergonomics, University of Twente, Enschede, The Netherlands*, <sup>4</sup>*Department of Psychology, Emory University, Atlanta, USA*, <sup>5</sup>*Department of Neurology, University Medical Centre Utrecht, Utrecht, The Netherlands*.

Previous research has shown that occlusion effects occur in conceptual combination. For example, occluded properties such as 'roots' and 'soil' are not perceivable and less available for processing for the concept 'lawn'. However, for the complex concept 'rolled-up lawn' these hidden properties are perceivable and were mentioned in a property generation task. This suggests that subjects constructed perceptual simulations to solve the task. The main question of the current experiment is to what extent visual perception is dominant in perceptual simulations. To answer this question we tested occlusion effects in conceptual combination in both sighted and blind subjects. An occlusion effect was found for the generation of properties of noun phrases. Unoccluded properties were produced more often than occluded properties, but only when a revealing modifier was used (e.g. 'rolled-up lawn') and not when that same modifier was non-revealing (e.g. 'rolled-up snake'). Interestingly this effect was similar in blind and sighted subjects, which suggests an innate role for perceptual simulation. The results will be further discussed in terms of possible qualitative differences between the blind and sighted with respect to the nature of their simulations.

#### (SY\_22.2)

##### **The brain as a sensory-motor task machine: insights from the dark**

AMEDI, A.<sup>1,2</sup>. <sup>1</sup>*Dpt. of Medical Neurobiology, Institute for Medical Research Israel-Canada (IMRIC)*, <sup>2</sup>*The Edmond and Lily Safra Center for Brain Sciences (ELSC), Hebrew University of Jerusalem, Israel*.

About one-quarter of our brain “real estate” is devoted to the processing of vision. So what happens to this vast “vision” part of the brain when no visual input is received? We are working with novel high-tech multisensory ‘glasses’ that convert visual information from a tiny video camera into sensory signals that the blind can interpret. In this talk I will mainly highlight work done using The-vOICe algorithm. We have devised a training program which teaches blind individuals to use such a device. Following approximately ~30 hours of training, congenitally blind individuals can use this device to recognize what and where various objects are, for instance within a room (like a chair, glass, and even people and their body posture). Additional training is given specifically for encouraging free “visual” orientation enabling blind individuals to walk in corridors while avoiding obstacles and applying hand-“eye” coordination (e.g. playing bowling). A main focus of the project is using this unique “set-up” to study brain organization and brain’s flexibility. We have demonstrated that visual training can create massive adult plasticity in the ‘visual’ cortex to process functions like recognizing objects and localizing where they are located, much like the original division of labor in the visual system in which the ventral stream recognize objects and the dorsal stream help to localize them in order to orient action. We also found that reading using a different sense (e.g. Braille) recruit the same structure as in sighted, namely the visual word form area. Such visual cortex recruitment for ‘visual’ processing of soundscapes may greatly promote sight restoration efforts both via such technologies and by training people undergoing clinical procedures to restore vision. This approach might also be relevant, in other cases in which massive adult brain plasticity / flexibility is needed, e.g. after a stroke

#### (SY\_22.3)

##### **Space, language and touch in blind and sighted individuals**

POSTMA, A.<sup>1,2</sup>, STRUIKSMA, M. E.<sup>1,3</sup> & NOORDZIJ, M. L.<sup>4</sup> <sup>1</sup>*Experimental Psychology, Helmholtz Institute, Utrecht University, The Netherlands*, <sup>2</sup>*Department of Neurology, University Medical Centre Utrecht, The Netherlands*, <sup>3</sup>*Utrecht Institute of Linguistics OTS, Utrecht University, The Netherlands*, <sup>4</sup>*Department of Cognitive Psychology and Ergonomics, University of Twente, The Netherlands*.

When communicating about the spatial positions of objects in the outside world it is critically important to use the same reference frame. Blind individuals are thought to depend to a great extent on spatial language processing. It is not clear yet which reference frames they prefer under which conditions. In this presentation we will show work on matching spatial descriptions to haptic object configurations. In a recent experiment a large group of sighted, blind and visually impaired participants (> 200) gave ratings on the acceptability of a number of verbal statements (e.g. the ball is above the shoe) in relation to object relations which were haptically

explored. Interestingly, the blind more often choose an object centered reference frame (i.e. the shoe) than the sighted and visually impaired, who were as likely to pick a relative reference frame (own body). We argue that this reflects a stronger reliance in the blind on the functional relationship between haptically explored objects. Employing a more complex haptic object display in a separate study (Postma et al., 2007), we observed blind to more often give object centered descriptions of the display, whereas sighted more frequently used board oriented descriptions. We will discuss these findings in terms of how blindness affects reference frame processing in language and perception

#### (SY\_22.4)

##### **Cross-modal plasticity and functional specialization in the “visual” cortex of early blind humans**

RENIER, L. & DE VOLDER, A. G. *Institute of Neuroscience, Neural Rehabilitation group, Université catholique de Louvain, Brussels, Belgium.*

It is now established that the elevated metabolism in the deafferented “visual” cortex of congenitally blind adults has a physiological significance. Despite numerous studies on cross-modal brain plasticity, still little is known about how their “visual” cortex is functionally organized. On the one hand, several occipital regions in blind subjects seem quite indifferently recruited in various experimental conditions (tasks and stimuli), which led some authors to propose that this activation is nonspecific and serves a general purpose. On the other hand, numerous studies brought evidences of the existence of functional specializations in the occipital cortex of blind subjects. Using functional brain imaging (PET and fMRI) we monitored the brain activity in early blind and sighted control subjects while they were involved in various tasks including spatial imagery, mental imagery of object shape, auditory motion processing, localization of auditory and vibrotactile stimuli as well as during the use of a visual-to-auditory sensory substitution device to perceive 2D geometrical figures, schematized faces and houses. In total we brought evidences in favour of a preserved functional specialization within the ventral and dorsal “visual” streams in early blind subjects. In addition we recently observed that the occipital cortex was involved in the processing of odours in early blind subjects and that olfactory and auditory-verbal processing was segregated in their reorganized cortex. This leads us to conclude that there is a functional specialization in the occipital cortex of early blind subjects: sensory modalities are to some extent segregated in this reorganized cortex and the “visual” streams seem to develop their designated functional role in processing spatial and nonspatial stimuli regardless of visual experience

#### (SY\_22.5)

##### **The effects of visual impairments on the representation of peripersonal space: Spatial and numerical leftward biases in bisection tasks**

CATTANEO, Z.<sup>1</sup> & VECCHI, T.<sup>2</sup>. <sup>1</sup>*Department of Psychology, University of Milan-Bicocca, Italy,* <sup>2</sup>*Department of Psychology, University of Pavia, Italy.*

Individuals typically show a leftward bias – known as pseudoneglect – in bisecting physical lines as well as numerical intervals. We found that congenitally blind individuals show such leftward bias in haptic as well as in

numerical bisection (thus reflecting the spatial nature in which numbers are represented, the mental number line). These findings support the view that pseudoneglect operates at a mental representational level rather than being perceptually-based. Moreover, the consistent leftward bias shown by blind individuals in both line and numerical bisection suggests that the right hemisphere dominance in spatial processing, resulting in an overestimation of the left side of space, develops even in the absence of any visual input. Further, monocular and strabismic individuals were also tested and the pattern of performance was less consistent suggesting that an imbalance between the inputs from the two eyes may have a different impact compared to blindness on the development of attentional spatial mechanisms.

#### SYMPOSIUM 23 (SY\_23) Room 2

##### **Neurocognitive bases of learning and consolidation for spoken and written language**

PUGH, K. M.<sup>1,2,3</sup> & RUECKL, J. G.<sup>1,2</sup>. <sup>1</sup>*Haskins Laboratories,* <sup>2</sup>*University of Connecticut,* <sup>3</sup>*Yale University.*

Attempts to identify the mechanisms underlying reading disabilities have revealed the need to understand the neurobiological and cognitive bases of language learning abilities more generally. The current symposium brings together experts in cognitive studies of spoken and printed word learning, multi-modal neuroimaging, computational modeling, and the neurobiology of general learning and consolidation. Each presentation focuses on novel language learning from these distinctive but potentially linked perspectives, with the general aim of identification of critical next steps in understanding neuroplasticity as it applies to speech and reading. We will consider new research on spoken word learning, print learning, learning difficulties and brain pathways, computational modeling, and the neural mechanisms associated with consolidation in procedural and declarative learning as we seek general principles that link neural pathways to typical and atypical language learning, and, ultimately, differences within and across these populations

#### (SY\_23.1)

##### **A motor perspective on language 'rule' learning with a critical look at 'critical periods' in skill acquisition**

KARNI, A. *Department of Human Biology & the Edmund J Safra Brain Research Center for the Study of Learning & Learning Disabilities, University of Haifa.*

The language superiority of children has been ascribed to a childhood advantage in the acquisition of skills (procedural memory) specifically in language domains. It is commonly assumed that while declarative (“what”, explicit) memory undergoes maturation, procedural (“how-to”, implicit) memory, is well established at an early age and is superior to that of adults. This has been tied to a widely accepted notion of “critical periods” as restricted periods of brain malleability (plasticity) during childhood. Nevertheless, there is increasing evidence showing that adults are highly effective in acquiring and consolidating perceptual and motor skills, and in some controlled conditions are better learners than children. A recent study (Ferman & Karni, PLoSone, 2010) suggests a clear advantage for adults in a laboratory language task, both in learning implicit task aspects and in the long-term retention of the skill; findings that support the notion of age-dependent maturation in the establishment of both

declarative and procedural memory. In line with recent studies of motor skill learning, it is conjectured that the adult brain may become more selective in the making of long-term skill memory, rather than lose its potential to undergo experience-driven plasticity. CNS maturation may affect the time constants of memory consolidation processes, which in turn change the conditions and constraints under which procedural memory is consolidated before and after puberty. The potential for, and effectiveness of, skill acquisition per-se may remain unchanged or even increase. Under some learning conditions adults can effectively express their language skill acquisition potential.

#### (SY\_23.2)

##### **Neuroimaging studies of reading and language development: An update on recent findings**

PUGH, K. R. *Haskins Laboratories and the University of Connecticut.*

Reading disability (RD) has been characterized as a brain-based difficulty in acquiring fluent reading skill associated with problems in operating on the phonological structures of language. The claim of brain-basis is supported by a growing literature rife with reports of various sorts of anomalies in brain structure and function in RD. We will present data showing that relative to typically developing (TD) readers, RD children and adolescents fail to coherently activate left hemisphere (LH) occipitotemporal (OT) and temporoparietal (TP) regions during reading. Additionally, structural neuroimaging studies reveal group differences in both grey matter density and white matter connectivity in key LH regions. Brain/behavior analyses have indicated that the development of reading fluency in children is strongly associated with the development of a well-integrated left hemisphere posterior reading system. With regard to plasticity and learning, intervention studies have examined the influence of intensive phonological remediation in at-risk children and adolescents, revealing substantial gains in both reading scores and development of these posterior LH reading systems for readers afforded this treatment. Recent extensions of learning studies with older RD readers continue to suggest a high degree of plasticity in this age-range. Implications for theory and practice will be discussed. New extensions focus on individual differences in bilingual populations and will be discussed

#### (SY\_23.3)

##### **The impact of prior knowledge on word learning**

RUECKL, J. G. *Haskins Laboratories and the University of Connecticut.*

Studies of novel word learning in adult readers have demonstrated the importance of how novel words are processed during the learning stage, how learning is assessed, and when it is assessed. In some of our recent research we have focused on another factor: the role of the knowledge that the learner brings to the learning situation. Specifically, we've asked whether learning a new word depends on its similarity to familiar words. We've operationalized 'similarity' at both the lexical and sublexical levels. (Lexical: orthographic and phonological neighborhood size; sublexical: the sequential probability of the constituent letters or phonemes). In our central experiment we contrasted the learning of 'wordy' and 'less wordy' novel words, intentionally confounding

orthographic and phonological similarity to maximize the difference between conditions. Not surprisingly, we found that more wordy novel words were learned faster at the form level. More interestingly, we also found that the meanings associated with more wordy forms were learned faster too. This pattern is readily accommodated by the lexical quality hypothesis (Perfetti & Hart, 2001) and, at a more mechanistic level, the triangle model (Harm & Seidenberg, 2004). Ongoing experiments are aimed towards disentangling orthographic and phonological contributions to this effect and isolating its neural bases.

#### (SY\_23.4)

##### **A complementary systems account of spoken word learning: fMRI and MEG evidence**

DAVIS, M. H. *Medical Research Council, Cognition and Brain Sciences Unit, Cambridge, UK.*

This presentation provides neuroimaging evidence in support of two neural processes in initial learning and later consolidation of novel spoken words. This proposal builds on neuro-computational accounts of lexical processing and complementary learning systems (CLS) models of memory. As in other domains, the CLS account suggests a division of labour between medial temporal systems responsible for rapid encoding of novel items and the contexts in which they occur, followed by slower, offline integration of novel and existing items in cortical representations. A review and meta-analysis of recent fMRI studies of spoken word learning shows that: (1) successful initial acquisition is associated with the magnitude of hippocampal activity, (2) rapid changes in cortical responses to pseudowords following familiarization are best explained as task-specific repetition priming, or consequences of hippocampal encoding, rather than new, word-like cortical representations, (3) cortical responses to pseudowords (e.g. in the superior temporal gyrus) only become word-like in test sessions that follow a period of overnight consolidation. A recent MEG study of spoken word learning and consolidation (with Pierre Gagnepain and Rik Henson) provides additional evidence concerning the specific cortical computations that are consolidated overnight. We assessed the time-course and location of evoked responses to trained novel words (cathedruke), real word (cathedral) and non-word neighbours (cathedron) at different stages during learning and consolidation. Consolidation-induced differences in evoked responses to learned items are: (1) time-locked to the phonetic deviation point between these triples, (2) localized to the same cortical regions that show consolidation effects in fMRI, and (3) simulated by changes in segment prediction error rather than lexical competition in neural network inspired models. These findings suggest an important role for consolidated cortical representations in supporting efficient recognition of newly learned words and provide initial ideas concerning the integration of behavioural, computational and neural evidence in spoken word learning.

#### (SY\_23.5)

##### **Individual differences in learning artificial lexicons**

MAGNUSON, J. S. *University of Connecticut and Haskins Laboratories.*

Among the most important tools in the psycholinguist's kit are corpora, which allow us to estimate individual

language experience from large-scale averages from many sources. Corpus estimates are the basis for crucial theoretical constructs such as frequency and neighborhood density, and analogous dimensions of computational models. However, there are obvious challenges in applying such estimates to understanding variation in language ability. For example, findings that children with Specific Language Impairment do not show typical effects of phonological neighborhood density in spoken word recognition may indicate theoretically interesting differences in lexical organization, but they might also reflect simple differences in vocabulary -- it would seem that this issue is unresolvable without comprehensively documenting each child's lexicon. An alternative is to use 'human models' that put participants on maximally equal footing, as with artificial lexicon learning tasks. I discuss recent work my colleagues and I have carried out using this approach, and complementary computational and statistical modeling of the dynamics of lexical processing. In particular, I will focus on recent results with a rigorously assessed group of low-literacy adults and discuss the potential for individual differences in spoken language comprehension to illuminate difficulties with reading.

#### SYMPOSIUM 24 (SY\_24) Room 1

##### Auditory learning

VROOMEN, J. *Tilburg University.*

How does the auditory system solve complex learning challenges like those posed by natural speech where a continuous acoustic signal is ultimately parsed into discrete phoneme classes? In this symposium, a number of researchers in auditory cognitive neuroscience address this question. One focus is on the conditions under which auditory learning takes place. It is becoming increasingly clear that in addition to classic supervised categorization training, auditory perception can be shaped by the multimodal regularities of the world without requiring overt categorization of the sound or explicit feedback. Also, even simple repeated exposure of otherwise meaningless noise burst induces unsupervised learning with striking properties. For example, multiple noises can be remembered for weeks. These findings have been extremely useful in elucidating how exposure, reinforcement, and attentional mechanisms interact to produce learning. We also address whether learning to categorize speech sounds into phonemes is fundamentally different from learning non-speech sounds. For any auditory adaptive system, there are two conflicting requirements: It should be as stable as possible, but it should also be able to adjust to a changing environment. The balance between these two requirements, though, may be different for speech and non-speech with potential consequences for how sounds are learned. Finally, we will address how perceptual changes in sound processing are accompanied by specific changes in the cortical sound representations, using fMRI and multivariate pattern analysis (MVPA). Ultimately, we hope this symposium will deepen our understanding of human auditory processing as an adaptive, experience-dependent perceptual system.

#### (SY\_24.1)

##### Rapid auditory learning for meaningless sounds

AGUS, T.<sup>1,2</sup> & PRESSNITZER, D.<sup>1,2</sup> <sup>1</sup>*Laboratoire Psychologie de la Perception, UMR 8158, CNRS & U. Paris Descartes,* <sup>2</sup>*École normale supérieure, Paris, France.*

One basic goal of auditory perception is to recognize the plausible physical causes of incoming sensory information. In order to do so, listeners must learn recurring features of complex sounds and associate them with sound sources. However, how memories emerge from everyday auditory experience with arbitrary complex sounds is currently largely unknown. We will describe a novel psychophysical paradigm designed to observe the formation of new auditory memories [Agus, Thorpe, & Pressnitzer, *Neuron*, 2010]. The behavioral measure was based on the detection of repetitions embedded in 1s-long noises. Unbeknownst to the listeners, some noise samples re-occurred randomly throughout an experimental block. In line with our hypothesis, repetitions in these re-occurring noises were detected more frequently, showing that repeated exposure could induce learning of otherwise meaningless sounds. The learning displayed several striking features: it was unsupervised and resilient to interference from other task-relevant noises. When memories were formed, they emerged rapidly, performance became abruptly near-perfect, and multiple noises were remembered for several weeks. The acoustic transformations to which recall was tolerant suggest that the learnt features were local in time and generalizable over a range of frequencies. We will also present new results: in subsequent experiments, listeners were presented learnt noises but without a within-trial repetition. They often mistakenly reported that these stimuli were repeated, suggesting that they relied to some extent on noise recognition, rather than repetition detection. Listeners were also able to learn sounds in the absence of within-trial repetitions, showing that the auditory learning mechanism could function at larger interstimulus intervals. Based on these results, we hypothesize that the ubiquitous rapid plasticity we observed could be key to the efficient formation of auditory memories. As the noise-learning paradigm uses totally meaningless sounds, it is well-suited to studying the effect of auditory learning on low-level perception.

#### (SY\_24.2)

##### How the challenges of speech perception can inspire investigations of general auditory learning

HOLT, L. *Carnegie Mellon University.*

A rich history of research with adults and infants informs us about the ways experience with the native language shapes speech perception. However, in part because it is so difficult to control and manipulate speech experience, we know very little about the learning mechanisms that are responsible. Moreover, there has been somewhat limited attention to how the auditory system solves complex learning challenges like those posed by speech signals. I will describe the results of a series of studies that exploit artificial, nonlinguistic sounds that mimic some of the complexities of speech to gain experimental

control over listeners' histories of experience and, ultimately, to leverage this control to work toward mechanistic explanations of auditory learning. We have exploited classic supervised categorization training techniques commonly employed in visual cognition as well as a more naturalistic videogame training paradigm that models multimodal regularities of the world without requiring overt categorization or providing explicit feedback. Our results demonstrate the feasibility of relating general auditory learning to better understand speech processing and indicate the ways in which auditory perception is jointly shaped by the acoustic signal, long-term learned representations, and regularities of the immediate environment. The literature in this area is not yet large, but already there are insights. We argue that progress in understanding speech processing can be made by understanding the boundaries and constraints of auditory cognition, in general. Reciprocally, our understanding of human auditory processing is deepened by studying the complex, experience-dependent perceptual challenges presented by speech. Long relegated as a special system that could tell us little about general human cognition, the study of speech perception as a flexible, experience-dependent perceptual skill has much to offer the development of a mature auditory cognitive neuroscience.

#### (SY\_24.3)

##### **Accents, Assimilation, and Auditory Adjustments**

SAMUEL, A.<sup>1,2,4</sup> & KRALJIC, T.<sup>3</sup>. <sup>1</sup>*Basque Center on Cognition, Brain, and Language*, <sup>2</sup>*Stony Brook University*, <sup>3</sup>*University of Pennsylvania*, <sup>4</sup>*Nuance communications*  
<sup>1</sup>*Ikerbasque, Basque Foundation for Science*.

The perceptual system's two main requirements are potentially conflicting: It should be as stable as possible, but it should also adjust to a changing environment. A growing body of research is clarifying how the system balances these requirements in the perception of speech. Many studies have shown that when a listener receives an ambiguous phonetic input, additional context (e.g., lexical; visual) is used both to resolve the phonetic ambiguity in the moment, and to adjust the associated perceptual representation that informs subsequent perception. For example, if the /s/ in "Tennessee" is produced with a somewhat "sh"-like quality, the lexical context both determines that the segment was /s/, and expands the /s/ category for later inputs. Kraljic, Brennan, & Samuel (2008) tested a possible constraint on this adjustment process by exposing listeners to these ambiguous segments, but only in a particular context: /str/ (as in "abstract", or "district"). In the participants' local dialect of American English, /s/ before /tr/ is typically produced as precisely such an ambiguous sound. The theoretical question was whether perceptual adjustment would occur under these circumstances. It did not. Thus, the same ambiguous segments that reliably generate retuning in other contexts do not do so in the /str/ context, implicating an additional factor. Kraljic et al. discussed the possibility that a dialectal "explanation" for phonetic ambiguity might block the adjustment process. However, they noted that the shift in /s/ before /tr/ is also a form of place assimilation. Thus, the blocking of adjustment could either be due to dialect, or to assimilation. In the current work, we tease these two cases apart, testing a case of dialect without assimilation, and a case

of assimilation without dialect. The results favor blocking based on assimilation, rather than dialect, clarifying the processing levels that are subject to perceptual adjustment.

#### (SY\_24.4)

##### **Task-irrelevant auditory learning**

SEITS, A.<sup>1</sup> & PROTOPAPAS, A.<sup>2</sup>. <sup>1</sup>*University of California, Riverside*, <sup>2</sup>*University of Athens*.

Numerous studies of visual learning have shown that task-irrelevant stimuli can be learned when they are paired with important behavioral events. These studies of task-irrelevant perceptual learning (TIPL) have helped elucidate how reinforcement and attentional mechanisms interact to produce learning. Here, I will present data from two studies of auditory TIPL. We show that detection of formant transitions (changes in spectral energy peaks) can be learned through TIPL. In the second study, we found that non-native speech sound contrasts can also be learned. Interestingly, the magnitude of the learning effects through TIPL is similar to that found through direct, explicit and attended training on the same stimuli. These studies help demonstrate the generality of TIPL to audition and show promise for TIPL as a methodology to aid adult learners of new languages.

#### (SY\_24.5)

##### **Representations of newly-learned sound categories**

LEY, A.<sup>1,2</sup>, HAUSFELD, L.<sup>1</sup>, VROOMEN, J.<sup>2</sup>, VALENTE, G.<sup>1</sup>, DE WEERD, P.<sup>1</sup> & FORMISANO, E.<sup>1</sup>. <sup>1</sup>*University of Maastricht*, <sup>2</sup>*Tilburg University*.

Mapping different sounds onto the same identity requires the extraction of relevant features for enhancing between-category and minimizing within-category differences. We used complex artificial sounds (ripples), fMRI and multivariate pattern analysis (MVPA) to investigate the relation between behavioral and neural changes in the course of category learning. Subjects were scanned twice during passive listening, once before category training and once after successful learning of pitch categories. Pre- and post-training classification accuracies were compared for the relevant (i.e. consistent with the behavioral categorization rule) and irrelevant stimulus labels. Sound identification curves gradually change into a sigmoid shape, reflecting successful category learning. MVPA revealed that the most discriminative voxels were highly distributed over the auditory cortex, and included locations of early auditory areas. Perceptual changes associated with feature specific category learning are thus accompanied by specific changes in the cortical sound representations.

#### **SYMPOSIUM 25 (SY\_25) Auditorium**

##### **Face perception: ERP correlates of Rapid Adaptation, Category-selectivity, Recognition, and Individual Differences**

SCHWEINBERGER, S. R.<sup>1,2</sup>. <sup>1</sup>*DFG Research Unit Person Perception*, <sup>2</sup>*Department of General Psychology, Friedrich Schiller University, Jena, Germany*.

The efficient analysis and representation of person-related information from faces is one of the most important challenges for human social perception. This symposium discusses a number of current and controversial issues in research on face perception. Martin Eimer will

present current evidence for a systematic pattern of selective neural adaptation effects, suggesting that several dissociable processes are involved in early stages of face processing as reflected in the N170 ERP. Guillaume Thierry will then discuss research on early category-selective ERPs that compares the P1 and N170 components with respect to their face-selectivity and response to experimental variations including inter-stimulus variability and stimulus integrity. Stefan R. Schweinberger presents evidence for multiple face-sensitive ERP responses including occipitotemporal N170, P2, N250r components as well as a centroparietal N400, and argues that further progress in this field requires consideration of the variety of ERP responses that relate to different functional components of face perception. Finally, Werner Sommer reports about research to establish face cognition abilities as specific elements of social intelligence from an individual differences perspective, age-related changes, and electrophysiological correlates of these abilities. As a whole, these presentations sketch future directions in face perception research that will further elucidate how structural facial information, as well as cues to social information such as age, gender, identity and others are represented and processed in the human brain.

#### (SY\_25.1)

##### **Rapid neural adaptation: A new tool for the study of face perception**

EIMER, M. *Department of Psychology, Birkbeck College, University of London, UK.*

I will present results from a series of event-related brain potential (ERP) studies that used rapid neural adaptation (or repetition suppression) procedures to study component processes of face perception, and how these processes are reflected by the face-sensitive N170 component. Face and non-face adaptor stimuli (S1) and test face stimuli (S2) were presented for 200 ms, and were separated by a very brief (200 ms) interstimulus interval. The pattern of N170 adaptation effects measured in response to test faces that were preceded by different types of adaptor stimuli provided new insights into the organisation of face processing, and into the category-selectivity of brain activity that is reflected by N170 responses. Results observed with naturalistic, schematic, and Mooney face adaptors suggest that several dissociable processes are involved in early stages of face processing, including the generic analysis of individual face parts, in particular the eyes, as well as configural and holistic face processing. The systematic pattern of N170 adaptation effects observed across experiments demonstrates the potential of the rapid adaptation technique as a tool to dissociate component processes of face perception, and also underlines the fact that the N170 component is a direct electrophysiological index of neural mechanisms that implement human face processing.

#### (SY\_25.2)

##### **P1 and N170 face-to-face: When does the human brain distinguish between visual object categories?**

THIERRY, G.<sup>1</sup>, DERING, B.<sup>1</sup>, MARTIN, C.<sup>2</sup> & PEGNA, A.<sup>3</sup>.  
<sup>1</sup>*School of Psychology, Bangor University, Bangor, UK,*  
<sup>2</sup>*Department of Technology, Universitat de Pompeu Fabra, Barcelona, Spain,* <sup>3</sup>*Neurology Department, Geneva University Hospital, Geneva, Switzerland.*

The human face is the most studied object category in visual neuroscience. In a quest for markers of face processing, event-related potential (ERP) studies have debated whether two peaks of activity –P1 and N170– are category-selective. I will briefly present datasets from six studies involving two-by-two experimental designs showing that P1 mean amplitude significantly distinguishes faces from cars –an object category often compared to faces– independently of modulations elicited by inter-stimulus variability, external feature cropping, and inter-category morphing: (1) By manipulating randomly generated inter-stimulus variability (high vs. low) and object category (cars, faces, butterflies), we show that P1 is weakly sensitive to variability but robustly category-selective, whilst the N170 unexpectedly shows the reverse pattern of response (Thierry et al. 2007; Dering et al., 2009). (2) By manipulating stimulus integrity via deletion of peripheral features of faces (hair, ears, and neck) and cars (rooftop, wing mirrors, and wheels), we show that cropping artificially increases N170 but not P1 amplitude and leaves P1 category-sensitivity intact. (3) By morphing full-front views of faces and cars to different extents, we show that P1 category-selectivity resists 30% contamination of one category by visual information from the other category, whilst the N170 fails to respond to the amount of face information embedded in the stimulus. In sum, we show that the N170 peak of visual event-related brain potentials is highly sensitive to factors other than object category, whereas P1 amplitude is modulated in a face-selective fashion as early as 100 ms after picture onset

#### (SY\_25.3)

##### **Neurophysiological correlates of face recognition**

SCHWEINBERGER, S. R.<sup>1, 2</sup>. <sup>1</sup>*DFG Research Unit Person Perception,* <sup>2</sup>*Department of General Psychology and Cognitive Neuroscience, Friedrich Schiller University, Jena, Germany.*

I will present part of a 20-year research programme in which my colleagues and I have used cognitive (e.g., Bruce & Young, 1986) and computational (e.g., Burton et al., 1990) models as frameworks for the study of neurophysiological correlates of face recognition. Here, face recognition has been conceived as a complex facility that requires the orchestrated activity of multiple neurocognitive subroutines (cf. the contributions in Schweinberger, S.R. & Burton, A.M., Eds., 2011. *Person Perception 25 years after Bruce and Young (1986)*. Special Issue, *British Journal of Psychology*, 102(4), 2011). I will argue that a substantial part of electrophysiological research has seen a strong focus on the N170, at the expense of other face-sensitive ERP components including those that were shown to relate more specifically to individual face recognition. I will briefly discuss evidence for multiple face-sensitive components suggesting that (a) the N170 is related to face detection and structural encoding, but not recognition, (b) the occipitotemporal P2 is sensitive to second-order spatial configuration, and possibly indexes processes related to unfamiliar face learning and population expertise, (c) the posterior temporal N250r is highly sensitive to face familiarity and can index individual face recognition, and (d) a centroparietal N400 systematically relates to domain-independent access of semantic information about people. I will argue that because other aspects of face perception (e.g., perception of gender,

age, eye gaze, emotional expression etc.) also depend on multiple neurocognitive subroutines, further progress in electrophysiological research necessitates appreciating the variety of ERP components that relate to different functional components of face perception.

#### (SY\_25.4)

##### **Individual Differences in Face Cognition: Psychometrics, Ageing, and Neuronal Correlates**

SOMMER, W.<sup>1</sup>, HERZMANN, G.<sup>2</sup>, HILDEBRANDT, A.<sup>1</sup> & WILHELM, O.<sup>3</sup>. <sup>1</sup>*Department of Psychology, Humboldt-University at Berlin, Germany*, <sup>2</sup>*Department of Psychology and Neuroscience, University of Colorado at Boulder, USA*, <sup>3</sup>*Department of Psychology and Educational Science, Ulm University, Ulm, Germany*.

Individual differences in face cognition, an element of social intelligence, were investigated in three psychometric studies with more than 800 participants. Structural equation modeling of an extensive test battery shows that face cognition can be subdivided into distinct abilities, the accuracy of face perception, the accuracy of face memory and the speed of face cognition. The structure of face cognition remained invariant and its relation with established ability constructs was robust across the adult age range from 18 to 82 years, demonstrating its robust specificity from an individual differences perspective. Expectedly, there were substantial age related performance decrements of up to .5 SD per decade for the speed of face cognition. In a subsample of 85 young adults, we studied neuronal correlates of individual differences in face cognition with event-related brain potentials. For the N170 component, held to be an index of the structural analysis of faces, only moderate evidence was obtained for a relationship of its latency with face cognition accuracy. Stronger relationships, however, were found for the amplitudes of the memory-related Early Repetition Effect/N250r and Late Repetition Effect/N400 components with both face cognition speed and accuracy.

#### **SYMPOSIUM 26 (SY\_26) Room 4**

##### **Response-related effects in task switching**

HUBNER, R. *University of Konstanz, Germany*.

Switching between tasks usually produces costs. Meanwhile, it is known that these costs are not caused by a single factor, but are due to various sources of interference such as task-set cueing, stimulus congruency, rule congruency, etc. Moreover, they are controlled by mechanisms such as backward inhibition, competitor rule suppression, response inhibition, etc. For most of these factors responses play a crucial role. This is not surprising, because task switching requires individuals to flexibly combine a fixed set of responses with a variable set of stimulus features. Especially if stimulus features related to different tasks are simultaneously present, selection conflicts are produced at the response level, the rule level, and even at the task level. The talks of this symposium are concerned with these conflicts and corresponding mechanisms. Their topics focus on effects closely related to responses. One effect is response-repetition (RR) costs, which are observed on task-switch trials and which contribute considerably to the task-switch costs. Several accounts have been proposed for their explanation. In the talks of Koch and Schuch and of Druey studies

are reported that were designed to distinguish between two of these accounts: response-inhibition and the associative strengthening. In the study reported by Grzyb and Hubner the details of the previous-trial congruency effect were investigated, i.e. of the phenomenon that the size of RR costs depends on the response activation on the previous trial. Hubner and Grzyb take response inhibition as granted and show how the RR costs can be considerably increased by incongruent and rule-incongruent stimuli. They also discuss several possible mechanisms. Finally, Meiran and Hsieh extend the focus by considering negative repetition effects caused by the competition between whole task rules. They provide behavioral as well as electrophysiological evidence for the idea that that irrelevant task rules that generate response conflicts are inhibited.

#### (SY\_26.1)

##### **Response representations and task representations in task switching**

KOCH, I. & SCHUCH, S. *RWTH Aachen University, Germany*.

Cognitive control mechanisms underlying flexible action can be examined using task switching methodology. There are (at least) two robust findings in task switching. First, a switch of tasks incurs performance switch costs. Second, repeating a response is beneficial in task repetitions but leads to costs in task switches. This interactive pattern of switching tasks and responses may be informative with respect to the underlying representations. Task representations ("task sets") probably include the mapping of stimuli to responses, suggesting task-specific response representations (e.g., pressing a left key may be used to represent a color feature in one task but a shape feature in another task). However, theoretical accounts differ in terms of whether they assume associative strengthening of task-specific response meaning or persisting inhibition of representations of just executed responses, which has different implications for the nature of task representations. In this presentation we discuss existing evidence and report new experimental data. We conclude that both accounts are not mutually exclusive, and we present new evidence for inhibitory mechanisms acting on response representations.

#### (SY\_26.2)

##### **Dissociating learning and inhibition based accounts for response repetition effects in task switching**

DRUEY, M. *University of Zurich*.

In many studies it has been shown that response repetitions produce benefits in task repetition trials, but costs in task switch trials. So far, three main types of accounts have been proposed to explain this interaction of task and response sequence: First, models referring to reconfiguration mechanisms, second accounts based on the learning of associations and, third, priming and inhibition accounts. In the present study, the last two of these accounts were directly contrasted in one experiment by implementing all possible types of stimulus and response category repetitions. Whereas from both accounts costs are predicted for response category repetitions, they differ with respect to the predictions derived for stimulus category repetitions. These should also produce costs according to the learning accounts, but they should result in benefits according to the priming and inhibition

accounts. The results show a clear pattern of benefits in case of stimulus category repetitions, and of costs in case of response category repetitions. The present results thus provide clear evidence for an explanation of the interaction of task and response sequence in terms of priming and inhibition.

#### (SY\_26.3)

##### **The previous-trial congruency effect in task switching: Which property of response activation on trial n-1 determines the amount of response-repetition costs on trial n?**

GRZYB, K. R. & HUBNER, R. *University of Konstanz, Germany.*

Under task switching response repetitions (RR) are typically associated with costs compared to response shifts. Moreover, when the stimulus on the previous trial was congruent RR costs are usually larger than when it was incongruent. This previous-trial congruency effect has been explained by assuming that a response is generally inhibited after its execution and that the amount of inhibition depends on the activation of the response on the previous trial. Here, we investigated which property of the response activation on the previous trial is crucial in determining the amount of inhibition: the absolute activation of the correct response or the activation difference between the alternative responses. To differentiate between these two possibilities we compared RR costs after congruent, neutral, and incongruent trials. In two experiments we found similar RR costs after congruent and neutral trials, whereas the RR costs were smaller after incongruent trials. These results support the hypothesis that the amount of response inhibition is determined by the activation differences between the response alternatives on the previous trial.

#### (SY\_26.4)

##### **The amplification of response-repetition costs by response and task competition**

HUBNER, R. & GRZYB, K. R. *University of Konstanz.*

It is a well-known phenomenon that response repetitions (RR) produces costs on task-switch trials. However, the size of these costs varies considerable between different experiments. This suggests that several factors contribute to these costs. Unfortunately, up to now these factors are largely unknown. Therefore, the goal of the present study was to examine the extent to which different factors affect the size of RR costs. Specifically, we investigated the role of congruency, i.e. whether the stimuli activate only the correct response or also the incorrect one, and of valence, i.e. whether the stimuli activate only the relevant task or also the irrelevant one. We report a series of experiments in which we show that these conflicting stimulus properties increase RR costs. With simple univalent stimuli RR costs are relatively small but still reliable, which indicates that responses are generally inhibited after their execution. However, by adding incongruent stimulus items or by using bivalent stimuli the small response inhibition effect can be amplified. Moreover, if both factors are combined, then RR costs can increase dramatically. This shows that response conflict and task conflict interact. Possible accounts of this interaction are discussed.

#### (SY\_26.5)

##### **Resolving task rule incongruence during task switching by competitor rule suppression**

MEIRAN, N.<sup>1</sup> & HSIEH, S.<sup>2</sup>. <sup>1</sup>*Ben-Gurion University of the Negev, Beer-Sheva, Israel,* <sup>2</sup>*National Cheng Kung University, Tainan, Taiwan.*

Task switching requires maintaining readiness to execute any task of a given set of tasks. However, when tasks switch, the readiness to execute the now-irrelevant task generates interference, as seen in the task rule incongruence effect. Overcoming such interference requires highly fine-tuned inhibition that impairs task readiness only minimally. In experiments involving two object classification tasks and two location classification tasks, the authors show that irrelevant task rules that generate response conflicts are inhibited. This Competitor Rule Suppression (CRS) is seen in response slowing in subsequent trials, when the competing rules become relevant. CRS is shown to operate on specific rules without affecting similar rules and to operate on the competing responses only when generated by the specific competing rule. CRS and backward inhibition, which is another inhibitory phenomenon, produced additive effects on reaction time, suggesting their mutual independence. Using Event Related Potentials, the authors show CRS to operate during the cue epoch, suggesting that it involves the rules rather than the responses. Implications for current formal theories of task switching are discussed.

#### SYMPOSIA PROGRAM

Sunday Noon

SY\_(27-32): 11:30-13:10

#### SYMPOSIUM 27 (SY\_27) Room 4

##### **Processing frequent multi-words expressions: behavioral and electrophysiological perspectives**

VESPIGNANI, F.<sup>1</sup> & CACCIARI, C.<sup>2</sup>. <sup>1</sup>*University of Trento,* <sup>2</sup>*University of Modena Reggio Emilia.*

Despite the fact that most language processing models almost ignore them, multiword expressions (MWEs) are extremely pervasive: According to Jackendoff (1995), in American English there are as many words as there are multi-word expressions, roughly around 80000. Semantic memory is in fact a repository of a variety of knowledge that includes not only word meanings and concepts but also many types of MWEs that people learn or to which they are exposed. MWEs are not only frequent but also different and span from literal word pairs to non literal language. Recently, how MWEs are represented and processed has gained an increasing interest associated with: a) how these strings formed by co-occurring lexical units are represented in the mental lexicon; b) the role of distributional regularities in language comprehension and production; c) the role of semantic expectations in modulating contextual integration at a sentential level; d) the electrophysiological correlates of processing MWEs. The aim of the Symposium is to present these topics by bringing together researchers that present behavioral and ERP evidence relevant for highlighting them. Specifically, Arnon contributes to clarifying the ways in which the frequency and predictability of four-gram literal units affect production processes. Siyanova-Chanturia et al., present behavioral and ERP results on the processing of literal multi-word frequent phrases and the processing



load associated with computing them. Vespignani and Cacciari present ERP evidence questioning the idea that a unique component (the N400) is associated with the computation of highly predictable literal and idiomatic strings. Rommers et al. show ERP evidence on how semantic processing exploits contextual information to modulate the activation of expected constituents belonging to non literal expressions. Finally Katz presents reading time and ERP evidence on dynamic meaning integration processes subserving the comprehension of proverbs.

#### (SY\_27.1)

##### **More than words: phonetic duration is reduced in more frequent chunks**

ARNON, I. *Department of Linguistics, University of Manchester.*

Are speakers sensitive to four-gram frequency? Production is affected by the frequency (and predictability) of linguistic material of varying sizes. Words are phonetically reduced in more predictable environments (e.g., Jurafsky et al. 2001; Gahl & Garnsey, 2004), and in highly collocated phrases like "I don't know" (Bybee & Schieffman, 1999). Such investigations uncover the range of distributional information speakers attend to. However, they mostly focus on the co-occurrence relations between words and other words (bigrams), and between words and the constructions they appear in. Less research has looked at how pronunciation variation is systematically affected by larger, less collocated, chunks of language. Here, we show that phonetic duration is affected by four-word frequency: three-word phrases are shorter when they are produced as part of a higher frequency phrase. Such findings have been previously reported in comprehension (Arnon & Snider, 2010) and in children (Bannard & Matthews, 2008) but have not been tested in adults. We tested the effect of phrase frequency on production by looking at four-gram phrases (11 item-pairs) that only differed on the final word (e.g. "don't have to worry" vs. "don't have to wait") in a between-subject design (each participant saw one variant from each item-pair). The pair had the same bigram, unigram, and trigram frequency (and a phonologically similar final-word onset) but differed in phrase-frequency. Speakers (N=32) were faster to produce the first (identical) trigram in higher frequency chunks, indicating they both attend, and are affected by chunk frequency. These findings (a) extend the range of frequencies speakers are sensitive to, (b) illustrate parallels between production and comprehension, and (c) blur the distinction between 'stored' and 'computed' forms. Speakers showed whole-form frequency effects for compositional phrases. We discuss implications for lexical models, and suggest that speakers represent linguistic units of varying sizes, regardless of frequency and/or compositionality.

#### (SY\_27.2)

##### **Representation and processing of frequent phrases in the brain**

SIYANOVA-CHANTURIA, A.<sup>1, 2</sup>, CONKLIN, K.<sup>2</sup>, KAAAN, E.<sup>3</sup> & VAN HEUVEN, W.<sup>2</sup>. <sup>1</sup>*University of Modena and Reggio Emilia*, <sup>2</sup>*University of Nottingham*, <sup>3</sup>*University of Florida*. Previous research suggests that frequent multiword sequences may be represented in the mental lexicon

along with morphemes and words. Such studies provide evidence for a processing advantage for frequent versus infrequent phrases. While such behavioural research is informative, it tells us little about the mechanisms involved in phrasal processing above and beyond the speed of processing. In Experiment 1a, participants read frequent phrases (knife and fork), infrequent but strongly associated phrases (spoon and fork), and semantic violations (theme and fork). In Experiment 1b, participants read the same stimuli without "and". Experiment 2 investigated the processing of frequent phrases, their reversed forms, and semantic violations in a sentence context. An N400 was observed for semantic violations. Further, frequent phrases elicited smaller N400s than associated phrases (Experiment 1a), suggesting easier semantic integration. In addition, they elicited the P300 both in (Experiment 2) and out (Experiment 1a) of context. We attribute this finding to the phenomenon of "template matching", wherein the target sequence activates a template that matches the upcoming information. Crucially, in Experiment 1b, where items were presented without "and", no differences were observed between frequent phrases (knife-fork) and associates (spoon-fork). This finding implies that what drives the difference between frequent phrases and associates in Experiment 1a is the phrasal status of binomials, which is why this difference disappears in Experiment 1b, where word sequences are no longer presented in their phrasal, uniquely identifiable, form. The above findings suggest that different neural correlates underlie the processing of familiar and novel language, as evidenced by increased P300s and reduced N400s for the former. Our findings are in line with the view, according to which frequent multiword sequences are characterized by a reduced processing load.

#### (SY\_27.3)

##### **Single or multiple expectation-verification mechanisms during language processing?**

VESPIGNANI, F.<sup>1</sup> & CACCIARI, C.<sup>2</sup>. <sup>1</sup>*University of Trento*, <sup>2</sup>*University of Modena Reggio Emilia*.

Recent neurocognitive models of language comprehension attribute a crucial role to predictive and anticipatory processing based on long term memory information. Several sources of evidence in fact show that the distributional properties of language make words rather predictable within a sentence or a text: at a processing level an appropriate context can facilitate word identification, storage, syntactic and semantic integration. The N400 component is known to be sensitive to word frequency (out of context or at sentence beginning), to semantic associations with previously processed words or pictures, and to predictability. A number of experiments showed that some of these N400 modulations, classically attributed to bottom-up integrative processes, reflect message level predictive anticipatory processing. However a specific word can be predicted based on different sources of information. From the one side, the fact that predictions based on semantic association and world knowledge trigger similar N400 effects and the generality of the inverse relation between cloze-probability level of a constituent and N400 amplitude, suggest the existence a common neural mechanism dealing with expectations and verifications during language processing. From the other side recent ERP evi-

dence on multiword units as idioms (e.g., "cry over spilt milk") or collocational complex prepositions (e.g., "with respect to") shows a more articulated picture with patterns other than the classic N400 effects: an interplay between P3 and N400, dissociations between lexical processing negativity and N400-700. These signatures of are discussed as evidence in favor of the existence of different cognitive mechanisms involved in the processing of unexpected constituents in specific situations. This multiplicity of psychophysiological indexes questions the idea that a unique cognitive process is responsible for processing expected constituents simply by estimating the probability of co-occurrence of words.

#### (SY\_27.4)

##### **Context-dependent semantic processing: electrophysiological evidence from idiom comprehension**

ROMMERS, J.<sup>1</sup>, BASTIAANSEN, M. C.<sup>1,2</sup> & DIJKSTRA, T.<sup>1,2</sup>

<sup>1</sup>*Max Planck Institute for Psycholinguistics, Nijmegen.*

<sup>2</sup>*Radboud University, Donders Centre for Brain, Cognition and Behaviour, Nijmegen.*

Evidence from literal sentence comprehension suggests that sufficiently constraining sentence contexts can lead to semantically specified expectations for upcoming words. In an EEG experiment, we investigated whether this semantic expectancy extends to the case of predictable words in opaque idiomatic expressions, in which the literal word meanings are unrelated to the figurative meaning of the expression as a whole (e.g., Dutch "walk against the lamp", meaning "to get caught"). Dutch participants were presented with two types of predictable sentence contexts: literal (e.g., transl. "After lunch the electrician screwed the light bulb into the...") and idiomatic (e.g., transl. "After many transactions the fraud eventually walked against the..."). In both contexts the critical word was (1) a correct and expected word (e.g., "lamp"), (2) a word that was semantically related to the expected word (e.g., "candle"), or (3) a semantically unrelated word (e.g., "fish"). Both (2) and (3) were semantic violations. In literal contexts previous findings were replicated: a graded N400 was observed, being largest for the semantically unrelated words, intermediate for semantically related words, and smallest for correct words. In contrast, in idiomatic contexts the N400s to semantically related and unrelated words were indistinguishable. These results suggest that idiomatic contexts do not lead to activation of the semantics of the predictable words. Furthermore, in idiomatic contexts only, the violations elicited a late positivity which was independent of semantic relatedness, suggesting that the semantic violations were treated as form violations instead. The results highlight the context-dependency of semantic processing and have consequences for theories of idiom comprehension.

#### (SY\_27.5)

##### **When words of a feather flock together: The processing of proverbs**

KATZ, A. *The University of Western Ontario.*

Comprehension involves a range of processes, each of which involves the disambiguation of multiple possibilities. In the research discussed here, we use as our prototype case the processing of proverbs because proverbs often make sense both when used either literally or figuratively (i.e. as a proverb), and so can be employed to

examine (a) processing differences in integrating the literal or figurative sense of a sentence into equally supportive discourse contexts and (b) the type of contextual support that facilitates integration. Offline, reading time and ERP data will be presented. The examination of meaningful longer units, such as proverbs, is problematic for ERP studies that emphasize effects taking place at single words (with, for instance N400s) because discourse contexts might begin to influence comprehension even before the critical word is considered and continue to influence across the complete statement. With respect to ERP data, we time-lock to the first word of the critical statement, a technique that arguably captures slow wave potentials that develop over sentences and reflects the ease with which the target is integrated into an ongoing text model. Using this procedure we demonstrate processing differences that are not captured in word-by-word online reading tasks, that slow cortical potentials for proverbs are more negative at the front of the head than the same sentence used literally and that contextual cues influence integration earlier than if not present. These data point to an ongoing dynamic process of meaning integration and are problematic to several theoretical perspectives on non-literal processing, including the graded salience hypothesis.

#### **PLENARY SYMPOSIUM (SY\_28) Auditorium**

##### **Feedback processing and the brain: The ESCAN symposium at ESCoP**

VAN DER MOLEN, M. *Department of Psychology, University of Amsterdam.*

ESCAN is an acronym for European Society for Cognitive and Affective Neuroscience. ESCAN has been established recently and provides a European platform for interaction and collaboration for researchers working in diverse fields of the cognitive and affective neurosciences. By organizing symposia at mutual meetings ESCAN and ESCoP aim at developing and strengthening collegial ties between the two organizations. The first ESCAN symposium at ESCoP is devoted to feedback processing. The processing of performance feedback is critical to determine the success of actions. Similarly, the processing of social-evaluative feedback is important vis-a-vis the need to belong. Electrophysiological studies of performance feedback processing have identified a negative deflection at fronto-central recording sites that peaks approximately 250 ms following feedback presentation and that appears to be larger following the presentation of negative feedback. Autonomic manifestations of both performance and social-evaluative feedback processing showed a consistent and transient heart rate slowing to negative relative to positive feedback. Neuroimaging studies revealed that the anterior cingulate cortex is the most likely neural source implicated in the processing of both performance and social-evaluative negative feedback. In this symposium, illustrations will be provided of autonomic, electrocortical and brain activation correlates of performance and social-evaluative feedback processing. It will be shown how these measures can be used to elucidate the mechanisms implicated in feedback processing.

**(SY\_28.1)****Feedback processing in a hypothetico-deductive reasoning task**

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The capacity to adjust behaviour and evaluate performance in a changing environment is highly related to taking feedback into account. The present study focused on feedback processing in hypothetico-deductive reasoning tasks. In these situations, strong response biases have been evidenced. These biases alone are insufficient to conclude that they represent errors of reasoning. Recording electrodermal activity evoked by feedback signals indicate that, when subjects displayed these response biases, the "error" feedback was unexpected, confirming that these biases represent errors of reasoning. In the same task, we analysed Event-Related Potentials evoked by the feedback signals. Depending of the recording sites, Laplacian-transformed data were sensitive, on the one hand to participants' expectancies in a binary and a gradual way and, on the other hand to the evaluation of performance itself: correct vs false. In conclusion, the processing of feedback signals depends on at least three separate processes in this kind of tasks.

**(SY\_28.2)****Slowing after infrequent salient feedback irrespective of valence: Support for the orienting account**

NOTEBAERT, W., NUNEZ CASTELLAR, E., VAN DER BORGHT, L. & FIAS, W. *Experimental Psychology, Ghent University.*

We proposed the orienting account for post-error slowing by demonstrating that responses only slow down after infrequent errors. In a recent study, we observed that slowing occurred only after salient infrequent feedback. When the feedback was less positive or less negative (+1 instead of +10 or -1 instead of -10) than expected no slowing was observed. However, when the feedback was more positive or more negative than expected (+10 instead of +1 or -10 instead of -1) subsequent slowing was observed irrespective of the valence. Similarly, in a different study, we demonstrated that post-error slowing reduced as the (long) experiment proceeded. We also explain this effect in terms of saliency, in the sense that errors become less salient and attention-capturing during the time-course of the experiment.

**(SY\_28.3)****A tribute to Charlie Chaplin: How feedback-based learning benefits from watching slapstick comedy (and other dopamine-boosters)**

RIDDERINKHOF, K. R.<sup>1,2</sup>, VAN WOUWE, N. C.<sup>3</sup>, BAND, G. P.<sup>3</sup>, VAN DE VIJVER, I.<sup>1</sup>, VAN DEN WILDEBERG, W. P.<sup>1</sup> & WYLIE, S. A.<sup>4</sup>. <sup>1</sup>Amsterdam center for the study of adaptive control in brain and behaviour (Acacia), Department of Psychology, University of Amsterdam, <sup>2</sup>Cognitive Science Center Amsterdam, University of Amsterdam, <sup>3</sup>Leiden University Institute of Psychology, University of Leiden, <sup>4</sup>Neurology Department, University of Virginia Health Systems, Virginia, USA.

Feedback-based learning refers to the process of learning to select those actions that lead to rewards while avoiding actions that lead to punishments. This process, known to rely on dopaminergic activity in striatal brain

regions, is compromised in healthy aging and in Parkinson Disease (PD). We hypothesized that such decision-learning deficits are moderated by factors that improve frontostriatal dopaminergic activity. Computational measures of probabilistic feedback-based learning have been shown to rely on the nucleus caudatus (outcome evaluation during the early phases of learning) and the putamen (reward prediction during later phases of learning). We observed that various dopamine boosters (including induced positive affect, dopamine agonists, and deep brain stimulation) facilitated learning, through its effects on reward prediction rather than outcome evaluation. For instance, watching a few minutes of comedy clips served to remedy dopamine-related problems in putamen-based frontostriatal circuitry and, consequently, in learning to predict which actions will yield reward.

**(SY\_28.4)****Feedback-related processes during a time production task in young and older adults**

FALKENSTEIN, M., WILD-WALL, N. & WILLEMSEN, R. *Leibniz Research Centre for Working Environment and Human Factors, Dortmund, Germany.*

The mid-brain dopamine system subserves motor functions and also reward learning. We examined whether decline of the mid-brain dopamine system plays a role in the adaptation of precisely timed motor responses by feedback information. A young, a healthy older and a group with off-medicated Parkinson patients performed a time-production task with feedback given after each trial. Young participants performed superior to the two older groups whereas the performance was comparable between the healthy older group and the patients. The feedback-related negativity (FRN) was of lower amplitude for older vs. young participants. Preliminary results suggest that the FRN-amplitude of the Parkinson's patients is comparable to the healthy older participants. The decreased response accuracy of the older group, and possibly also of the patients, may be related to a weakened fronto-striatal dopamine system and thus a reduced ability to use feedback information for improving temporal aspects of the motor response.

**(SY\_28.5)****Autonomic and brain correlates of social-evaluative feedback processing**

VAN DER MOLEN, M.<sup>1</sup>, GUNTHER MOOR, B.<sup>1,2</sup> & CRONE, E.<sup>1,2</sup>. <sup>1</sup>Department of Psychology, University of Amsterdam, <sup>2</sup>Institute of Psychological Research, University of Leiden.

Social relationships are vitally important in human life. Social rejection in particular has been conceptualized as a potent social cue resulting in feelings of hurt. In two studies participants were presented with a series of unfamiliar faces and were asked to predict whether they would be liked by the other person. Following each judgment, participants received feedback indicating that the other person had either accepted or rejected them. A neuroimaging study showed increased activation when participants had positive expectations about social evaluation, and increased activation following social acceptance feedback. A heart rate study showed that feedback was associated with transient heart rate slowing and a return to baseline that was considerably delayed in

response to unexpected social rejection. This pattern of results indicates that the impact of social rejection is context-dependent. In addition, the results seem to suggest that the heart and brain are differentially sensitive to social rejection/acceptance.

#### SYMPOSIUM (SY\_29) Room 2

##### L1 influences on L2 revisited

ROMÁN, P. E. & KOTZ, S. *Max Planck Institute, Leipzig, Germany.*

Since the early models on word production (Kroll and Stewart, 1994) and word recognition (Dijkstra & van Heuven, 1998), there has been much evidence on the influence that a first language (L1) exerts on second language (L2) acquisition. Although high and low proficient bilinguals have been shown to activate both languages, learners seem to be more prone to suffer the influence from their first language, whether facilitating as in cognate effects or interfering as in the case of the homograph effect. Such differences are reflected not only at the behavioral (e.g. Chen & Ho, 1986) but also at a cerebral level (e.g. Perani et al., 1998) and at every language processing level: syntax (van Hell & Tokowicz, 2010); grammar (Bialystok & Miller, 2000), and lexicon (Poulishse & Boungaerts, 1994). The need to trigger additional mechanisms to control selection of the correct representations seem to have consequences on general cognitive processing (Colzato et al., 2008). At present, research takes major steps forward exploring different aspects that modulate the complexity of this relation between languages and its consequences. The aim of the symposium will be, therefore, to offer an integrative view on the influence of L1 on L2 that includes these new exciting impacts on bilingualism. Thus, Kroll et al. will focus on the time course of lexical L1 influence on L2 across scripts. The contributions by Dussias and Van Hell & Tokowicz address how syntactical differences between L1 and L2 modulate processing of uncertainties or violations, respectively, in bilinguals with different backgrounds. Kotz will review neural correlates of the influence of non-linguistic functions such as rhythm and attention and their relation to linguistic functions. Finally, the contribution of Bajo et al. shows evidence on the executive control mechanism acting to prevent interference between languages and its dependence on the bilingual experience.

##### (SY\_29.1)

##### Does the first language influence second language processing once learners are proficient bilinguals? Behavioral and ERP evidence on cross-language lexical activation

KROLL, J. F.<sup>1</sup>, MISRA, M.<sup>1</sup> & GUO, T.<sup>2</sup>. <sup>1</sup>*Pennsylvania State University, State College, USA*, <sup>2</sup>*Beijing Normal University, Beijing, China.*

When individuals acquire a second language (L2) past early childhood, the established first language (L1) may be used as a basis on which to mediate access to the meaning of new L2 words. According to the Revised Hierarchical Model (Kroll & Stewart, 1994), the mediation of L2 words via their L1 translation characterizes the performance at lower levels of proficiency, but not once individuals become highly proficient and appear able to conceptually process the meaning of L2 words directly.

Past studies have challenged this view in two ways, suggesting first that L1 mediation is not required at all (e.g., Brysbaert & Duyck, 2010), even at the earliest stages of L2 learning, and second, that proficient bilinguals may continue to access the L1 translation equivalent even well after they have acquired a high degree of proficiency in the L2 (e.g., Morford et al., 2011; Thierry & Wu, 2007). We present two sets of behavioral and ERP studies that examine this issue with highly proficient Chinese-English and Spanish-English bilinguals performing a translation recognition task. By manipulating the relation of distractor words in L1 to target words in L2, we could determine the degree to which the L1 actively influences processing in the L2. By comparing behavioral results and ERPs, we could identify the time course over which these effects unfold. The comparison of two different relatively proficient bilingual groups also enabled us to assess the role of same vs. different-script language in mediating the persisting effects of the L1 on the L2. The results suggest that the L1 translation equivalent is indeed available to even highly proficient L2 speakers but the time course of these effects suggests that access to the meaning of L2 words does not depend on it.

##### (SY\_29.2)

##### Cross-language transfer and morphosyntactic processing: Event-related potential and behavioral evidence in Dutch-English and English-Spanish bilinguals

VAN HELL, J. <sup>1</sup> & TOKOWICZ, N. <sup>2</sup>. <sup>1</sup>*Department of Psychology, Pennsylvania State University, State College, USA*, <sup>2</sup>*Department of Psychology and the Learning Research and Development Center, University of Pittsburgh, Pittsburgh, USA.*

Does knowledge of syntactic structures in the first language affect the learning and processing of syntactic structures in the second language? The Competition Model predicts that transfer of syntactic structures from L1 to L2 depends on cross-language similarity (e.g., MacWhinney, 2008; Tokowicz & MacWhinney, 2005). The competition model predicts that in case of similar structures, but not in dissimilar structures, L2 learners will be highly sensitive to syntactic violations at an early point in L2 learning, and that acquisition of structures that are unique to the second language will depend on the availability and reliability of relevant cues. These predictions were tested in two studies with Dutch learners of L2 English and English learners of L2 Spanish. The syntactic structures under study were similar across two languages (English verb inflection for native Dutch speakers, Spanish demonstrative determiner-noun number agreement for native English speakers), unique (Spanish determiner-noun gender agreement for native English speakers) or dissimilar (English present progressive for native Dutch speakers, Spanish definite determiner-noun number agreement for native English speakers). Dutch-English relatively proficient bilinguals showed typical native-like ERP signatures of morphosyntactic processing on all structures (irrespective of L1-L2 similarity). Unlike some previous findings in beginning learners, both the Dutch-English and the English-Spanish beginning learners' ERP patterns showed ERP sensitivity to violations of constructions that are similar and different in the two languages; the English-Spanish beginning learners showed no sensitivity to the construction that is unique

to Spanish. We will discuss these findings in relation to the (scarce but emergent) literature on ERP patterns in morphosyntactic processing in beginning L2 learners, cross-language transfer, and the Competition Model.

#### (SY\_29.3)

##### **The role of the L1 in explaining observed L1/L2 differences during syntactic processing**

DUSSIAS, P. *Pennsylvania State University, State College, USA.*

When we read sentences in our second language, we face many uncertainties about how the people or objects referred to in the text are connected to one another. This is so because when our eyes move along the printed line, the information needed to establish correct dependencies between word strings is not yet available. So what does the second language (L2) reader do under these conditions of uncertainty? Because L2 speakers who are relatively proficient in two or more languages have access to the grammar and lexicon of each language when they comprehend written sentences, one critical question concerns whether the specific semantic and syntactic sub-processes engaged during L2 language comprehension are different when monolingual speakers and second language speakers process input in the target language. In this talk, I will examine how differences in the linguistic systems of a bilingual's two languages might influence the syntactic representations that adult L2 learners compute during comprehension. I will also discuss how the bilinguals' characteristics and specific linguistic experience may determine their performance in reading comprehension tasks.

#### (SY\_29.4)

##### **Timing, rhythm, and syntax in tonal and sentential processing: L1 and L2 evidence**

KOTZ, S. *Neurocognition of Rhythm in Communication Group, MPI for Human Cognitive and Brain Sciences, Leipzig, Germany.*

Neural cortical correlates of linguistic functions such as syntax and phonology are well supported in the neuroscience literature. However, the influence of non-linguistic functions such as timing, rhythm, and attention, well established in music research, are currently sparsely considered in speech and language research. This is surprising as latter functions play a critical role in first and second language acquisition. In this context, I will focus on basal ganglia and cerebellar circuitries which are involved in beat perception, timing, attention, memory, language, and motor behaviour (see Kotz, Schwartze, & Schmidt-Kassow, 2009; Kotz and Schwartze, 2010) in L1. Furthermore, I will present a concept of how linguistic and non-linguistic functions interface and will support this concept with recent event-related potential (ERP) data from L2 speakers that belong to different rhythmic L1 and L2 classes (e.g. Schmidt-Kassow et al., 2011).

#### (SY\_29.5)

##### **Retrieval induced forgetting and language control**

ROMÁN, P. E.<sup>1</sup>, GÓMEZ-ARIZA, C. J.<sup>2</sup> & BAJO, M. T.<sup>3</sup>. <sup>1</sup>*Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig*, <sup>2</sup>*Universidad de Jaén*, <sup>3</sup>*Universidad de Granada*.

Bilinguals activate their two languages even in contexts where just one of them is required. Inhibition has been proposed as a candidate mechanism for language selec-

tion; suppressing the lexical representations of the irrelevant language facilitates access to the relevant one. The relation of language selection to a more general inhibitory control mechanism has also been the focus of interest (Green, 1998) and some researchers have built a bridge between retrieval induced forgetting (RIF) and language inhibition (Levy et al., 2007). In this study, we explore the neural substrates of RIF in language control. To do so, we register ERPs during retrieval practice in a bilingual picture naming task. As expected, results showed differences in ERPs during picture naming as a function of the number of the retrieval practice in L2. Moreover, source analyses on such differences reveal that the neural activity is originated in regions that have been associated to the RIF effect in neuroimaging studies. We discuss the data in the context of theories of bilingual language selection and control.

#### SYMPOSIUM 30 (SY\_30) Room 1

##### **Context modulations of neurocognitive processes evoked by counterintuitive meanings**

ARISTEI, S. & SOMMER, W. *Humboldt Universität zu Berlin.*

Meaning often depends on the context in which it is expressed. We present four studies about context-induced modulation of neurocognitive processes associated with semantic integration of counterintuitive ideas. We first report a comparison of religious and profane counterintuitive ideas. Using the N400 component of the event-related potentials, it will be shown that counterintuitions in religious context are treated as less anomalous and easier to integrate into the semantic cognitive system than similarly counterintuitive profane ideas. However, religiosity is not the only property influencing the processing of semantic anomalies. As demonstrated in the second study, context emotionality seems to facilitate the semantic integration of so-called minimally counterintuitive concepts. For instance, within emotionally neutral contexts concepts such as a "flying mule", typical of fairy tales and other phantasy stories, are recognized and processed as semantic anomalies (N400 effect) but not so within negative emotional contexts (N400 effect absent). Moreover, as shown next, word meaning can be rapidly reversed when interpreted figuratively rather than literally, for example in the ironic statement "That was great". Ironic expressions do not necessarily induce an increased semantic integration difficulty (N400 effects absent); however, understanding their meaning seems to involve late inferential processes (P600 effects). Similarly, reported in the final presentation, the two related concepts in oxymora, e.g. "real dream", are integrated in novel metaphorical meanings after an initial semantic analysis, as indicated by later frontal positive ERP effects (500-900 ms). Thus, various semantic anomalies that are part of our everyday language are not always processed like classic semantic expectancy violations. On the contrary, they can be accepted and integrated into our semantic system, depending on discourse context. Importantly, these anomalies elicit different brain activities, probably reflecting the integration work of the semantic system.

## (SY\_30.1)

**Contrasting meanings in minimal noun-adjective pairs: ERP correlates of Oxymora interpretation**

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<sup>1</sup>*Basque Center on Cognition, Brain and Language, Donostia, Spain*, <sup>2</sup>*Ikerbasque*, <sup>3</sup>*Universidad del País Vasco*.

In this study we evaluated the neurocognitive processes involved in the interpretation of paradoxical figures of speech. Oxymora are figures of speech in which two words whose meaning is antithetic are merged. The most common form of oxymoron involves adjective-noun combinations (e.g. cold fire or real dream). While oxymora are literally paradoxical, pleonasms are noun-adjective pairs in which similar meanings are redundantly expressed (burning fire). In a first ERP experiment 20 participants were visually presented with word by word Spanish sentences containing noun-adjectives Oxymora (Estaba completamente confusa por el sueño real de la noche anterior. - I was completely confused by the real dream from last night), compared to literally Neuter sentences (funny dream) and semantic Violations (I expert dream). The Violation condition elicited an enhanced N400 compared to the other two conditions, that did not differ around 400 ms. The Oxymoron condition elicited a larger frontal positive effect (500-900 ms) compared to the other conditions. In a second experiment 20 Spanish speakers read sentences containing Pleonasms (unreal dream; plus Neuter and Violation). While Pleonasms and Neuter sentences did not differ around 400 ms the Violation caused a N400 effect. The Pleonasm elicited a short-living (500-650 ms) increased frontal positive component compared the other conditions. The two experiments suggest that understanding oxymora requires more than the simple activation and combination of semantic features (mirrored in the N400). Only after this initial semantic analysis, related concepts are integrated in activating novel metaphorical meanings: while pleonasms trigger short-living late positivities, oxymora trigger long-lasting positivities maybe due to the antonymic semantic relation between noun and adjective.

## (SY\_30.2)

**Isn't it ironic? Neurocognitive correlates of figurative language processing**

REGEL, S., GUNTER, T. C. & FRIEDERICI, A. D. *Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany*.

The comprehension of figurative language, especially irony, raises some interesting questions onto how implied meanings are processed. For instance, the sentence 'That's great' can be interpreted either literally (i.e. meaning something positive), or ironically (i.e. conveying the speaker's disappointment about an annoying event) depending on the context of this utterance. In order to comprehend an ironic sentence different, and often opposite, meanings beyond the literal sentence meaning need to be processed. In two experiments using event-related brain potentials (ERPs) we investigated the neurocognitive processes involved in the processing of ironic and literal sentences. In Experiment 1, participants listened to short stories consisting of three context sentences followed by a target sentence like 'That's really bland', which achieved either an ironic or literal meaning by the foregoing contextual information. ERPs at the

target sentence's final word revealed a large late positivity (i.e. P600 component) but no N400 component for irony compared to equivalent literal sentences. In Experiment 2, this ERP pattern was replicated for the visual modality. Moreover, the observed P600 component appeared to be most robustly associated with irony processing since it was neither affected by task demands (comprehension task vs. passive reading), nor by probability of stimulus occurrence. Thus, the current findings suggest that the increasing P600 amplitude for irony is related to the processing of implied meanings, and might be a reflection of pragmatic interpretation processes. Comprehending figurative language does not necessarily evoke a semantic integration difficulty (absence of an N400 component), but rather seems to involve late inferential processes for understanding ironic meanings (presence of a P600 component). It appears that in the case of irony, the processing of implied meanings does not require a rejection of literal sentence meanings but rather a computation of appropriate sentence meanings.

## (SY\_30.3)

**Contextualizing religious counterintuitive ideas: an ERP approach**

FONDEVILA, S.<sup>2</sup>, MARTÍN-LOECHES, M.<sup>2,3</sup>, JIMÉNEZ-ORTEGA, L.<sup>2,3</sup>, CASADO, P.<sup>2,3</sup>, FERNÁNDEZ HERNÁNDEZ, A.<sup>2</sup> & SOMMER, W.<sup>1</sup>. <sup>1</sup>*Humboldt Universität zu Berlin, Berlin, Germany*, <sup>2</sup>*Center for Human Evolution and Behaviour, UCM-ISCIII, Madrid, Spain*, <sup>3</sup>*Complutense University of Madrid, Madrid, Spain*.

Cognitive approaches generally accept that religion, far from being an extraordinary set of facts, constitute a by-product of normal cognition. The cultural success of religious ideas has been explained as a function of their minimally counterintuitive nature, which makes them highly appealing for better recall and transmission. Thus, religious concepts challenge certain features related to intuitive core knowledge while keeping intact other tacit assumptions. However, there are also many culturally successful concepts that are counterintuitive but clearly profane. In the present experiment we addressed the question how both counterintuitive religious and profane ideas are integrated into the semantic system by using the N400 semantic component of the event related brain potentials as a measure of semantic incongruity or counterintuitiveness. Religious ideas were collected from various mythologies and religious corpora building up sentences where counterintuition appeared in the last word. The intuitive and profane sentences were elaborated by changing the last word of the religious sentences. Participants with low degree of religiosity performed a semantic judgment task based on plausibility while their brain activity was recorded. Results showed a modulation of the N400 amplitude by counterintuitiveness with a typical centroparietal scalp distribution. The main finding was a significantly larger amplitude of the N400 for the profane as compared to the religious counterintuitive ideas, the latter also displaying a larger N400 amplitude as compared to intuitive sentences. Furthermore, behavioural data showed greater difficulty in rejecting religious ideas as counterintuitive (unacceptable) than profane ones. Consequently, counterintuitive religious ideas appear as less anomalous, more plausible and easier to integrate into the semantic cognitive sys-

tem and thus, only minimally counterintuitive even if they imply clear violations of core knowledge.

#### (SY\_30.4)

##### **Neurocognitive correlates of minimally counterintuitive concepts and their modulation by context affectivity**

ARISTEI, S.<sup>1</sup>, NEHRICH, T.<sup>2</sup>, KNOOP, C.<sup>2</sup>, SOMMER, W.<sup>1</sup>, LUBRICH, O.<sup>2</sup>, JACOBS, A.<sup>2</sup> & ABDEL RAHMAN, R.<sup>1</sup>.  
<sup>1</sup>*Humboldt Universität zu Berlin, Berlin, Germany*, <sup>2</sup>*Freie Universität Berlin, Berlin, Germany*.

Concepts minimally violating word core knowledge, i.e. minimally counterintuitive concepts (MCI), are special cases of semantic violations. These concepts are characterized by a semantic feature belonging to a different category while maintaining all properties of its own category (e.g. smiling trees blossom). MCIs are better remembered than non-violating or bizarre concepts. This mnemonic advantage is assumed to be one of the mechanisms responsible for the cultural success of narratives involving MCIs (e.g. fairy tales). Our study is the first attempt to understand how our neurocognitive system copes with MCIs at first encounter. Two issues were of central interest: first, whether MCIs involve different cognitive processes than other semantic violations; and second, whether emotional context modulates MCI processing. We recorded ERPs during the reading of sentences containing MCIs (e.g. a barren tree smiles), semantic expectancy violations (e.g. a barren tree blossoms), and non-violating concepts (e.g. a barren tree breaks down). Each sentence was preceded by a neutral or an emotionally negative context. MCIs elicited a long lasting N400 effect, and the effect was reduced by the negative emotional context. In contrast, semantic expectancy violations elicited a larger P600 than the other conditions, in absence of N400 effects. Furthermore, the P600 effect was enhanced by the negative emotional rather than the neutral context. Our results suggest that MCIs and semantic violations are differentially processed. MCIs are recognized and processed as semantically anomalous at earlier stages than semantic expectancy violations. Semantic expectancy violations, conversely, appear to be initially processed as semantically coherent (no N400 effect) and only later to be re-analyzed and possibly repaired (P600). Most interesting, context affectivity appears to reduce counterintuition but to make semantic expectancy violations more costly. In conclusion, cognitive processing of MCIs differs from semantic expectancy violations and is differentially modulated by the affective connotation of the context.

#### **SYMPOSIUM 31 (SY\_31) Room 6**

##### **Motor and perceptual aspects of temporal expectation**

THOMASCHKE, R. *Institut für Psychologie. Universität Regensburg. Regensburg. Germany*.

It is a well established finding that temporal expectation facilitates a wide range of cognitive processes, from early stimulus perception to late motor-levels. It is, however, still under debate, which underlying mechanisms are responsible for temporal expectation and its behavioral effects. The symposium brings together five accounts of temporal expectation, which address the phenomenon each from a different experimental perspective. The symposium has two main emphases. One is on integrating results from different experimental designs. For

example, recent research has shown that auditory attention is differently affected by temporal expectation, depending on the experimental context. In the symposium, electrophysiological effects of inducing auditory temporal expectation in different way by rhythms, or by constant foreperiods, are discussed, and compared with related temporal expectation effects on visual perception. A second emphasis of the symposium is on showing how new results from temporal expectation research can fruitfully inform theorizing on classical response-time paradigms, like attentional cuing, and cross modal integration, which has previously largely neglected the temporal dimension.

#### (SY\_31.1)

##### **Motor and perceptual aspects of temporal expectancy: Identifying classic confounds in attention research**

BOULINGUEZ, P. *Centre de Neuroscience Cognitive, UMR CNRS 5229 & Université Claude Bernard Lyon 1, France*.

Questions about attention are usually addressed by cueing tasks assessing whether knowledge of stimulus-related information provided in advance will improve target processing. However, growing evidence suggests that inhibitory control of response is critically involved in such tasks. This control operates in anticipation of stimulus arrival and acts as a gating mechanism intended to withhold automatic responses to visual stimuli in order to prevent false alarms (responses to cues). As a consequence, behavioural and physiological baselines classically used to refer cue-related changes in attention research using standard cue-target detection protocols are biased and multiple cue-induced effects are potentially confounded. Here, I will review EEG, fMRI, behavioural and clinical data in humans revealing this widespread bias, and propose methodological refinements of standard protocols that allow disentangling executive control mechanisms from motor, perceptual and attentional processes.

#### (SY\_31.2)

##### **Limits to multisensory integration – a case for temporal preparation**

LOS, S. A. & VAN DER BURG, E. *VU University, Amsterdam, Netherlands*.

A well known finding in the human reaction time (RT) literature is that an irrelevant auditory stimulus (S1) reduces RT for a simultaneous visual target stimulus (S2). Two explanations have been offered for this finding: (1) the information of the visual and auditory senses merge to yield a stronger percept than when the visual stimulus is presented alone (i.e., multisensory integration); (2) the auditory S1 arrives earlier at a central level than the visual S2 and initiates a preparation process that reduces RT (i.e., temporal preparation). Starting from the temporal preparation explanation, we devised a procedure that allowed us to estimate the effective preparation period (EPP) – the interval between S1 and S2 corrected for differences in their central arrival times. In addition, we manipulated the stimulus onset asynchrony (SOA) between S1 and S2 (0 – 400 ms) in conjunction with the modality of S1. When expressed as a function of SOA, we observed a substantial effect of S1 modality on RT. However, this effect disappeared completely after re-expressing RT as a function of EPP. This finding strongly supports the temporal preparation explanation.

**(SY\_31.3)****Temporal expectancy shortens the onset of perceptual processes**

SEIBOLD, V. C., BAUSENHART, K. M. & ROLKE, B. *Eberhard Karls Universität Tübingen, Tübingen, Germany.*

Over the past ten years, a variety of studies have shown that temporally expecting a stimulus facilitates perceptual processing. To investigate the possible mechanisms underlying this perceptual benefit, we conducted two studies. In the first study, we used speed-accuracy-tradeoff (SAT) functions to assess whether temporal expectancy affects the dynamics of perceptual processing. Specifically, we used a spatial discrimination task in which participants had to judge whether the upper line of a cross was longer or shorter than the other ones. The time available for target processing was varied by presenting a response signal with a variable delay after target onset, and temporal expectancy for targets was manipulated via constant foreperiods. The obtained SAT functions suggest that temporal expectancy acts on the onset of perceptual processes. In the second study, we aimed to find possible neuronal markers for this onset effect by means of sensory event-related potentials (ERPs). Specifically, we used an auditory oddball task in which participants had to detect infrequent target tones intermixed in frequent standard and infrequent deviant tones. Temporal expectancy was again manipulated via constant foreperiods. We observed that the latencies of sensory ERPs, i.e. the N1 and the N2 difference wave, were shortened in conditions of high temporal expectancy. Taken together, the two studies provide first evidence that temporal expectancy leads to a perceptual benefit by shortening the onset of perceptual processes.

**(SY\_31.4)****The ups and downs of temporal orienting: Different effects of temporal expectations on early auditory processing**

LANGE, K. *Heinrich Heine Universität Düsseldorf, Düsseldorf, Germany.*

Temporal expectations can induce an orienting of attention to the expected point in time. On a behavioral level, it has been consistently shown that this temporal orienting leads to faster responding to attended compared to unattended stimuli. Regardless of how exactly temporal expectations were induced, these behavioral effects have been accompanied by an enhancement of the P300 wave of the auditory event-related potential. This suggests that temporal orienting affects processes localized relatively late in the auditory processing stream. By contrast, effects of temporal orienting on early auditory processing (as measured by the auditory N1) are more diverse. Early effects depend on the underlying temporal expectations and on whether or not the timing of the stimuli can be anticipated reliably. In the talk, I will present data of three experiments in which temporal expectations were based on different experimental manipulations, leading to distinct effects of temporal orienting on the auditory N1. When temporal expectations were based solely on statistical properties of the stimulation, no effects of temporal orienting on the auditory N1 were observed. When temporal expectations were rhythmical, based on a regular (vs. an irregular) stimulus sequence prior to the critical tone, the effect of temporal orienting on the N1

depended on whether the sequence reliably predicted the tone's onset or not. Reliable predictions of the tone's onset were associated with a reduced N1. By contrast, rhythmic expectations lead to an enhancement of the auditory N1 when participants could not be certain about the timing of the tone. Thus, the present data suggest that effects of temporal orienting on early sensory processing steps depend crucially on the involved temporal expectations, whereas temporal orienting effects in later, response-related processing stages are independent of how exactly the underlying temporal expectations are achieved.

**(SY\_31.5)****The power of rhythms in modulating early auditory processing**

CORREA, A. & SANABRIA, D. *Universidad de Granada, Spain.*

In this talk I will present electrophysiological evidence showing that rhythms can induce strong temporal expectations and modulations of early auditory processing exogenously, that is, even when the rhythm does not predict the time of target onset.

**SYMPOSIUM 32 (SY\_32) Room 3****The cognitive neuropsychiatry of delusional belief**

COLTHEART, M. *Centre for Cognition and its Disorders, Macquarie University, Sydney, Australia.*

Cognitive neuropsychiatry is a relatively new branch of cognitive neuropsychology that investigates higher-order cognitive processes such as belief formation, the sense of agency, self-knowledge, and emotion, via detailed studies of people with impairments of such cognitive processes. That is, cognitive explanations of psychiatric symptoms are sought. Just as acquired dyslexia was the major topic for cognitive neuropsychology in its early years, so delusional belief has been the major topic in the initial years of cognitive neuropsychiatry. The four speakers at this symposium will discuss the current state of the cognitive-neuropsychiatric understanding of a variety of delusional beliefs such as Capgras delusion ("My wife has been replaced by an impostor who looks just like her"), Fregoli delusion ("I am being constantly followed by people I know, whom I cannot recognize because they are always disguised"), Cotard delusion ("I am dead"), the delusion of alien control ("Other people can cause parts of my body to move, against my will"), and shared delusions such as the mass hypochondria present in cultures affected by Koro syndrome (the belief that one's sexual organs are shrinking and will disappear). Laboratory research within the frameworks of behavioural economics and of associative learning that bears upon the cognitive explanation of delusional belief will be presented, as will psychopharmacological research concerning the model psychosis produced by administration of ketamine.

**(SY\_32.1)****Delusional beliefs: a two-factor cognitive theory**

COLTHEART, M. *Centre for Cognition and its Disorders, Macquarie University, Sydney, Australia.*

According to the two-factor theory of delusion, to explain any particular form of delusional one needs to provide answers to just two questions. First: why did a belief with



this particular content ever occur to the deluded person in the first place (for example, what made a patient with Cotard delusion ever entertain the thought that his wife has vanished and been replaced by an identical-looking impostor)? Second: once the delusional idea does come to mind, why is it accepted as a belief, rather than rejected (as it should be, given that most delusional beliefs are so bizarre, and given that the patient's family, friends and clinicians are all denying the truth of the belief)? An account will be given of how this theory is applied to the explanation of a variety of delusions will be given, and current difficulties for this account will be discussed.

#### (SY\_32.2)

##### **The two-factor approach to delusional belief and the distinction between immediate and reflective delusions**

LANGDON, R. *Centre for Cognition and its Disorders, Macquarie University, Sydney, Australia.*

Inspired by the idea that delusions begin when a person reflects upon a disquieting experience and searches for explanatory hypotheses, researchers have focused on the role of reasoning biases in delusional formation. But such biases are not always present in delusional people. Moreover, the reflective explanation has difficulties in accounting for the incorrigibility and unwarranted subjective conviction of delusions. An alternate approach fares better here. On this alternate approach, the explanation of anomalous data proceeds largely unconsciously and outputs fully-formed delusional content directly to consciousness, where it is endorsed as representing reality. Neither approach accounts satisfactorily for all delusions. I suggest, instead, an  $\tilde{\text{immediate-reflective}}$  spectrum. At one pole of this spectrum are immediate delusions with content that arises fully-formed and fully-(mis)believed in consciousness. At the other pole are reflective delusions that arise after reflection upon a disquieting experience, and for which the crystallisation of delusional conviction is more gradual.

#### (SY\_32.3)

##### **Shared delusions**

MCKAY, R. *Department of Psychology, Royal Holloway University of London, Egham, UK.*

Deluded individuals hold beliefs unwarranted by available evidence and jeopardizing their prospects in some way. Such beliefs can stem from clinical abnormalities in cognitive processes, but may also arise via ordinary operation of such processes, coupled with the social diffusion of information. Examples include cases of mass hypochondria (e.g., epidemics of Koro, the belief that one's genitals are retracting into one's body). We call such examples "shared delusions". We allowed participants to learn from each other in the face of a common uncertainty, state-dependent error costs, and a subtle framing manipulation activating the concept of intentional agency. In the end, incorrect choices often spread in social groups. The result was a profusion of persistent, error-prone social traditions involving choices resulting in substantial losses. Such traditions may not quite qualify as delusions, but do represent collective errors, transmitted from one person to another, with potentially far-reaching social, political and economic repercussions.

#### (SY\_32.4)

##### **Rendering delusions understandable through cognitive neuroscience**

CORLETT, P. *Department of Psychiatry, Yale University, New Haven, USA.*

Prediction error is the mismatch between expectation and experience, used as a teaching signal to update beliefs and an impetus to allocate attention toward potential explanations. Delusions could result from aberrant prediction errors, specified inappropriately, driving attention toward irrelevant stimuli, thoughts and percepts and forging the formation of odd and unusual beliefs. I will outline evidence favoring this model from functional neuroimaging studies of causal belief formation in patients with endogenous psychosis and healthy individuals exposed to a pharmacological "model psychosis"; the drug ketamine. A crucial feature of delusions is their tenacity. This feature may well also be explicable in terms of aberrant prediction error. Surprising events demand change in expectancies, necessitating making what we have learned labile and so updatable: updating, binding memories anew (memory reconsolidation). Under the influence of excessive prediction error, delusional beliefs may be repeatedly reconsolidated, strengthening them so they persist, impervious to contradiction.

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## ORAL SESSIONS

## Friday Morning

OS\_02\*: 08:30-08:50

OS\_(01-07): 10:50-11:50

## OS\_02\*, Room 3, beginning of SY\_2

**Reasoning about other people's intentions: the side effect phenomenon**

BYRNE, R. *School of Psychology and Institute of Neuroscience, Trinity College Dublin, University of Dublin, Ireland.*

We examine how people reason about other people's intentions in two experiments designed to test factors that underlie the well-known 'side effect' phenomenon. Participants' judgments about an actor who decided to introduce a new company program which would increase profits and which would also affect the environment show an intriguing asymmetry: they judge the actor to have intentionally harmed the environment when the outcome is negative, but they do not judge him to have intentionally helped the environment when the outcome is positive. The first experiment shows that the effect occurs even when the actor had no foreknowledge of the outcome. The second experiment shows that the actor is judged to have intentionally brought about the negative outcome, even when he had the desire to bring about a good outcome. We discuss the implications of the results for alternative theories of reasoning about intentionality.

## · Dyslexia ·

## OS\_01, Room 2

## (OS\_01.1)

**Characterising attentional difficulties in children with reading disabilities**

SERRANO CHICA, F., LUPIÁÑEZ, J., SOCCINI, A. & DEFIOR, S. *University of Granada*

Developmental dyslexia is a persistent reading disability usually associated with phonological deficits. Recent research has also found alterations in attentional processes associated to this disorder. However, these results are still controversial and highly dependent on the specific paradigm being used. This study aims to investigate dyslexic attentional difficulties by comparing different aspects of attention in children with and without reading disabilities. Participants are 72 children with reading disabilities (dyslexic and poor readers) compared to children with the same chronological age and younger children with the same reading level (reading level-matched design). A reduced version of the ANTI task was used to independently measure, within a single experimental session, three main attentional functions usually associated with the three attentional networks proposed by Posner: Alerting (Vigilance Network), Orienting (Posterior network) and Cognitive control (Anterior network). Results showed an overall slowing in responding in dyslexic children, together with larger interference (i.e., reduced cognitive control), as compared to the control groups. The observed attentional deficits are discussed in the context of current theories of dyslexia.

## (OS\_01.2)

**It's about time: Revisiting rapid processing deficits in dyslexia**

CASINI, L.<sup>1, 2</sup>, PECH-GEORGEL, C.<sup>4</sup>, BURLE, B.<sup>1, 2</sup> & ZIEGLER, J.<sup>2, 3</sup> *<sup>1</sup>Laboratoire de Neurobiologie de la Cognition. Université de Provence. Marseille, France, <sup>2</sup>CNRS. France, <sup>3</sup>Laboratoire de Psychologie Cognitive. Université de Provence. Marseille, France, <sup>4</sup>Service de neurologie pédiatrique. CHU La Timone. Marseille, France.*

Developmental dyslexia is typically associated with a phonological deficit but the origin of this deficit is still a matter of debate. The purpose of the present study was to reexamine Tallal's rapid processing deficit theory according to which phonological deficits are caused by auditory temporal processing impairments. This was done by investigating whether such a temporal deficit could be found in speech as well as non-speech stimuli, and whether it would generalize to other sensory modalities. In particular, we studied how children with dyslexia dealt with temporal judgments in three different tasks: 1/ judgment of segmental duration in a speech perception task, 2/ duration judgment of non speech auditory stimuli, and 3/ duration judgment of visual stimuli. The results showed that children with dyslexia, compared to normally developing age-matched controls, presented deficits when processing segmental durations as well as the duration of non speech auditory or visual stimuli. These results are in agreement with Tallal's theory but are also consistent with a general and amodal temporal processing deficit. In the framework of cognitive theories of temporal processing, these data suggest a dysfunction of the "internal clock" in children with dyslexia.

## (OS\_01.3)

**Order or disorder? Impaired Hebb learning in dyslexia**

SZMALEC, A.<sup>1</sup>, LONCKE, M.<sup>1</sup>, PAGE, M.<sup>2</sup> & DUYCK, W.<sup>1</sup> *<sup>1</sup>Ghent University, Belgium, <sup>2</sup>University of Hertfordshire, UK.*

The present study offers an integrative account which proposes that dyslexia and its various associated cognitive impairments reflect an underlying deficit in the long-term learning of serial-order information, here operationalized as Hebb repetition learning. In non-dyslexic individuals, improved immediate serial recall is typically observed when one particular sequence of items is repeated across an experimental session, a phenomenon known as the Hebb repetition effect. Starting from the critical observation that individuals with dyslexia seem to be selectively impaired in cognitive tasks that involve processing of serial order, the present study is the first to test and confirm the hypothesis that the Hebb repetition effect is affected in dyslexia, also in non-verbal modalities. We present a theoretical framework in which the Hebb repetition effect is assumed to be a laboratory analogue of naturalistic word learning, on the basis of which we argue that dyslexia is characterized by an impairment of serial-order learning that affects language learning and processing.

• Memory •  
OS\_02, Room 4

## (OS\_02.1)

**How specific is source memory for faces of cheaters?  
Evidence for categorical emotional tagging**

BELL, R.<sup>1</sup>, BUCHNER, A.<sup>1</sup>, ERDFELDER, E.<sup>2</sup>, GIANG, T.<sup>1</sup>, SCHAIN, C.<sup>3</sup> & RIETHER, N.<sup>4</sup>. <sup>1</sup>Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany. <sup>2</sup>Universität Mannheim, Mannheim, Germany. <sup>3</sup>Westfälische Wilhelms-Universität Münster, Münster, Germany. <sup>4</sup>Universität Bielefeld, Bielefeld, Germany.

The study was designed to examine the specificity of emotional source memory. In the encoding phase, participants saw faces along with emotional context information, that is descriptions of cheating, trustworthy, or irrelevant behavior. In the test phase, participants were required to complete a source of classification test and a cued recall test. The source memory advantage for faces characterized by negative context information (cheating) was replicated. Extending previous research, a multinomial source monitoring model was applied to distinguish between specific source memory for individual behavior descriptions and partial source memory in the sense of only a rough classification of the behavior as belonging to a particular emotional category-cheating, trustworthy, or neither of these. The results indicate that the source memory advantage for the emotional context information is not always accompanied by enhanced recollection of the specific details of the learning episode and might rather reflect unspecific memory for categorical emotional information.

## (OS\_02.2)

**Disembodying memory - the role of covert oral simulations for implicit memory, familiarity, and recollection**

TOPOLINSKI, S. *University of Wuerzburg.*

The present embodied account of memory argues that fluency-based memory forms, namely both implicit memory and familiarity, are genuinely embodied in drawing on the efficiency of sensorimotor simulations related to the to-be-judged stimulus. These simulations are trained and run more fluently for old compared to new stimuli. In contrast, retrieval-based memory, namely recollection, is independent from stimulus-specific sensorimotor simulations because it draws on additional retrieval processes. In four experiments, words as verbal stimuli being mediated by the oral motor system were presented, some of them repeatedly, either under manual (e.g., moving a ball), or oral motor interference (e.g., chewing gum). In contrast to manual interference, oral interference prevented the acquisition of implicit memory (Experiment 1) and familiarity (Experiment 2), and substantially impaired the familiarity estimates in the remember-know paradigm (Experiment 3) and receiver-operating characteristics (Experiment 4), while leaving recollection unaffected (Experiments 1-4). This pattern establishes unconventional memory dissociations in healthy participants, e.g. explicit without implicit memory (Experiment 1), or recognizing without feeling familiar (Experiment 2), which are only known from severe clinical cases and have strong implications for our understanding of memory across disciplines.

## (OS\_02.3)

**Effects of age of acquisition on implicit memory**

SPATARO, P.<sup>1</sup>, ROSSI-ARNAUD, C.<sup>2</sup> & MULLIGAN, N.<sup>3</sup>. <sup>1</sup>Sapienza University, Department of Dynamic and Clinical Psychology, <sup>2</sup>Sapienza University, Department of Psychology, <sup>3</sup>University of North Carolina, Department of Psychology.

The present study examined the effects of subjective age of acquisition (AoA) in two different tasks of implicit memory that are heavily based on the retrieval of visual-orthographic information. The rationale is that, having established where priming effects are located, the assessment of the interaction with psycholinguistic variables like AoA may allow one to determine if their effects influence the same processing levels. Experiment 1 employed the Word-Fragment Completion task. The to-be-completed fragments were exposed for 4 sec, to reduce possible contributions from phonological and semantic processes. Results indicated that the overall percentages of correct completion were significantly greater for early- than for late-acquired words. Importantly, repetition priming interacted with AoA, such that priming was higher for late- than for early-acquired items. Experiment 2 used a modified version of the Lexical Decision task, in which non-words were represented by illegal, unpronounceable strings of letters. Data showed that decision times were significantly shorter for early- than for late-acquired words. Again, repetition priming interacted with AoA, because priming was greater for late- than for early-acquired items. These findings suggest that AoA can affect implicit memory by facilitating the retrieval of the orthographic properties of the studied words.

• Emotions •  
OS\_03, Room 3

## (OS\_03.1)

**Talking emotions: Evidence for an articulatory feedback hypothesis**

RUMMER, R. & SCHWEPPE, J. *University of Erfurt.*

In literature on sound symbolism, it is suggested that /i/ (as in peace) is associated with positive words and /o/ is associated with negative words. We tested the hypothesis that this is due to the face muscle activation involved in articulating these vowels (articulatory feedback hypothesis). Articulating /i/ contracts the same muscles as smiling (i.e., the zygomaticus major muscle, ZMM) and should thus increase positive feelings, while articulating /o/ prevents smiling (by contracting the orbicularis oris muscle, OOM). In the first experiment we demonstrated that people who articulated /i/ (once per second) while reading cartoons perceived them as funnier than people who concurrently articulated /o/ (once per second). (In contrast, hearing /i/ or /o/ while looking at the cartoons did not affect the funniness ratings.) In a second experiment, we demonstrated that pseudowords including smile vowels (i.e., vowels whose articulation contracts the ZMM) are rated as more pleasant than pseudowords with frown vowels (i.e., vowels whose articulation contracts the OOM) when they are read aloud, but not when they are just heard, as should be the case based on existing sound symbolism theories. In sum, our findings clearly support the articulatory feedback hypothesis.

**(OS\_03.2)****Effect of perspective modulation on performance of a detection task: a mental imagery study**MAZZIETTI, A. & KOENIG, O. *Université Lumière Lyon 2.*

The aim of the present study was to build an emotional induction paradigm using mental imagery in order to investigate the effect of perspective modulation on the performance of a detection task. In the first phase, participants were asked to evaluate various pictures representing emotional elements so as to determine which elements evoked the most emotions for them. These elements were inserted into a standardized scenario in which perspective was manipulated. Perspective could be internal (participant as actor) or external (participant as witness). In the second phase, participants were presented with these personalized induction scenarios to imagine for thirty seconds. A detection task was given to them immediately afterwards. Mental images were then evaluated in terms of valence, relevance, intensity, impact and quality. Results showed a significant effect of perspective modulation only for pleasant scenarios. Reaction times were faster for external perspective compared to internal perspective in pleasant condition. Pleasant stimuli presented in an external perspective were rated (valence, etc.) as less emotional than other stimuli. Unpleasant stimuli were both considered as equally emotional regardless the perspective. Results were explained using the appraisal theory and the concept of relevance, which perspective seems to modulate differently depending on the valence.

**(OS\_03.3)****Threat in the spotlight. Storage of emotional content in short term memory**

OLSZANOWSKI, M.<sup>1</sup>, BALAS, R.<sup>1, 2</sup> & KLYSZEJKO, Z.<sup>1, 3</sup>.  
<sup>1</sup>Warsaw School of Social Sciences & Humanities, <sup>2</sup>Polish Academy of Science, Institute of Psychology, <sup>3</sup>Information Processing Center, Visual Cognition Research Department.

Presented studies examine the effect of emotional content on short-term memory (STM) storage. Our basic assumptions were made according to Cowan model of working memory - WM (2001), as we hypothesized that emotional stimuli would have higher activation which should result with better and longer availability for the central executive system. Additionally we expected that emotional content (especially negative or dangerous) can possibly focus the attentional resources (as predicted by "emotion drive attention" hypothesis - Ohman, Flykt, Esteves, 2001), which may lead to poorer accessibility of other/neutral content stored in STM. To test this we asked participants to perform a set of modified Sternberg tasks (1966) using faces or pictures as stimuli. Across the experimental trials we manipulated the type of stimuli (facial display or picture emotionality), that appeared within the short lists of stimuli (faces or pictures) presented one after another. The data support general conclusion that emotional (especially threatening) stimuli have increased short term accessibility that also impair other stimuli storage and memory activation (lower recognition of items appearing next in the row). This results stands along with other data and support general observation about attention-grabbing power of negative stimuli and automatic vigilance for threat.

· **Executive control** ·  
**OS\_04, Room 6**

**(OS\_04.1)****Neural correlates of executive control training**KARBACH, J. & BRIEBER, S. *Department of Psychology. Saarland University. Saarbrücken, Germany.*

Although a number of behavioral studies have shown that executive control training can transfer to new untrained tasks, little is known about the underlying mechanisms and the associated changes in functional brain activity. Previous studies have yielded mixed results, including patterns of increases, decreases, and functional reorganization of regional activations after training. The aim of this study was to investigate qualitative and quantitative changes in neural activity associated with the transfer of task-switching training. We assessed 31 young adults in a pretest-training-posttest design. Both pretest and posttest included functional neuroimaging (fMRI) while participants performed task switching and working memory tasks. After the pretest, participants were randomly assigned to a training condition (n=16) or an inactive control condition (n=15). The training group performed five sessions of task-switching training. Behavioral data showed training-related benefits on the switching task as well as transfer of training to a similar new switching task and a working memory task. Neuroimaging data revealed reduced activity in prefrontal and superior parietal areas after the training, pointing to increased neural efficiency. Consistent with previous findings, the training also resulted in increased activity in the striatum, suggesting that it plays an important role in mediating learning and transfer effects.

**(OS\_04.2)****A TMS study of the role of right intraparietal sulcus in advance task-set preparation**STEVENS, T. & MONSELL, S. *School of Psychology. University of Exeter. Exeter, UK.*

Imaging studies suggest that the right intraparietal sulcus (rIPS) is activated during advance preparation for a task-switch, but little or no rIPS activation is seen in experiments that do not allow time for preparation. We examined the role of rIPS using TMS with a task-cuing paradigm. The tasks were to classify the colour or the shape of a stimulus with a left or right key press. An auditory task cue preceded the stimulus by an interval of 100 ms (short CSI) or 750 ms (long CSI). In Experiment 1, we applied 3 TMS pulses at 20 Hz over rIPS, or over a control site, from 250 ms before the stimulus onset: i.e. during preparation with a long CSI, or before the cue with a short CSI. When the control site was stimulated, the usual reduction in behavioural switch cost with increasing CSI was observed. Stimulation of rIPS significantly attenuated this reduction. In Experiment 2, TMS applied 300 ms after stimulus onset had no impact on switch costs. This result suggests that rIPS plays a critical role in advance task-set preparation rather than in task-set reconfiguration more generally.

## (OS\_04.3)

**Genes implicated in executive functioning during neuropsychological testing and in daily life**

ALFIMOVA, M., KOROVAITSEVA, G., LEZHEIKO, T. & GOLIMBET, V. *Mental Health Research Center RAMS.*

The objective of this study was to investigate whether the same sets of genes influence executive functioning during neuropsychological testing and in everyday behavior. Overlapping samples of healthy individuals completed neuropsychological tests measuring executive functions (n=150) and the Self Report form of the Behavioral Rating Inventory of Executive Function - Adult version (BRIEF-A) (n=100). The samples were genotyped for genes involved in dopaminergic neurotransmission (DRD4, COMT, MAOA) and neuroplasticity (BDNF, SNAP-25, NRG1). We failed to reveal strong relations between the BRIEF-A and standardized neuropsychological tests of executive functions. Neuropsychological measures showed specific associations with both dopamine system and neuroplasticity genes. A BRIEF-A score correlated only with dopaminergic genes, different alleles of DRD4, COMT, and MAOA being related to higher subjective rating of everyday executive functioning in men and women. The results suggest that dopaminergic system genes plays a critical role in everyday executive functions/self-regulation, while pure cognitive executive functions are influenced by a larger number of gene sets involved in different types of CNS processes.

• Bi/Multi-lingualism •  
OS\_05, Room 5

## (OS\_05.1)

**Homographs processing in sentence context: Inhibitory processes and their time course**

MARTÍN, M. C., MACIZO, P. & BAJO, M. T. *University of Granada.*

This study investigated inhibitory mechanisms in language selection in Spanish-English bilinguals during the processing of interlexical homographs in a sentence context. Recent studies on out-of-context homographs processing have shown cross-language activation, and that inhibitory processes are triggered to select the target meaning (Macizo, Bajo, & Martín, 2010). Moreover, Martín et al. (2010) showed that this inhibitory effect had a transient effect of around five-hundred milliseconds. In this study, participants read sentences in English, including homographs as critical stimuli. After each sentence, they were presented a test word and had to decide whether the word was related with the sentence meaning. Test words included the English translation of the Spanish homograph meaning, and they were presented 100 ms immediately after the sentence or after 500 ms. The results showed that participants slowed their responses to the critical test words preceded by sentences including homographs relative to control test words. This effect was only observed at the immediate interval. A control experiment with English monolinguals showed no differences among conditions. The overall pattern of results further extends our previous findings to homograph processing in a sentence context.

## (OS\_05.2)

**Effects of the encoding task on the emotional effect on memory for first and second language words**

FERRÉ, P.<sup>1, 2</sup>, SÁNCHEZ-CASAS, R.<sup>1, 2</sup> & FRAGA, I.<sup>3</sup>.  
<sup>1</sup>Universitat Rovira i Virgili. Tarragona. Spain, <sup>2</sup>CRAMC. Tarragona. Spain, <sup>3</sup>Universidad de Santiago de Compostela.

Emotionally charged words are better remembered than neutral words. This well established fact in monolinguals has been recently tested in bilinguals. The results of these studies have not been consistent, since several authors have obtained the emotional effect on memory only for L1 words (Anooshian & Hertel, 1994), whereas others have observed this effect for words in the two languages (Ayçiçeği & Harris, 2004; Ayçiçeği-Dinn & Caldwell Harris, 2009; Ferré et al., 2010). In most of the previous studies, the task that participants had to perform with the words at the encoding phase was to rate them on some affective dimension. The aim of the present study was to test whether the emotional effect on memory can be obtained when participants perform other encoding tasks. We conducted two memory experiments with early proficient bilinguals of Spanish and Catalan. At the encoding phase of Experiment 1, participants had to count the number of letters of L1 and L2 words (a physical encoding condition). In Experiment 2, they had to rate the concreteness of each word (a semantic encoding condition). Results showed that the type of encoding task can modulate the emotionality effect obtained in L2.

## (OS\_05.3)

**The role of phonological and orthographic overlap in cognate processing: Behavioral and electrophysiological evidence**

COMESAÑA, M.<sup>1</sup>, SOARES, A.<sup>1</sup>, SÁNCHEZ-CASAS, R.<sup>2</sup>, FRADE, S.<sup>1</sup>, RAUBER, A.<sup>3</sup>, PINHEIRO, A. P.<sup>1</sup> & FRAGA, I.<sup>4</sup>.  
<sup>1</sup>University of Minho (Portugal), <sup>2</sup>University of Rovira i Virgili (Spain), <sup>3</sup>Catholic University of Pelotas (Brazil), <sup>4</sup>University of Santiago de Compostela (Spain).

Two major positions have been proposed in order to explain the differential processing of cognate vs. non cognate words: a lexical-morphological hypothesis (Davis et al., 2010), according to which the differential processing observed in cognate words is due to their special morphological representation in bilingual memory; and a symbolic, localist connectionist framework (Dijkstra et al., 2010) that emphasizes the cross-linguistic similarity of cognate words. In order to contrast these hypotheses, we examined the role of phonological and orthographic similarity in the processing of cognate words, as well as the duration of SOA, by recording electrophysiological (event-related potentials -ERP) and behavioral data. One-hundred and ninety-two words (96 cognate vs. 96 non-cognate words) were selected based on to their orthographic -O- and phonological -P- overlap and matched on frequency, length, grammatical category, thematic structure, and orthographic and phonological neighborhood. Forty-eight proficient European Portuguese-English bilinguals performed a silent reading task combined with a masked priming paradigm. The results showed that the processing of cognate words was modulated by both phonological and orthographic overlap, although the orthography effect was more pronounced for the longer SOA.

· Modeling ·  
OS\_06, Room 1

## (OS\_06.1)

**Learning semantic representations from sequential and syntactic statistics**

ANDREWS, M.<sup>1, 2</sup> & VIGLIOCCO, G.<sup>2</sup>. <sup>1</sup>*Nottingham-Trent University*, <sup>2</sup>*University College London*.

In recent years, a common computational approach to the problem of the learning semantic representations has been premised on the hypothesis that aspects of the meaning of words can be inferred from their statistical characteristics across spoken and written language. Well known examples of models of this kind include Latent Semantic Analysis due to Landauer et al. One of the widely shared assumptions of these models, however, has been to treat the linguistic context in which a word occurs as an unordered set of words, and by so doing they disregard fine-grained sequential and syntactic information. In the present work, we will describe a set of Bayesian distributional models that go beyond this so-called "bag-of-words" paradigm. These models avail of information regarding the sequential order in which words occur, the argument structure and general syntactic relationships within sentences, all of which potentially provide vital information about the possible meaning of words. By reference to word-associations norms and experimental behavioural measures of semantic representation in both monosemous and polysemous words, we demonstrate that more precise and psychologically valid semantic representations can be learned when these more fine-grained sources of statistical information are used.

## (OS\_06.2)

**Detecting inherent bias in the lexical decision task**

KEULEERS, E. & BRYSBART, M. *Department of Experimental Psychology, Ghent University, Ghent, Belgium*.

A basic assumption of the lexical decision task is that a correct response to a word requires access to a corresponding mental representation of that word. However, systematic patterns of similarities and dissimilarities between words and nonwords can introduce inherent biases for a particular response to a given stimulus (e.g., word-stimuli can contain more vowels, nonword stimuli can end frequently with a certain letter). We introduce LD1NN, a simple algorithm based on the Levenshtein Distance (LD) and one-nearest-neighbor classification (1NN), which derives the inherent response bias for each stimulus in an experiment from the distribution of word and nonwords among the most similar previously presented stimuli. We first show that LD1NN is very sensitive to differences between words and matched nonwords generated according to different principles (i.e., random nonword generation, letter replacement, linguistically informed pseudoword generators). Finally, we examine participant data from three lexical decision megastudies and show that the algorithm's predicted biases for and against responses correspond to respectively faster and slower responses to stimuli. The algorithm can be used to examine and limit the degree of inherent bias when designing an experiment and to control for existing bias in statistical analysis of experimental data.

## (OS\_06.3)

**A new computational theory of mental imagery**

SIMA, J. F. *Cognitive Systems, University of Bremen, Germany*.

The nature of the mental representations and processes underlying human mental imagery has been one of the most prominent open questions in cognitive science for decades and still remains unresolved today. We shed new light on this question with a new theory of mental imagery, which is able to integrate the three contemporary theories, i.e., descriptive, enactive, and quasi-pictorial, by providing a consistent explanatory framework for a range of phenomena, which are not covered by one of the other theories on its own. In contrast to the other theories, this new theory is also implemented as a computational cognitive model. We show how the model accounts for common imagery phenomena, e.g., mental scanning, cognitive penetration, eye movements, and mental reinterpretation. We discuss how the structure and components of the model offer a new take on the distinction between visual and spatial mental imagery as well as neuropsychological results, e.g., imaginal neglect.

· Social cognition ·  
OS\_07, Auditorium

## (OS\_07.1)

**What are you looking at? Effects of the co-actor's focus of attention on task performance**

BÖCKLER, A., KNOBLICH, G. & SEBANZ, N. *Donders Center for Brain, Cognition, and Behaviour, Nijmegen, NL*.

People take a co-actor's perspective on a jointly attended scene into account and give up their egocentric view when the other's spatial perspective is noticeably different. Present experiments investigated whether people's performance is also affected by a co-actor's focus of attention - even when spatial perspectives do not differ. Two participants were sitting next to each other while each performed a two-choice Navon task, responding to the identity of letters consisting of similar (congruent) or different (incongruent) smaller letters. Stimuli and responses of the two participants were kept independent. The critical manipulation concerned the focus of attention: participants either attended to the same aspect of the letters (e.g. both to the local aspect/small letters) or they attended to different aspects. Results revealed a significant slow-down of responses when participants focused on different aspects. This slow-down did not depend on participants attending to the same stimulus location, but the effect broke down when the other's stimuli could not be perceived. An EEG-study revealed effects of the co-actor's focus of attention on components related to attentional processing. Taken together, this may indicate that the co-actor's different focus can't be ignored and induces the need to re-focus on one's own stimulus aspect.

## (OS\_07.2)

**When machines make errors: The role of simulation in error observation**

DESMET, C., DESCHRIJVER, E., FIAS, W. & BRASS, M. *Department of Experimental Psychology, Ghent University, Ghent, Belgium*.

It has been observed that the posterior frontomedian cortex (pFMC) is not only sensitive to the production of

errors but also to the observation of human errors. Some researchers explained this finding by arguing that we internally simulate observed errors. This would implicate that the pFMC is only sensitive to errors that can be simulated. In a recent fMRI study we tested this prediction by comparing brain activity related to human errors and machine errors. We showed that the pFMC was even more strongly activated by machine errors than by human errors. In other words, errors that cannot be simulated evoke larger activation in the pFMC than errors that can be simulated. Further, we showed that an unexpected event, not related to error processing, revealed the most extensive activity in the pFMC. In sum, our data contradict the simulation hypothesis and support a view where the pFMC is related to violations of expectations.

### (OS\_07.3)

#### **Interplay between prior and action intentions during social interaction**

ONDOBAKA, S.<sup>1</sup>, DE LANGE, F. P.<sup>1</sup>, NEWMAN-NORLUND, R. D.<sup>2</sup>, WIEMERS, M.<sup>1</sup> & BEKKERING, H.<sup>1</sup>. <sup>1</sup>*Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen*, <sup>2</sup>*Department of Exercise Science, University of South Carolina*.

Observing the actions of another person influences planning and control of our own actions. However, little is known about how intentions formed prior to action planning influence this process. In the current experiment, we manipulated the congruency of action intentions and prior intentions in a pair of jointly acting individuals in a card-game situation and investigated how this influences performance. In general, actions were initiated faster when co-actors had the same prior intention, i.e., had to follow the same rule. We also observed an action intention congruency effect when their movements were directed to the same spatial location. Importantly, this action congruency effect was only present when co-actors had the same prior intention. These findings suggest the existence of a shared representation of own and others' prior intentions, and argue for a dynamic, multi-tiered intentional mechanism involved in the processing of others' actions.



**ORAL SESSIONS**  
**Friday Afternoon**

OS\_(08-13): 14:20-16:00

• Human learning •  
OS\_08, Room 6

**(OS\_08.1)**

**How implicit is visual statistical learning?**

BERTELS, J.<sup>1, 2</sup>, FRANCO, A.<sup>1, 3</sup>, SAN ANTON, M. E.<sup>1</sup> & DESTREBECQZ, A.<sup>1</sup>. <sup>1</sup>*Université libre de Bruxelles, <sup>2</sup>FRS/FNRS (Belgique), <sup>3</sup>FNR (Luxembourg).*

In visual statistical learning (VSL), participants learn the statistical regularities present in a sequence of visual shapes. A recent study (Kim, Seitz, Feenstra, & Shams, 2009) suggests that VSL occurs implicitly as it is not accompanied by conscious awareness of these regularities. However, Kim et al.'s conclusion depends on two unwarranted assumptions concerning the nature and the sensitivity of the tasks used to measure participants' knowledge of the regularities. In a replication of this study, we used a Rapid Serial Visual Presentation (RSVP) task as an indirect measure of learning, as well as a direct measure consisting in a four-choice completion task. Crucially, binary confidence judgments were also recorded after each completion trial, in order to systematically measure the extent to which sequence knowledge was available to consciousness. Our results show that a subset of participants who learned the regularities between shapes do not have conscious access to their knowledge. In most cases, however, we observed a significant correlation between performance and confidence, suggesting that participants were conscious of the knowledge they were using in the completion task.

**(OS\_08.2)**

**Inhibition and interference between cues: Training a cue-outcome association prevents the retrieval of other cues associated with the same outcome**

VADILLO, M. A. & ORTEGA-CASTRO, N. *Universidad de Deusto, Bilbao, Spain.*

Interference effects have become one of the most important topics in current theorizing about contingency learning. Although most of these studies focus on experimental designs that are to some extent isomorphic to the classic A-B, A-C interference paradigm (i.e., interference between outcomes), it has been found that similar effects can be found in situations that resemble to a A-B, C-B interference paradigm (i.e., interference between cues). However, the available theories, which were designed to account for the former type of interference, are unable to provide an explanation for the latter. Using an adaptation of the standard experimental procedure for the study of retrieval-induced forgetting (RIF), we show that the kind of inhibitory processes invoked in memory research to account for RIF can take place both in A-B, A-C and A-B, C-B interference paradigms. This suggests that the explanatory mechanisms that have been advanced to account for RIF can have an important role in future attempts to provide an integrative explanation of interference between cues and interference between outcomes.

**(OS\_08.3)**

**Overestimations of null contingencies depend on the probability of the action**

BLANCO, F., MATUTE, H. & VADILLO, M. A. *Departamento de Fundamentos y Métodos de la Psicología. University of Deusto. Bilbao, Spain.*

The probability of responding, P(R), is known to bias contingency judgments between actions and uncontrollable outcomes. That is, the more active a participant is, the more likely he/she is to overestimate the null contingency, and thus to develop an illusion of control. The current two experiments test a potential account for this P(R) bias: by responding with high P(R), participants may accidentally expose themselves to higher values of actual contingency. Contrary to this account, our results indicate that contingency overestimations are better predicted by P(R) itself than by any differential exposure to contingency. Moreover, as training proceeds, the actual contingency participants are exposed to gets closer to the programmed zero contingency value. However, this does not result in more accurate judgments of control. This finding motivates a discussion on a potential volitional component of the P(R) bias.

**(OS\_08.4)**

**Learning to search - simplification of task processing transfers within and across tasks**

GASCHLER, R., VATERRODT, B. & FRENCH, P. A. *Humboldt-Universität zu Berlin, Department of Psychology.*

Theoretical as well as practical concerns render it highly relevant to understand how and why people spontaneously search for and apply shortcut strategies. Here we report skill acquisition research with adults as well as eyetracking data on mental calculation in children to make the case that people can (a) pick up easily and (b) transfer very broadly a general notion that shortcuts can be found and applied in task material. Similar to the concept of "learning to learn" we argue for "learning to search" as a key means in (a) understanding top-down contributions to strategy change in skill acquisition and (b) foster or impede the spontaneous application of shortcut strategies depending on practical goals. The results show that simplification of task processing transfers across items within a task as well as across tasks involving different stimuli, responses and operation rules. In many cases strategy change seems to be driven by a conscious and voluntary decision to apply the knowledge about task regularities acquired incidentally. In primary school mathematics, offering material with regularities that can be found and exploited rather easily seems to be an effective intervention to spark a general search for efficient ways of calculation.

**(OS\_08.5)**

**Summing causes: People often choose simple non-normative strategies**

ORTEGA-CASTRO, N.<sup>1</sup>, BARBERIA, I.<sup>2</sup>, VADILLO, M. A.<sup>1</sup> & BAKER, A. G.<sup>2</sup>. <sup>1</sup>*Deusto University, Bilbao, Spain, <sup>2</sup>McGill University, Montréal, Canada.*

Many associative and rule-based theories assume that the probability of a binary outcome given a set of potential binary causes should equal the sum of the independent causal tendencies of each cue or cause. By contrast, some other models such as the Power PC theory of causal learning assume that the causal power of a com-

pound cue or combination of causes should be computed in a more rational way. The causal power of each cue is added but the sum should be corrected by subtracting the overlap between them. We conducted a series of experiments testing these predictions, using different sets of probabilities, several cover stories and different formats of presenting information. We found that participants usually chose the simplest, though not normative, strategy to combine the influence from several causes. Most of the time they simply added the probabilities without considering the potential overlap; other times they averaged both conditional probabilities. Finally, we argue that, based on our experiments, it seems reasonable to conclude that there are a number of factors that might promote one strategy or another.

• **Executive control** •  
OS\_09, Room 4

(OS\_09.1)

**The impact of physical activity on the executive functions inhibition and updating**

BARENBERG, J., BERSE, T., HILBOLL, D. & DUTKE, S. *University of Muenster*.

As executive functions play an essential role in many complex cognitive tasks, approaches capable of enhancing executive functioning are of particular interest to cognitive research. Recently, in sports and neurosciences, the hypothesis has been advanced that executive functioning, more than other cognitive functions, may benefit from neurobiological processes induced by physical activity. There is a growing body of research examining executive functions and physical activity but, up to date, it is still unclear which executive functions do benefit from physical activity and to which extent beneficial effects are limited to executive task components. To explore these questions, a series of experiments is being conducted. The first experiment with N=48 young adults was designed to test the effect of physical activity on inhibition and updating functions in a cross-over design. Inhibition and updating tasks were applied immediately after a short period of intense ergometer cycling or resting. The order of intervention type and executive task was counterbalanced. Physical activity enhanced inhibition performance to a greater extent than updating performance. However, performance in non-executive control tasks did not differ after physical activity and resting, respectively.

(OS\_09.2)

**Conflict adaptation during verbal response selection**

ALARIO, F.<sup>1</sup>, OSTRAND, R.<sup>2</sup>, THOEING, M.<sup>3</sup> & BURLE, B.<sup>4</sup>

<sup>1</sup>Laboratoire de Psychologie Cognitive, Aix-Marseille université & CNRS, Marseille, France, <sup>2</sup>Département of Cognitive Science, University of California, San Diego, USA, <sup>3</sup>Department of Economics, Université de Lausanne, Switzerland, <sup>4</sup>Laboratoire de Neurobiologie Cognitive, Aix-Marseille université & CNRS, Marseille, France.

Cognitive control broadly refers to our ability to adapt behavior to an evolving environment. A paradigmatic manifestation of this ability are adaptation effects in conflict resolution tasks. When participants respond to a visual stimulus carrying conflicting information (e.g. a target arrow and distracting arrows pointing in different directions), latencies are longer than in the absence of

such conflict. An adaptation (aka Gratton) effect occurs when the magnitude of the conflict effect in a given trial is modulated by the nature (conflict vs. no conflict) of the preceding trial. We set out to distinguish adaptation to conflict from effects of stimulus or response repetition, and from performance effects (i.e. auto-correlation naturally present in response time series). To do so, we resorted to a verbal Stroop task with eighth different targets and distractors, and we conducted advanced data processing at the single trial level. The results of two experiments show that adaptation occurs for current conflict trials only, in the absence of stimulus or response repetition, and that it lasts several trials. Finally, conflict induced by subliminal distractors did not result in adaptation. These results have consequences for our understanding of the control operations reflected by adaptation effects.

(OS\_09.3)

**Physical-exercise-intermezzi for improved learning**

BERSE, T.<sup>1</sup>, DUTKE, S.<sup>1</sup>, UHLENBROCK, K.<sup>2,3</sup>, VÖLKER, K.<sup>2</sup> & KNECHT, S.<sup>3</sup>, <sup>1</sup>University of Muenster, Institute of Psychology in Education, <sup>2</sup>University Hospital Muenster, Institute of Sports Medicine, <sup>3</sup>University Hospital Muenster, Department of Neurology.

Given the relevance of associative learning and executive functioning for learning, optimizing these cognitive processes is highly desirable from an educational point of view. A growing body of research in sports and neurosciences suggests that physical exercise can improve cognitive functioning. The current study investigated a sample of eighth- and ninth-grade students using a cross-over design. Performance in a set-shifting task and in an implicit associative word learning paradigm (Wernicko) was measured after a short, intense physical exercise intervention on a bicycle ergometer and a period of rest. The order of interventions was counterbalanced between participants. In contrast to previous studies, the present sample consisted of healthy high-school students, and the complete experimental procedure was run at school. Intermediate analysis of 109 participants indicated that physical exercise significantly reduced shifting costs. With respect to associative learning performance we found an interaction between type of condition and order of condition only in a subgroup of efficient learners. We concluded that short high-impact physical exercise interventions are beneficial for learning. However, the exercise effect vanished when the learning task was too difficult. Final analysis of the complete sample will be presented and discussed at the conference.

(OS\_09.4)

**Is the ability to prepare for a task impaired in old age? Evidence from a task-switching study**

LAWO, V., PHILIPP, A. M., SCHUCH, S. & KOCH, I. *RWTH Aachen University*.

A robust finding is that performance impairments in task-switching conditions (mixed-task blocks) relative to single-task conditions are larger for old adults than for young adults. Previous studies have suggested that these increased "mixing costs" are due to deficits either in the preparation of the relevant task set or to deficits in the inhibition of competing task sets. The aim of our study is therefore to examine the role of task preparation and task inhibition in the age-related increase in mixing costs.

In two experiments, using a task-cuing paradigm with three different tasks, we assessed task preparation by manipulating the cue-stimulus interval (CSI). Task inhibition was assessed by measuring n-2 task repetition costs (e.g., ABA vs. CBA task sequences), which are assumed to reflect persisting inhibition of abandoned task sets. In both experiments, we observed a smaller preparation benefit in old adults. In Experiment 1, we found larger mixing costs for old adults than for young adults. Additionally, we only found n-2 repetition costs in Experiment 2 using blocked CSIs. These costs were comparable in both age groups. Together, the data suggest that impaired task-switching performance in old age is primarily due to a deficit in task preparation.

#### (OS\_09.5)

##### **Neuroticism affects switch costs, but not inhibition in cognitive flexibility**

GADE, M.<sup>1</sup> & PAELEECKE, M.<sup>2</sup>. <sup>1</sup>*Universität Zürich, Switzerland*, <sup>2</sup>*Julius-Maximilians-Universität Würzburg, Germany*.

Personality traits are assumed to be reflected in individual differences in basic cognitive performance. Higher levels of dispositional negative emotionality, usually associated with biased processing of unpleasant stimuli, have been shown recently to be associated with increased performance in tasks affording cognitive control processes. We tested whether individual differences in switch costs and inhibition costs (measured as n-2 repetition) can be dissociated and how such differences are related to the trait Neuroticism (as measured via the NEO-PIR). Our subjects performed two experiments in randomized order: In one they did a classical task switching experiment, assessing cognitive flexibility when switching between two tasks. In the other experiment, we devised another switching experiment, this time analyzing n-2 repetition costs, i.e. comparing n-2 switches (CBA sequences) to n-2 repetitions (ABA sequences). Across both studies switch costs and inhibition costs were unrelated. So far, Neuroticism was associated with reduced switch costs, whereby correlations were absent and even reversed for our inhibitory measure. Beneath suggesting the value of personality traits to account for performance of basic cognitive functions, personality traits as assessed via a standardized questionnaire can also be used to answer ongoing cognitive theorizing.

· Attention ·  
OS\_10, Room 3

#### (OS\_10.1)

##### **Inhibition of return with endogenous cueing of low-level saliency-based processes**

SOETENS, E., HENDERICKX, D., MAETENS, K. & DEROST, N. *Cognitive Psychology, Vrije Universiteit Brussel (VUB), Brussels, Belgium*.

People are faster at detecting a visual target when it appears at a cued, as compared to an uncued location. With exogenous cues, a reversal of this cost-benefit pattern generally occurs when the cue-target interval exceeds approximately 250 ms. This pattern is known as 'Inhibition of Return' (IOR), and is usually not obtained with endogenous cues. We suggest that no IOR is found with endogenous cues, because most volitional attention shifts act upon higher processing levels, while the IOR-

mechanism acts only upon bottom-up saliency-based orienting processes. To demonstrate this, participants had to orient to one out of two differently coloured peripheral cues, indicated by a (preceding) central cue. With this method, endogenous orienting could act upon low-level saliency processes when participants had sufficient time between central and peripheral cues. In all experiments, IOR was observed in the split cue conditions. When central and peripheral cues were presented simultaneously, or when the central cue followed the peripheral cues, no IOR was found. These results suggest that the use of saliency-based processes in endogenous (or exogenous) orienting is a prerequisite for the appearance of IOR.

#### (OS\_10.2)

##### **Modality dependent central processing: Implications for parallel processing of two tasks**

GOETHE, K.<sup>1</sup> & OBERAUER, K.<sup>2</sup>. <sup>1</sup>*Department of Psychology, University of Potsdam, Potsdam, Germany*, <sup>2</sup>*Department of Psychology, University of Zurich, Zurich, Switzerland*.

In two experiments we examined whether dual-task costs were influenced by the content specific characteristics of two tasks. Four groups practiced two tasks which differed across groups with respect to their modality pairings. Modality pairings increased or decreased representational overlap across tasks. The results clearly showed that the effects of representational overlap on dual-task costs were higher than one would predict according to their effects on single-task performance. Moreover, for two groups with low representational overlap dual-task costs vanished after practice. This strongly supports the view that a qualitative switch in processing from serial to parallel was realized for these task combinations. The observed effects cannot be explained by dual-task theories assuming response selection to be amodal or sequential for two tasks. We postulate that the manipulation of representational overlap has influenced the amount of crosstalk between the tasks at the stage of response selection with low crosstalk promoting parallel processing after practice.

#### (OS\_10.3)

##### **Understanding the allocation of attention when faced with varying perceptual load in partial report: a computational approach**

KYLLINGSBÆK, S.<sup>1</sup>, SY, J. L.<sup>2</sup> & GIESBRECHT, B.<sup>2</sup>. <sup>1</sup>*Department of Psychology, University of Copenhagen*, <sup>2</sup>*Department of Psychology, University of California, Santa Barbara*.

The allocation of visual processing capacity is a key topic in studies and theories of visual attention. The Load Theory of Lavie (1995) has proposed that allocation happens in two stages where processing resources are first allocated to task-relevant stimuli and secondly remaining capacity 'spills over' to task-irrelevant distractors. In contrast, the Theory of Visual Attention (TVA) by Bundesen (1990) assumes that allocation happens in a single step where processing capacity is allocated to all stimuli, both task-relevant as well as task-irrelevant, in proportion to their relative attentional weight. Here we present data from two partial report experiments where we varied the number and discriminability of the task-irrelevant stimuli (Experiment 1) and perceptual load

(Experiment 2). The TVA fitted the data of the two experiments well thus favoring the simple explanation with a single stage of capacity allocation. We also show that the effects of varying perceptual load can only be explained by a combined effect of allocation of processing capacity as well as limits in visual working memory. Finally, we link the results to processing capacity understood at the neural level based on the Neural Theory of Visual Attention by Bundesen, Habekost, & Kyllingsbæk (2005).

#### (OS\_10.4)

##### **Effects of visible and masked arrow cues on visual attention**

REUSS, H., KIESEL, A., POHL, C. & KUNDE, W. *Julius-Maximilians-Universität Würzburg, Institute of Psychology III.*

Laterally presented masked spatial cues have been shown to capture attention only when they fit current top-down settings (top-down contingent capture). We investigated if the impact of centrally presented masked cues likewise depends on one's intentions. To this end, we conducted two spatial cuing experiments. In both experiments, a central arrow cue that was either masked or visible (varied randomly on a trial-by-trial basis) was presented in each trial, pointing to the left or to the right. The target stimulus then appeared either at the cued or at the non-cued location. Participants responded to the identity of the target. In Experiment 1, the cues were not predictive of the target's location. With visible cues, participants responded faster after valid than after invalid cues. There was no validity effect, however, with masked cues. In Experiment 2, the cues predicted the actual target location in 80% of the trials. Here, participants responded faster after valid than after invalid cues both with visible and with masked cues. In contrast to Experiment 1, masked cues impacted on attention, presumably because participants intended to use the cues due to their higher validity. Masked arrow cues therefore impact on attention in a top-down contingent way.

#### (OS\_10.5)

##### **The functioning of alerting, orienting, and executive control networks under sleep deprivation**

MARTELLA, D.<sup>1, 2</sup>, ROCA, J.<sup>3</sup>, MAROTTA, A.<sup>3</sup>, LÓPEZ-RAMÓN, M.<sup>3</sup>, CASTRO, C.<sup>3</sup>, LUPIÁÑEZ, J.<sup>3</sup> & FUENTES, L. J.<sup>2</sup>. <sup>1</sup>*Basque Center on Cognition, Brain and Language (BCBL). Donostia. Spain,* <sup>2</sup>*Dpto. de Psicología Básica y Metodología, Facultad de Psicología, Universidad de Murcia, Murcia, Spain,* <sup>3</sup>*Dpto. de Psicología Experimental y Fisiología del Comportamiento, Universidad de Granada, Campus Universitario Cartuja, Granada Spain.*

This study aims to assess the effects of sleep deprivation (SD) on attention performance. Specifically, we analyse the effect of presenting infrequent and unpredictable stimuli at the same time of measuring the functioning of the three attentional networks, under sleep-deprivation and not-sleep deprivation conditions, by means of the ANTI-Vigilance (ANTI-V). Thus, measures of tonic and phasic alertness, orienting, and executive control were obtained. A sleep deprivation has been conducted with two main objectives: a) Provide further evidence of the validity of the ANTI-V as an effective measure of vigilance, and b) Analyze the effects of SD on the three attentional functions. Twenty-five participants completed

the ANTI-V on two sessions: first, on a morning after an usual sleep time and, again, after a 24h SD. Results revealed that the participants were slower and committed more errors after SD. Also, they were less able to detect the infrequent stimuli and their sensitivity ( $d'$ ) was decreased. The phasic alertness score was diminished, while the orienting and executive control obtained similar scores in both sessions. These data suggest that the ANTI-V is effectively reflecting the vigilance performance. Also, some interesting differences from previous studies in the attentional functioning after sleep deprivation have been found.

· Spatial cognition ·  
OS\_11, Room 5

#### (OS\_11.1)

##### **The flexibility of spatial mental models: How perspectives and format of presentation interact**

GYSELINCK, V.<sup>1</sup>, PICUCCI, L.<sup>2</sup> & BOSCO, A.1. <sup>1</sup>*LPNCog, Université Paris Descartes, CNRS, Boulogne-Billancourt, France,* <sup>2</sup>*University degli Studi di Bari, Bari, Italy.*

One of the trends of research to explore the nature of our spatial representations is to examine the extend to which they are dependant on the source through which spatial information is acquired. Another related way is to examine the extend to which these spatial representations maintain the perspective in which spatial information was provided. In this study, young adults were assigned to one of the four learning conditions: a tour across a virtual city (visual-route), the verbal description of the navigated environment (verbal-route), the map study (visual-survey) and the verbal description of the map comprising cardinal coordinates (verbal-survey). Results on a statement verification task showed that when spatial information was acquired through a verbal presentation, performance on switched perspective statements was particularly weakened in the route perspective learning condition compared to the survey perspective. In addition, results on a sketch map showed that positioning landmarks was more difficult for participants engaged in a route perspective via a verbal description. When spatial information was provided adopting a survey perspective, locations were correctly reported regardless the format of presentation. These results suggest that the condition under which a spatial representation is perspective-free depends also on the learning format.

#### (OS\_11.2)

##### **Implication of verbal and visuo-spatial working memory in a route representation from a virtual environment**

DORIANNE, G., PERRUSSEL, M. & GYSELINCK, V. *Laboratoire de Psychologie et Neuropsychologie Cognitives. Université Paris Descartes. Boulogne-Billancourt, France.*

That research investigated the role of verbal and visuo-spatial working memory (WM) on spatial representation building using a dual-task paradigm. Subjects saw movies of routes in virtual environments while performing a spatial tapping task (spatial condition), an articulatory task (verbal condition), or no task (control condition). Then, subjects had to draw the itinerary on a map (route drawing), recognize which building among two was part of the movie (visual recognition task), and place the buildings on a map (spatial location task). WM capacities

were measured with the Corsi Blocks test (spatial), the digit span test (verbal), and participants took the Mental Rotation Test (MRT). Results show that accuracy was impaired in the spatial and verbal concurrent conditions compared to the control condition for route drawing and location tasks, but not for visual recognition. Moreover, subjects with the higher spatial capacities (higher score to Corsi and MRT) were more affected by tapping than others. These results show that verbal WM is involved in the construction of a spatial representation, even when only visual information is used both at learning and test. They also suggest that participants rely on their spatial WM, especially when their capacities are high.

#### (OS\_11.3)

##### **How the conversational partner affects spatial memory and spatial descriptions**

GALATI, A., MICHAEL, C., GREENAUER, N., MELLO, C. & AVRAAMIDES, M. *University of Cyprus*.

Does advance knowledge about a partner's perspective affect how people remember and describe spatial information? 18 Directors learned arrays of objects while: (1) not knowing about having to describe the array to a Matcher, (2) knowing about the subsequent description, and (3) knowing the Matcher's subsequent viewpoint, which was offset by 90°, 135°, or 180°. In memory tests preceding descriptions, Directors were faster to recall objects from perspectives aligned with their own. Additionally, knowing that Matchers would be offset by 90° or 135°, led to slower orienting to these perspectives. Although Directors showed overriding preferences for the perspective of their descriptions, knowing the Matchers' viewpoint led to consistent switches in perspectives—more Director-centered expressions for 135° and more Matcher-centered at orthogonal offsets. These findings suggest that advance information about the partner's perspective is incorporated in spatial memory and enables communicating partners to coordinate flexibly the perspective of their descriptions.

#### (OS\_11.4)

##### **The relation between body semantics and spatial body representations**

VAN ELK, M. & BLANKE, O. *École Polytechnique Fédérale de Lausanne, Laboratory of Cognitive Neuroscience, Lausanne, Switzerland*.

Several studies indicate that body semantics, i.e. semantic knowledge about the human body, comprises a distinct conceptual category. The present study addressed the relation between body semantics and spatial body representations, by presenting participants with word pairs, one below the other, referring to body parts. In the first experiment it was found that subjects responded faster to word pairs that were in a congruent (e.g. EYE / MOUTH) compared to an incongruent (e.g. MOUTH / EYE) spatial position. In addition, a body distance effect was observed, reflected in a decrease in reaction times for word pairs referring to body parts that are further apart (e.g. MOUTH / FOOT) compared to body parts that are close in space (e.g. MOUTH / EYE). In two follow-up studies we found that these effects did not occur during a semantic categorization task and were not modulated by the visual field to which the words were presented. Thereby the present study shows that only when asked

to judge the spatial congruency of words referring to body parts, subjects implicitly activate veridical information about the relative distance between body parts. We discuss these new data with respect to theories of embodied cognition and body semantics.

#### (OS\_11.5)

##### **The influence of stereoscopy in Virtual Environments for metric and non metric distances estimates**

SARACINI, C.<sup>1</sup>, BLUEMEL, E.<sup>2</sup> & OLIVETTI BELARDINELLI, M.<sup>1,3</sup>. <sup>1</sup>*Interuniversity Centre for Research on Cognitive Processing in Natural and Artificial Systems (ECONA), Rome, Italy*, <sup>2</sup>*Fraunhofer Institute for Factory Operation and Automation IFF, Magdeburg, Germany*, <sup>3</sup>*Department of Psychology, Sapienza University of Rome, Italy*.

Few work has been done to verify if the use of stereoscopy in a Virtual Environment simulate well, or well enough, the human vision's processes and if it allows a satisfactory mental spatial representation of the surrounding space, with reference to reciprocal distances between objects and depth perception. In our study, we tested a distances estimates task on the same huge screen (Engineers Workstation), with and without stereoscopy. The results showed that a) the presence of stereoscopy didn't help in having a precise estimate of metric ego and allocentric distances of objects, but b) if the modality of the answer changes from metric to non-metric, the tendency is to respond more correctly in the stereoscopy condition; c) women do worse than men, especially within the stereoscopy condition; d) independently from the modality of the estimates, women perform better without stereoscopy, while men get better results with it. This allow us to claim that there is a difference between the artificial stereoscopy in VR and the natural binocular disparity, as it's known from literature that monocular view reduce dramatically the human ability for distances estimates in real environments. These results are therefore discussed in terms of gender differences and cognitive styles.

#### • Orthographic processing • OS\_12, Room 2

#### (OS\_12.1)

##### **An ERP investigation of location-specific and location-independent orthographic priming**

KTORI, M.<sup>1,2</sup>, GRAINGER, J.<sup>1,2</sup>, DUFAU, S.<sup>1,2</sup> & HOLCOMB, P. J.<sup>3</sup>. <sup>1</sup>*CNRS, France*, <sup>2</sup>*Laboratoire de Psychologie Cognitive (LPC), Aix-Marseille University, Marseille, France*, <sup>3</sup>*Department of Psychology, Tufts University, Medford, Massachusetts, U.S.A.*

The present study used event-related potentials (ERPs) to examine the time-course of location-specific and location-independent orthographic priming. In a masked sandwich priming experiment, changes in the relative positions of letters in prime and target stimuli combined with shifts of prime location relative to target location were manipulated. In particular, relative-position primes formed by concatenated subsets of the target stimuli (e.g., 'grdn/GARDEN') and absolute-position primes formed by hyphenated equivalent subsets (e.g., 'g-rd-n/GARDEN') were presented either centrally or displaced by two letter positions to the right or to the left (targets were always central). ERP waveforms were modulated starting at around 100 ms post-target onset and ex-

tending into the N400 component. Early priming effects were seen between 100-200 ms post-target onset, where priming effects were only apparent with centrally presented hyphenated primes. By 200-300 ms post-target onset, priming effects were present for both concatenated and hyphenated primes, with the latter still showing sensitivity to prime location. Finally, on N400 amplitude, both prime types revealed priming of similar size and scalp distribution independently of prime location. These results are consistent with an early activation of location-specific letter detectors, between 100 and 200 ms after stimulus onset, that subsequently map onto location-independent orthographic representations.

#### (OS\_12.2)

##### **Orthographic knowledge affects the processing of unattended spoken words: mismatch negativity evidence**

PATTAMADILOK, C.<sup>1</sup>, COLIN, C.<sup>1</sup>, MORAIS, J.<sup>1</sup> & KOLINSKY, R.<sup>1,2</sup>. <sup>1</sup>*Université Libre de Bruxelles, Belgium*, <sup>2</sup>*Fonds de la Recherche Scientifique-FNRS, Belgium*.

Behavioral and brain-imaging studies demonstrated the influence of orthographic knowledge on active and high-level speech processing tasks even when written words are not presented. No studies, however, have successfully shown that such influence could be observed at a very low processing level: when speech is unattended. Here, the Mismatch Negativity, a specific ERP component that is an automatic index of experience-dependent auditory memory traces, was used to investigate this issue. An "odd-ball" sequence of acoustic stimuli containing a frequent-standard word /tRi/-"TRI", an orthographically congruent infrequent-deviant word, /kRi/-"CRI", and an orthographically incongruent infrequent-deviant word, /pRi/-"PRIX", was presented to 14 participants in a passive listening situation where participants watched silent movies and ignored the auditory stimuli. Both deviant words elicited a typical MMN over the fronto-central regions, reflecting automatic discrimination of standard and deviant stimuli. Most interestingly, the MMN elicited by the orthographically incongruent deviant word showed higher peak and mean amplitude than the one elicited by the orthographically congruent deviant word. We concluded that orthographic knowledge qualitatively changes the nature of spoken words. Once reading is acquired, the "phonological" representations might become "phonographic" representations. The implication of this observation on the architecture of the speech processing models will be discussed.

#### (OS\_12.3)

##### **How does reading experience shape letter processing? Behavioral and electrophysiological evidence from preschoolers and novel readers**

DIMITROPOULOU, M.<sup>1, 2, 3</sup>, CARREIRAS, M.<sup>1, 4, 5</sup> & DUÑABEITIA, J. A.<sup>1</sup>. <sup>1</sup>*Basque Center on Cognition, Brain and Language, BCBL, Donostia, Spain*, <sup>2</sup>*Project awarded with the 2010 Early Career Stimulus Award, ESCoP*, <sup>3</sup>*Facultad de Psicología, Universidad de La Laguna, Tenerife, Spain*, <sup>4</sup>*University of the Basque Country, Bilbao, Spain*, <sup>5</sup>*IKERBASQUE, Basque Foundation for Science, Bilbao, Spain*.

Reading acquisition depends on accurate letter identification. Studies testing experienced readers have identified two discrete stages of letter processing: featural

decomposition (enabling the discrimination of similar-looking letters; e.g., c-o) and abstract letter identity assignment (enabling the assignment of the same identity to visually dissimilar graphemes; e.g., A-a). By combining behavioral and ERP measures we investigated how processes underlying letter perception are modified by exposure to print during the initial phases of reading. Pre-readers, with knowledge of the letters, and first-graders, with regular exposure to print, performed same/different judgments on letter-pairs. Behavioral results showed that both pre-readers and first-graders tended to judge as identical letter-pairs differing by one-similar looking same-case letter (e.g., za-ze) as well as pairs only differing by an upper and a lowercase version of the same letter (e.g., za-zA). However, the cost for the latter pairs was significantly greater for first-graders than for pre-readers, suggesting that letter identities become automatically activated as a function of increased exposure. ERPs closely mimicked the pattern of behavioral effects, showing larger waveform differences for first-graders than for pre-readers with the latter pairs. These findings support a cognitive shift in letter processing induced by reading experience at the earliest stages of reading acquisition.

#### (OS\_12.4)

##### **Orthographic learning during reading: The role of whole-word visual processing**

BOSSE, M.<sup>1</sup>, CHAVES, N.<sup>2</sup> & LARGY, P.<sup>2</sup>. <sup>1</sup>*LPNC, Lab. of Psychology and Neuro Cognition, University Pierre Mendès-France, Grenoble France*, <sup>2</sup>*LPDPS, Lab. of Developmental Psychology and Socialisation Processes, University Toulouse le Mirail, Toulouse France*.

The self teaching hypothesis suggests that most knowledge about the orthographic structure of words is acquired incidentally during reading through phonological recoding. The current study assessed whether visual processing skills during reading further contribute to orthographic learning. French children were asked to read pseudo-words, in a context of stories. The whole pseudo-word letter-string was available at once for half of the targets and the pseudo-word's sublexical units were discovered in turn for the other half. Presentation time and total time of processing were controlled. The memorisation of target orthographic forms was assessed immediately after reading or seven days after. Results showed that more orthographic learning occurred when pseudo-words have been seen in their whole. The whole-word presentation effect was significant whatever the delay between reading and orthographic restitution. This effect depended on neither target reading accuracy nor target reading speed during the reading phase. Moreover, analyses revealed that orthographic learning was independent of presentation time. Beyond recoding skills, the ability to process the entire orthographic letter string at once during reading appears as a significant factor of efficient orthographic learning. This new finding opens the way for a better understanding of the visual-orthographic factor in the self-teaching hypothesis.

**(OS\_12.5)****Consistency effects in visual lexical decision task: Influence of item's presentation**

PETROVA, A. & GASKELL, G. *University of York, UK.*

Several studies carried out using the lexical decision task suggest that words with consistent (one-to-one) phonology-to-spelling mappings are easier to recognise than inconsistent words (one-to-several mapping). However, these effects appear less reliable in the visual than the auditory modality. This pattern of results could indicate a qualitative difference between the recognition systems, but alternative possibilities rely on differences in informational availability between modalities. The current study addressed the latter explanation using a range of different procedures and a set of items that did not show consistency effects in the classic version of the task. We found phonology-to-spelling consistency effects in visual lexical decision task using three different item presentation methods: Experiment 1 used a short item presentation duration (100 ms), Experiment 2 used letter-by-letter presentation and Experiment 3 used presentation with visual noise. This study suggests that interactions between phonology and spelling are present not only in the auditory modality but also in the visual modality. Consistency effects may be observable easily in visual word recognition only in noisier conditions that make the recognition process more similar to auditory processing. Importantly, our results also suggest that the underlying substrates for spoken and visual word recognition operate in broadly comparable ways.

• Face recognition •

OS\_13 (13.1-13.2), Room 1

OS\_13\* (13.3-13.4), Room 1

**(OS\_13.1)****Temporal integration of faces learned from view sequences and recognition of novel views**

ARNOLD, G. & SIÉROFF, E. *Institut de Psychologie, Université Paris Descartes, CNRS, FRANCE.*

When faces are learned from rotating view sequences, novel views may be recognized by matching with multiple discrete views, or with an integrated representation of the sequence. A view-matching process should benefit from long view durations, allowing the attention to sequentially focus on each view during the encoding of the sequence. Conversely, an integrated-representation process should benefit from short view durations, allowing the distribution of attention over the entire sequence in a short temporal window. In a sequential comparison task, we tested the recognition of novel interpolated and extrapolated views after learning faces from rapid (240 ms for each view) and slow sequences (960 ms for each view). In a first experiment, recognition was tested with internal views (learned and interpolated). In a second experiment, recognition was tested with internal and extrapolated views. Results showed a global superiority of rapid over slow sequences, in favour of the integrated-representation hypothesis. In addition, the recognition pattern for the different viewpoints in the sequence depended on the absence (Experiment 1) or presence (Experiment 2) of extrapolated test views. The presence of extrapolated views affects the global representation of the face, modifying the "centre of gravity" of the representation.

**(OS\_13.2)****Early perceptual processing of facial expression is independent of task demands: an event-related potentials study**

AGUADO, L., VALDES-CONROY, B. & FERNANDEZ-CAHILL, M. *Universidad Complutense de Madrid.*

Extensive previous evidence from event-related potential (ERP) studies has shown that early components sensitive to visual encoding of faces are modulated by their emotional expression, suggesting that affective relevance influences perceptual processing since the earliest stages of information analysis. In this study we looked at the influence of differences in task demand on these modulations. Happy, angry and expressively neutral faces were presented under three different task conditions, 1) emotion discrimination (emotional vs non-emotional), 2) gender discrimination and 3) irrelevant task (discriminating two symbols placed over the nose region). Supporting previous work we found significant modulations due to emotional expression on the P100, N170 and EPN (early posterior negativity) components, detected over posterior regions. A right-lateralized, late positive component (LPC), detected over posterior regions around 400 ms after stimulus onset, appeared to be sensitive only to task demands, with larger amplitudes for the emotion discrimination task. A lack of interactions between emotional expression and task demands suggests that the influence of facial expression on perceptual processing takes place regardless of the explicit orientation to the affective meaning of faces. Supported by grant PSI2010\_18682, of the Ministerio de Ciencia e Innovación (Spain).

**(OS\_13.3)****Brain and language acquisition research: Construction of recursive exercises for non verbal communication devices**

LOWENTHAL, F.<sup>1</sup>, FORTEMPS, P.<sup>2</sup> & WAUTIE, V.<sup>1,2</sup>.

<sup>1</sup>Cognitive Sciences, University of Mons, Mons (BE),

<sup>2</sup>Mathematics and Operational Research, University of Mons, Mons (BE).

One of us (FL) has shown that Non-Verbal Communication Devices approaches (NVCDs) favor both the acquisition and the reacquisition of language skills (Lowenthal & Saerens, 1986). Lefebvre et al. (2007) have shown that these approaches favor the emergence of new cerebral abilities. Lowenthal (2007) formulate the hypothesis that these results are essentially associated to the use of recursive exercises in an NVCD approach. In order to test this hypothesis, the authors want to use finite automata enabling the subject to discover the regularity of the sequence of exits: they want to use in parallel non recursive, partially recursive and fully recursive exercises in three different but equivalent groups. This requires the construction of equivalent exercises of different types: clearly recursive, partially recursive and totally non recursive. For the researcher, the creation of such exercises is an arduous task. In this paper we describe a systematic and algorithmic approach for constructing such exercises. We will present a software adapted for these constructions. The intended experimental setting will also be discussed.

**(OS\_13.4)****Congruency of cue and task transitions in task switching**

VANDIERENDONCK, A.<sup>1</sup> & LIEFOOGHE, B.<sup>2</sup>. <sup>1</sup>*Department of Experimental Psychology. Ghent University. Ghent, Belgium,* <sup>2</sup>*Department of Experimental-Clinical and Health Psychology. Ghent University. Ghent, Belgium.*

Previous research regarding the role of congruency of cue and task transitions in task switching has shown that in transition cuing with registration of cue interpretation besides task execution (double registration) reports a cue-task congruency effect in cue interpretation. By varying type and modality of the indication response, the present study aimed to clarify whether the cue-task congruency effect depends on procedural features. In two transition cuing experiments with double registration, the cue interpretation response was either a choice response indicating the task or a simple response indicating when the to-be-performed task is known. Experiment 1 used manual indication responses and observed a congruency effect that occurred in the indication response for the choice-response condition and in the execution response for the simple-response condition with an overall delay of execution responding. Experiment 2 used verbal indication responses and found the same pattern of results, with smaller but still robust congruency effects and no execution delay in the simple-response condition. The findings confirm that the congruency effect is a genuine part of task switching but that it can be augmented by overlaps between the indication and the execution response. Implications for our understanding of task switching more generally are discussed.



**ORAL SESSIONS**  
**Saturday Morning**

OS\_14\*: 08:30-08:50

OS\_14: 08:30-10:30

OS\_15-OS\_21: 10:50-11:50

**OS\_14\*, Room 1, beginning of SY\_10**

**Insights into response capture and inhibition with Transcranial magnetic stimulation**

VAN CAMPEN, D., VAN DEN WILDENBERG, W. P. & RIDDERINKHOF, K. R. *University of Amsterdam.*

Selective inhibitory control when selecting between two actions is an important aspect of goal-directed behavior. In the Simon task, participants respond to a relevant feature (color) while ignoring an irrelevant feature (location). The goal of the experiments is to link behavioral indices of top-down suppression of involuntary response impulses and response capture with physiological markers. In two experiments we collected data with single pulse and repetitive Transcranial Magnetic Stimulation (spTMS and rTMS). Behavioral data was assessed in all experiments, using RT distribution analyses and conditional accuracy functions (CAF). In the first experiment spTMS is applied over motor cortex at different timing moments to link behavioral inhibition with physiological markers and to track its time course. In the second experiment 1hz offline rTMS was applied over the pre-supplementary motor area (pre-SMA) and right inferior frontal gyrus (rIFG) to interfere with the function of the two cortical areas. The spTMS results showed an early increase in M1 activation indicative of response capture, followed by cortical inhibition on correct interference trials. Preliminary data from the rTMS-experiment point to more partial errors after pre-SMA stimulation, indicating impaired response selection. Secondly, rIFG stimulation seems to enhance interference effects, suggesting impaired selective suppression of irrelevant information.

**· Auditory perception and Multisensory integration ·**  
**OS\_14, Room 6**

**(OS\_14.1)**

**Auditory spatial negative priming: Are responses to irrelevant sound locations suppressed?**

MAYR, S., MÖLLER, M. & BUCHNER, A. *Heinrich-Heine-University Düsseldorf.*

The visuospatial negative priming effect—that is, the slowed-down responding to a previously ignored location—is partly due to response inhibition associated with the previously ignored location. We tested whether response inhibition underlies spatial negative priming in the auditory modality as well. 78 participants localized a target sound while ignoring a simultaneous distractor sound at another location. Sounds were presented from one of 8 locations arranged in a semicircle around the participant. Pairs of adjacent locations were associated with the same response. In location-repeated trials, the probe target sound was played from the same location as the previously ignored prime sound. In response-repeated trials, prime distractor and probe target were played from different locations but were associated with the same response. In control trials, prime distractor and probe target neither shared location nor response. A response inhibition account predicts slowed-down res-

ponding when the response associated with the prime distractor has to be executed in the probe. There was no evidence of response inhibition in audition. Instead, negative priming depended on whether the sound at the repeatedly occupied location changed identity between prime and probe. This latter result replicates earlier findings and supports the feature-mismatch hypothesis.

**(OS\_14.2)**

**Vision and audition in space and time: Crossmodal interference in switching stimulus modalities**

LUKAS, S.<sup>1,2</sup>, PHILIPP, A. M.<sup>2</sup> & KOCH, I.<sup>2</sup> <sup>1</sup>*General Psychology, Ulm University, Ulm, Germany,* <sup>2</sup>*Cognitive and Experimental Psychology, RWTH Aachen, Aachen, Germany.*

Often, a visual stimulus can be processed faster than an accompanying stimulus in another modality. This effect is called visual dominance. The modality appropriateness hypothesis (cf. Freides, 1974) explains this effect in stating that stimuli in different modalities are differently effectively processed depending on the dimension in which they are situated. For example, perception and processing of visual stimuli work best in the dimension of space, whereas in the dimension of time auditory stimuli are favored. In earlier studies, we already showed a clear benefit for visual stimuli in a modality-switch situation. In these studies subjects were required to make a spatial decision of the stimulus in the relevant modality. We found that for visual stimuli, RT and interference effects were smaller than for auditory stimuli. In the present study, we examined the assumption that this benefit should be reduced or even reversed in a timely task. Subjects were now required to fulfill a timely task. We found indeed that RT did not differ anymore in this setting. The interference effect was even reversed. We discuss our findings with respect of the modality-appropriateness hypothesis, as well as the hypothesis of directed attention (e.g., Posner, Nissen, & Klein, 1976).

**(OS\_14.3)**

**Evidence for a dual vs single origin of the Mismatch Negativity (MMN)**

COLIN, C.<sup>1</sup>, HOONHORST, I.<sup>1</sup>, MARKESSIS, E.<sup>2</sup>, COLLET, G.<sup>1,3</sup>, PABLOS MARTIN, X.<sup>1</sup> & DELTENRE, P.<sup>1</sup> <sup>1</sup>*Free University of Brussels (ULB), Belgium,* <sup>2</sup>*Institut Libre Marie Haps, Brussels, Belgium,* <sup>3</sup>*FNRS Belgium.*

This study was designed to test separately the effect of the featured/featureless nature of deviant stimuli and that of temporal distance between sound and deviance onsets on the Mismatch Negativity (MMN) as well as to look for discrepancies between behavioral discrimination performances and MMN amplitude when deviants are featureless. Ten healthy adults were submitted to stimuli that were contrasted by the presence or absence of a frequency sweep with an onset positioned early or late within the sound. Discrimination performances were collected after the electrophysiological sessions. MMNs were much larger for featured than for featureless deviants. The temporal distance between sound and deviance onset affected featureless deviants strongly, abolishing the MMN when deviance occurred later in the stimulus. Behavioral data were at ceiling levels for all conditions, contrasting with the absence of MMN in the featureless / late onset condition. We propose that two mechanisms contribute to the MMN evoked by featured

deviants: the memory comparison process and the adaptation/fresh-afferent one, the former being more sensitive to deviance onset within the Temporal Window of Integration than the latter. These results suggest that the two putative mechanisms of MMN elicitation are not mutually exclusive and can combine to yield composite MMNs.

#### (OS\_14.4)

##### **Impulsiveness dissociates in early deaf individuals: modality specific reactivity enhancement and amodal, poor sensitivity in temporal discrimination**

HEIMLER, B.<sup>1</sup> & PAVANI, F.<sup>1, 2</sup>. <sup>1</sup>*Center for Mind/Brain Sciences, University of Trento, Italy,* <sup>2</sup>*Department of Cognitive Science and Education, University of Trento, Italy.*

Reactivity enhancement has been repeatedly observed in deaf compared to hearing individuals through visual simple detection tasks, but it remains unknown whether these effects extend to other intact sensory modalities. Deaf also proved worse than hearing individuals on tactile temporal discrimination, but this ability has never been investigated in vision. It is thus unclear whether these differences are modality specific or amodal. Eight early deaf (loss > 70dB) and twelve hearing participants performed a simple detection or a temporal discrimination task. Stimuli were either tactile or visual, and they occurred at central or peripheral locations (vision: 1° and 32°; touch: forefinger, forearm, neck). Simple detection revealed a clear modality specific effect in deaf individuals: reactivity enhancement emerged selectively for vision, with no anticipation responses and regardless of stimulus eccentricity. By contrast, temporal discrimination revealed an amodal effect in deaf individuals, with poor sensitivity for both modalities and a clear speed-accuracy trade-off. The modality specific effect excludes a role for motivational and motor preparation factors in enhanced reactivity to visual events, suggesting instead a role of perceptual and attentional processes. The amodal finding reveals, however, that impulsiveness may indeed characterise deaf performance, particularly when a difficult perceptual discrimination is required.

#### (OS\_14.5)

##### **Audio-Visual integration in children with Cochlear implant**

LEYBAERT, J.<sup>1</sup>, BERTHOMMIER, F.<sup>2</sup> & HUYSE, A.<sup>1</sup>. <sup>1</sup>*Université libre de Bruxelles,* <sup>2</sup>*Gipsa-Lab.*

The study aimed to test whether audio-visual speech integration in cochlear-implemented (CI) children and in normally hearing children exposed to degraded auditory stimuli is impacted by the degradation of the visual speech information. A group of 31 children with CI and a group of 31 normally hearing children (who received spectrally reduced speech), matched for chronological age, performed a syllable identification task where stimuli were presented randomly in auditory only (AO), visual only (VO) and audiovisual (AV) (congruent and incongruent McGurk stimuli). The visual speech cue was normal in half of the experiment, and degraded in the other half. Results show that performances in VO and in congruent AV modalities were decreased in visual reduction, showing that our technique was efficient at degrading lip-reading. Visual reduction also led to a major increase of auditory-based responses to McGurk stimuli

in hearing as well as in deaf children, and this increase of auditory responses was larger in children who were proficient in the use of their implant. The increase of the weight of audition, including in cochlear-implemented children whose perception is generally dominated by vision, suggests that the natural imbalance in favour of vision is not immutable.

#### (OS\_14.6)

##### **To see and hear a word, we inefficiently combine features but efficiently combine streams**

DUBOIS, M.<sup>1, 2</sup>, POEPEL, D.<sup>2</sup> & PELLI, D. G.<sup>2</sup>. <sup>1</sup>*Laboratoire Cognition, Langage et Développement, Université Libre de Bruxelles, Brussels, Belgium,* <sup>2</sup>*Psychology and Neural Science, New York University, New York, USA.*

To recognize an object, we detect and bind the features it is made of. We also merge information across the senses into a coherent percept of our external environment. In general, how well do we combine information from several sources, be they features, cues, or sensory modalities? Building on the classic efficiency approach, here we introduce a "relative efficiency" paradigm to assess binding. We measure the energy threshold as a function of object extent (a word) or for a combination as opposed to each component alone (audio and visual). Efficient binding has a fixed energy threshold, independent of length or distribution among modalities. Inefficient binding requires more energy as length or number of modalities increases. Our results reveal an amazing dichotomy. Energy is integrated inefficiently within each modality: Observers need more energy to recognize longer words, whether seen or heard. However, text and speech summate perfectly: Observers require the same overall energy, irrespective of its distribution across eye and ear. Thus, to see and hear a word, we inefficiently combine features but efficiently combine streams.

#### · Working memory ·

##### OS\_15, Room 6

#### (OS\_15.1)

##### **Word-frequency effect on working memory task**

CAMOS, V.<sup>1</sup> & MORA, G.<sup>2</sup>. <sup>1</sup>*Université de Fribourg,* <sup>2</sup>*Université de Bourgogne.*

Many studies have shown an advantage for high-frequency words in various language and memory tasks. Surprisingly, only one study reported a word-frequency effect in a working memory task (Engle et al., 1990). In the present study, we evaluated the word-frequency effect in complex span task in which the pace of a concurrent task was manipulated. By slowing down the pace of a location judgement task, attention could be switched to maintenance activities for a longer time and recall should be better (Barrouillet et al., 2007). As already reported in immediate serial recall tasks, the advantage for recalling high-frequency words increased across serial positions. This finding is congruent with the redintegration hypothesis, which stated that long-term knowledge helps at reconstructing degraded memory traces at recall (Hulme et al., 1997). Although the pace effect was replicated, it did not interact neither with the word-frequency effect nor with the interaction between frequency and serial position. This pattern of results favours the idea that pace and word-frequency affect distinct steps of

processing, the maintenance during the concurrent task and the reconstruction at recall respectively.

#### (OS\_15.2)

##### **Attention modulates spatial and temporal encoding in auditory and visual working memory**

DELOGU, F., NIJBOER, T. & POSTMA, A. *Experimental Psychology, Helmholtz Institute, Utrecht University, the Netherlands.*

Information about where and when events happened seem naturally linked to each other, but only few studies have investigated if and how they become associated in working memory. We tested whether the location of item and their temporal order are jointly or independently encoded. We also verified if spatio-temporal interactions change according to the sensory modality of items. In two experiments, participants memorized sequences of five environmental sounds (exp.1) and pictures (exp.2) originating from five different locations. They were asked to recall either their position or temporal order. Attention during encoding was manipulated by contrasting blocks containing different percentages of spatial and temporal trials. Results indicate that temporal and spatial encoding is more effective when attention is focused on the target dimension. Interesting differences between modalities also emerged. In the auditory modality, while temporal order recall was linearly affected by the simultaneous encoding of item location, position recall was mostly unaffected by a concurrent memory load. In vision, the recall of both temporal and spatial information was strongly affected by attention. We conclude that temporal order and spatial encoding are conducted by separate mechanisms and that the strength of their association is modulated by the modality of the input.

#### (OS\_15.3)

##### **The role of short term consolidation in working memory updating**

KESSLER, Y. & GUY, M. *Department of Psychology, Ben-Gurion University of the Negev, Beer-Sheva, Israel.*

An updating variant of Jolicoeur & Dell'Acqua's (1998) paradigm was used to examine the role of short-term consolidation in working memory (WM) updating. In each trial, a set of letters appeared on the screen and the participants had to update their WM with the new information. The number of updated items was varied between one trial and another. After several updating trials a tone appeared, and the participants had to judge the tone pitch, and then to recall the last stimulus set that was presented. Stimulus onset interval (SOA) between the last updating trial and the tone was manipulated. Reaction times (RTs) for the tone judgment served to measure the updating duration. When the entire WM set was presented in each trial, RT for the updating conditions decreased with SOA within a given set-size, but was insensitive to the number of changed items. When only the updated items were presented in each trial, RT was sensitive both to the number of changed items and the total set-size. The results are discussed in relation to local and global WM updating processes (Kessler & Meiran, 2008), and suggest a role of short term consolidation in global updating.

#### **· Abnormal Psychology · OS\_16, Room 5**

#### (OS\_16.1)

##### **Impaired implicit sequence learning under dual task conditions in freezing of gait patients**

VANDEBOSSCHE, J.<sup>1, 2</sup>, DEROST, N.<sup>1</sup>, SOETENS, E.<sup>1</sup>, COOMANS, D.<sup>1</sup>, NIEUWBOER, A.<sup>3</sup> & KERCKHOFS, E.<sup>1, 2</sup>.  
<sup>1</sup>Cognitive Psychology, Vrije Universiteit Brussel, Brussels, Belgium, <sup>2</sup>Neurological Rehabilitation, Vrije Universiteit Brussel, Brussels, Belgium, <sup>3</sup>Rehabilitation Sciences, Katholieke Universiteit Leuven, Leuven, Belgium.

We examined whether implicit sequence learning, with or without additional working memory load, is impaired in patients with freezing of gait (FOG), a major disturbing symptom in Parkinson's disease (PD). Fourteen freezers, 14 non-freezers and 14 matched healthy controls performed a serial reaction time (SRT) task with a deterministic stimulus sequence under single (SRT-ST) and dual task (SRT-DT) conditions. The increase in reaction times for random as compared to sequenced trials was used as a measure of implicit sequence learning. Scales for Outcomes in PD-cognition (SCOPA-COG) and tests for cognitive flexibility and set shifting were used as neuropsychological measures of cognitive functioning. Only non-freezers and healthy controls showed significant implicit sequence learning effects, whereas freezers only demonstrated a tendency to learn sequence-specific information in the SRT-ST task. In the SRT-DT task, no sequence learning occurred in FOG. Set-shifting and cognitive flexibility did not correlate with SRT learning, however, scores on the revised Freezing Of Gait Questionnaire (NFOGQ), assessing the severity of FOG, correlated positively with SRT-DT task performance. These results show that implicit sequence learning under dual task conditions is impaired in freezers, and provide more insight into the mechanisms of compensation for deficient motor automaticity in FOG.

#### (OS\_16.2)

##### **A critical appraisal of neglect and pseudoneglect for the mental number line**

PRIFTIS, K.<sup>1, 2</sup>, UMILTÀ, C.<sup>1</sup> & ZORZI, M.<sup>1</sup>. <sup>1</sup>Department of General Psychology, University of Padova, Italy, <sup>2</sup>IRCCS, San Camillo Hospital, Lido-Venice, Italy.

We aim to provide a critical overview of the evidence that links spatial representation with the representation of number magnitude. This aim is achieved by reviewing critically the literature concerning the mental number interval bisection and related tasks in patients with left hemispatial neglect and in healthy participants (pseudoneglect). Finally, we shall consider some alternative, non-spatial explanations of the reviewed effects. We conclude that evidence from neglect and pseudoneglect might constitute the strongest evidence in favour of a left-to-right oriented mental number line for representing number magnitude in the human brain.

#### (OS\_16.3)

##### **The visuospatial imagery of sequence-space synaesthesia**

PRICE, M. *University of Bergen, Psychology Faculty.*

A large minority of people report experiencing certain ordinal sequences such as numbers or calendar units as arranged in precise visuospatial layouts in imaginal or

peripersonal space. The phenomenon has been described since the time of Galton at the end of the 19th century but recent years have seen a steady increase in experimental studies of these experiences. Most of this research has considered these so-called spatial forms as a variety of synaesthesia (sequence-space synaesthesia), noting many aspects of the experiences that conform to standard criteria of synaesthesia. However there are several respects in which spatial forms might be better thought of as overlearned visuospatial images. I will review some of these aspects of spatial forms, drawing on both descriptive self-report data and behavioural data, and emphasizing the continuity of the phenomenon with standard intentional thought imagery. Topics that I will consider include the association between these experiences and various categories of visuospatial imagery, the manner in which spatial forms do or do not qualify as automatically mediated, and the extent to which the apparent idiosyncrasies of spatial forms are rational attempts to depict sequence information in a spatial manner.

• Language acquisition •

OS\_17, Room 2

(OS\_17.1)

**Functional neuroimaging language profiles modeled with distributed sources**

DIAZ, J. & MESA, I. *CEIT. San Sebastian, Spain.*

For several years, researchers have been working on assessing hemispheric dominance for receptive language by using magnetoencephalography. As a result, a normative analysis for deriving brain activation profiles from single dipole models has been established. The main objectives of this study are 1) to perform a normative analysis of language profiles estimating distributed sources of brain activity and 2) to compare this analysis with other performed using single dipoles. Thus, a large sample of individuals were analyzed to observe if the features vary with stimulus presentation parameters, including the modality of presentation, task characteristics, or by the age or gender of the participants; and if the features happen to be similar to the ones found in single dipole models. For auditory tasks, as with single dipole models, the profile of activity detected in the middle temporal gyrus and perisylvian regions were consistently higher than the rest of the regions. For visual tasks, on the contrary, the perisylvian region happened to be low activated. Regarding the language lateralization, as the single dipole model, for the later components (>150ms) the activity found in the left temporal lobe is higher than in the right, but on the contrary, no statistical significance was found.

(OS\_17.2)

**Phonological features in lexical activation: Graded effects in adults and toddlers**

ALTVATER-MACKENSEN, N. & MANI, N. *University of Göttingen*

Several models of word recognition assume that lexical representations are organized in terms of phonological features. The present study investigates whether lexical activation in adults and toddlers can be modulated by the degree of feature overlap between two words. Using the visual world paradigm, 32 German adults were presented

with four images on a screen. Labels of two images, i.e., target and distracter, rhymed but differed in the degree of feature overlap on the initial consonant (1, 2 or 3 feature difference). Similarly, 24 German 24-month-olds were presented with a prime image, followed by simultaneous presentation of a target and distracter image. Again, prime and target labels rhymed but differed in the degree of feature overlap on the initial consonant (2 or 3 features difference). We then measured how fast subjects oriented towards the target upon hearing the target label, and how long they looked at the target image. Results show graded effects of target recognition- the amount of time spent looking at the target varied with increasing feature difference in both adults and toddlers. This suggests that, in the developing as well as the mature lexicon, phonological features, and not just phonemes, influence lexical activation of phonologically similar words.

(OS\_17.3)

**Novel word learning is associated with sleep in children**

HENDERSON, L.<sup>1</sup>, WEIGHALL, A.<sup>2</sup> & GASKELL, G.<sup>1</sup>.  
<sup>1</sup>University of York, <sup>2</sup>Sheffield Hallam University.

Although the acquisition of a novel spoken form is often rapid, previous research on adults suggests that integration of novel and existing knowledge (measured by engagement in lexical competition) requires a consolidation period associated with sleep. These findings are well-explained by neural models of learning in which sleep provides an opportunity for hippocampal information to be fed into long-term neocortical memory. It remains unclear whether this time-course dissociation characterises word learning in children. Fifty-three children (7 - 12 years) were exposed to novel competitor words at 07:30-09:30 (AM Group) or 17:30-19:30 (PM Group). Whilst children were able to recognise and recall some novel words immediately after exposure, performance improved significantly after sleep (at the 12-hr retest for the PM Group and the 24-hr retest for the AM Group) and remained good 8 days later. Similarly, novel words only induced competition effects after a period of sleep (rather than wake). These findings suggest that children utilize a dual-memory system in the acquisition and integration of vocabulary. Since previous research into vocabulary acquisition in children has largely focused on the immediate consequences of word learning, the present data call for a shift in our conception of vocabulary acquisition in development.

• Emotions •

OS\_18, Room 4

(OS\_18.1)

**Association with positive outcome induces early effects in event-related brain potentials**

SCHACHT, A.<sup>1</sup>, ADLER, N.<sup>2</sup>, GUO, T.<sup>3</sup> & SOMMER, W.<sup>2</sup>.  
<sup>1</sup>CRC Text Structures, University of Göttingen, Germany,  
<sup>2</sup>Department of Psychology, Humboldt-Universität zu Berlin, Germany, <sup>3</sup>State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University, China.

Emotional pictures, faces, or words elicit an early posterior negativity (EPN) in the event-related potential, starting around 200 to 400 ms, followed by a late positive

complex (LPC). Occasionally, also very early effects of emotion (VEEs) are seen between 50 and 150 ms. The present study examined whether VEEs can be due to direct links established by reinforcement learning. In the learning session, participants learned to associate previously unknown Chinese words with monetary gain, loss, or neither. In the test session, they were required to distinguish the learned stimuli from novel distracters. Specific to stimuli associated with positive outcome a VEE was observed around 150 ms and an LPC between 550 and 700 ms, whereas an EPN was absent. These results show that monetary gain can induce VEEs, indicating that emotion effects in ERPs may come about in the absence of biologically preparedness and semantic meaning, merely by previous association with reward.

#### (OS\_18.2)

##### **Emotion components and specificity of emotional inference**

GILLIOZ, C. & GYGAX, P. *Department of Psychology. University of Fribourg. Fribourg, Switzerland.*

In this study, we investigated if the mental representation of a character's emotional response built during reading is elaborated in a way that mirrors emotion construct, as defined by Scherer's (2005) emotion components. We manipulated the quality and the quantity of features of emotion components transmitted in emotional narratives according to the GRID instrument (Scherer, 2005). In the typical version of each narrative, the text included all emotion components qualified by their most typical features. In the similar version, the features of two components were congruent but not typical of the target emotion. In the filler version, two components were omitted. Surprisingly, results showed that target emotion sentences were read slower in the typical condition. However, sentences containing typical features were read faster than those similar ones. These results suggest that emotional inference is an incremental and constructive process and that readers rely on emotion components in order to elaborate a mental representation of the emotion described in the text. They also suggest that readers may construct specific emotion representations (different to the target emotions in our narratives) when presented with salient typical emotional features and keep more open representations of the emotion when the story conveys less typical features.

#### (OS\_18.3)

##### **Semantic coherence judgments are automatic and enable exclusion judgments**

SWEKLEJ, J.<sup>1</sup>, BALAS, R.<sup>1, 2</sup>, POCHWATKO, G.<sup>1, 2</sup> & GODLEWSKA, M.<sup>1</sup>. <sup>1</sup>*Warsaw School of Social Sciences and Humanities*, <sup>2</sup>*Institute of Psychology Polish Academy of Sciences.*

Semantic coherence judgments were shown to rely on fluent processing of semantically related concepts. In four studies we investigated whether such processing requires attentional resources, depends on mood and provide basis for intuitive exclusion. We used Bowers et al.'s (1990) task presenting triads of semantically related words with a commonly associated fourth concept (a solution). The task was to provide the solution and, if unable to do so, judge whether the triads were semantically coherent. We used a secondary task to investigate

the automaticity of processes leading to coherence judgments. Attentional load decreased the insight to solutions whereas coherence judgments were unaffected (Exp. 1). Additional mood manipulation showed that negative mood interferes with processing of semantically related concepts suggesting that fluency is responsible for coherence judgments (Exp. 2). Next we introduced a fourth, unrelated, word into triads. The data showed participants' ability to exclude the non-fitting word even though they could not provide the solution to the triad (Exp. 3). The accuracy of intuitive exclusion was enhanced by positive and inhibited by negative mood (Exp. 4). We conclude that coherence judgments rely on automatic and fluent processing of semantic associations and this fluency can be used in intuitive exclusion.

#### · Attention ·

##### **OS\_19, Auditorium**

#### (OS\_19.1)

##### **Resisting auditory attentional capture: The roles of task load, pre-knowledge, and working memory capacity**

HUGHES, R.<sup>1</sup>, HURLSTONE, M.<sup>1</sup>, VACHON, F.<sup>2</sup> & JONES, D.<sup>1</sup>  
<sup>1</sup>*Cardiff University*, <sup>2</sup>*Université Laval, Quebec.*

It is well established that a sound deviating in some way from the prevailing context captures attention and thereby disrupts cognitive performance even when such performance is based on visual information. In the present study, we showed that this form of auditory distraction is resistible through the complementary action of three putatively quite distinct factors: task encoding load, foreknowledge regarding an upcoming deviation, and individual differences in working memory capacity. The disruptive impact of a voice-deviation within a task-irrelevant speech sequence (i.e., one speech token presented in a different voice from the remainder) during a visual-verbal serial recall task was eliminated both when task encoding load was increased by changing the perceptual discriminability of the to-be-remembered stimuli and also when foreknowledge regarding an upcoming deviation was provided. Moreover, extending an observation made previously using tone sequences (Sorqvist, 2010), individuals low in working memory capacity—as measured by the operation span task—showed a greater susceptibility to attentional capture by the deviation within the irrelevant speech. The results suggest that auditory distraction by attentional capture is subject to a top-down blocking mechanism.

#### (OS\_19.2)

##### **Visual masking revisited: Number of repetitions and attention modulate priming and awareness of a masked stimulus**

ATAS, A., VERMEIREN, A. & CLEEREMANS, A. *Consciousness, Cognition and Computation Group. Université Libre de Bruxelles. Bruxelles, Belgique.*

Marcel (1983) showed that repeated presentations of a masked stimulus improved priming while failing to influence perceptual awareness. However, both empirical evidence (Ferrand, 1996) as well as theoretical proposals (Cleeremans et al., 2002) predict the opposite: Increasing bottom-up strength as resulting from repeated presentation associated with a short inter-stimulus interval (500 ms or less) should also result in increasing availability to awareness. Here, we tested this prediction by manipu-

lating the number of repetitions of a masked stimulus in a numerical priming task and in two visibility tests. To explore the influence of attention, we also compared three different task contexts in which the priming trials were performed before, after or concurrently with the visibility trials. Results showed a systematic increase of awareness with the number of repetitions, in both objective and subjective tests. However, we only obtained a repetition-dependent priming effect in the concurrent condition, suggesting the crucial role of attention. The influence of top-down factors was also illustrated by significantly smaller priming in the priming-first condition vs. the visibility-first condition. Altogether, our results do not replicate the dissociation observed by Marcel and are instead suggestive that increases in bottom-up strength are associated with increases in visibility, and hence, awareness.

### (OS\_19.3)

#### **Semantic effects in the Attentional Blink: Relatedness proportion modulates the P2 and the N400 components of the event-related potentials**

PERESSOTTI, F.<sup>1</sup>, PESCIARELLI, F.<sup>2</sup>, MULATTI, C.<sup>1</sup> & DELL'ACQUA, R.<sup>1,3</sup>. <sup>1</sup>DPSS - University of Padova, Italy, <sup>2</sup>Department of Biomedical Sciences, University of Modena-Reggio Emilia, Italy, <sup>3</sup>Centre for Cognitive and Brain Science, University of Padova, Italy.

Three target words (T1, T2, T3) were presented in a RSVP sequence and participants were required to report the targets at the end of the trial. T1-T2 lag was about 300 ms so that T2 was often missed (blinked) whereas T1 and T3 were almost correctly reported. In a ERP study under such conditions, Pesciarelli, et al. (2007) observed a semantic modulation of the T3-locked P2 component that was independent on the correct report of T2 and a semantic effect on the T3-locked N400 that was detected only when T2 was not blinked. The present study is aimed at exploring how these semantic effects are modulated by the context. The experimental items were mixed with filler items containing T2-T3 related pairs in one condition, and T2-T3 unrelated pairs in the other condition. The results showed that both the P2 and the N400 semantic effects were modulated by the context and independent (i.e. either one effect, or the other, or both, or none, were observed): The N400 effect for T2-reported trials was wider in the related-filler than in the unrelated-filler context whereas the P2 effect was present only in the unrelated-filler context and independent on the correct report of T2.

### • Sentence and text processing • OS\_20, Room 1

### (OS\_20.1)

#### **Are case markers like postpositions? The brain can tell the difference**

ZAWISZEWSKI, A., ERDOCIA, K., SANTESTEBAN, M. & LAKA, I. *University of the Basque Country*

Several ERP studies show that morphological violations elicit a late positivity (P600), often preceded by LAN or N400 (Coulson et al., 1998; Molinaro et al., 2008). Here we investigate in further detail the generality of the neurocognitive processes underlying morphological processing. To this end we compare case marking morphemes and postpositions, debated in Linguistics as to

whether they belong to one or two distinct categories (Mahajan, 2008). We conducted an ERP experiment in Basque with three conditions: (i) ergative case (ERG), (ii) dative case (DAT) and (iii) postposition "to" (TO). Morphologically well-formed nouns (irakaslea-k 'teacher-ERG', neska-ri 'girl-DAT' and klase-ra 'classroom-TO') were compared to ungrammatical counterparts (irakaslea, neska and klasea), all of them lacking the case marker or postposition required by the sentence context. 23 native speakers participated in the study. ERPs were registered while participants read grammatical and ungrammatical sentences (word-by-word) and performed a grammaticality judgment task. Results showed significantly higher accuracy and faster response times to case than to postposition violations. All violations elicited a P600 component, but only case violations generated an N400. Our results suggest that there are fine-grained distinctions in morphological processing related to grammatical category, where case and postpositions are distinct.

### (OS\_20.2)

#### **Information-theoretic measures of cognitive processing effort predict word-reading times**

FRANK, S. *Department of Cognitive, Perceptual and Brain Sciences. University College London. London, United Kingdom.*

In the Computational Psycholinguistics literature, it has been argued that the amount of information conveyed by each word in a sentence is a measure of the amount of cognitive effort needed to process the word. Two complementary formalizations of word information have been proposed: surprisal and entropy reduction. These quantify, respectively, the extent to which a word's occurrence was unexpected, and the word's effect on the uncertainty about the rest of the sentence. The goal of our study was to investigate whether both these information measures indeed predict processing effort, as observed in word-reading times. A recurrent neural network was trained on 700,000 sentences (comprising 6.9 million word tokens; 7,754 types) from the British National Corpus. Next, the network generated surprisal and entropy reduction estimates for 5,043 word tokens of 361 sentences, selected from three novels on [www.freeonlinenovels.com](http://www.freeonlinenovels.com). Reading times on the same words were collected in a self-paced reading task involving 54 native English speakers. Mixed-effect regression analyses showed that both surprisal and entropy reduction are positively related to word-reading time. This supports the hypothesis that more cognitive effort is required to process words that convey more information, and suggests that both unexpectedness and uncertainty reduction quantify information content.

### (OS\_20.3)

#### **Why some surprises are more surprising than other surprises**

FOSTER, M. & KEANE, M. *University College Dublin.*

The contrast-hypothesis of surprise (Teigen & Keren, 2003, Cognition) argues that cognitive responses of surprise occur when there is a high contrast between the surprising event and the default expected alternative. The integration hypothesis (Maguire, Maguire & Keane, 2011, JEP:LMC) has countered that surprise varies with the ease with which the surprising event can be inte-

grated into a developing model of the discourse. Previous tests have shown the main difference between these two views is likely to lie in how they handle the impact of prior knowledge and different processing demands. Two experiments are reported that look at one possible knowledge impact (whether the surprise scenarios, are within range of predictive schemas) and one type of processing demand (an intervening distractor task between comprehension of the scenario setting and the presentation of the surprise outcome). The results do not show any evidence that this processing demand impacts surprise, but both experiments show strong effects of prior knowledge. Specifically, we found that some surprising outcomes, were less surprising, than others if they fell within the "predictive range" of prior experience. The extent to which these two views can explain these results are discussed.

· **Object recognition & Visual processing** ·  
**OS\_21, Room 3**

**(OS\_21.1)**

**Expectation and priming affect pop-out target visibility**

PASCUCCI, D., MASTROPASQUA, T. & TURATTO, M. *Department of Cognitive Sciences and Education, Rovereto, Italy.*

In visual perception, the exposition to a visual target enhances the processing of the same target on a future encounter (Schacter, 1998). The priming of pop out (Maljkovic & Nakayama, 1994) provides an example of this perceptual facilitation, in which the repetition of the same target-distractors colour configuration, increases the speed with which target is discriminated. However, little is known as to whether priming of pop-out also improves target visibility. The aim of the present study is to evaluate whether the repetition of the singleton target color can change its visibility, which was manipulated via metacontrast masking. To this aim the color of the target was either kept constant (blocked condition) or changed randomly (random condition). Results showed that subjects were better at identifying the target in the blocked as compared to the random condition. This suggests a possible interaction between memory and attention-perception mechanisms. Interestingly, however, when repetitions of the same color in the random condition are considered, target visibility increased for runs up to 3, but then decreased for longer runs. We hypothesize that this could reflect mechanisms of "switch expectation" that interfere with the visual short memory system.

**(OS\_21.2)**

**What does our gaze behaviour tell us about how we categorize an object?**

HARTENDORP, M., VAN DER STIGCHEL, S., HOOGE, I. & POSTMA, A. *Experimental Psychology, Helmholtz Institute, Utrecht University, Utrecht, The Netherlands.*

Our gaze behaviour can inform us which information we use from the visual input to categorize an object. For instance, when we perceive a living object, we prefer to look at the head of the animal. In the current study, we used morphed figures to investigate whether the interpretation pattern of these unclear objects is reflected in the eye-movement pattern. Morphed figures are created by slowly changing one object into another object. For

example, a morphed figure can consist for 70% of object A (dominant object) and for 30% of object B (nondominant object). We conducted a free-naming experiment in which the eye-movements were recorded simultaneously. We investigated whether a similar eye-movement pattern was registered for morphed figures that were categorized as the same object. Our data suggest a strong correlation between what we see in a morphed figure and where we look at in a morphed figure. The next step is to reveal the direction of this correlation: can we predict the eye-movement pattern on the basis of the interpretation or can we predict the interpretation on the basis of the eye-movement pattern?

**(OS\_21.3)**

**Interhemispheric transfer costs in word reading: Evidence for a split fovea**

VAN DER HAEGEN, L. & BRYSAERT, M. *Ghent University.*

The split fovea theory (SFT) states that centrally and parafoveally presented information is organized in the same way: Letters at the left/right side of fixation are initially sent to the right/left hemisphere respectively. As a consequence, the beginning of a word is the optimal viewing position for readers with left hemispheric language dominance because this makes most letters of a word fall into the right visual field. Until now, the assumptions of SFT were never directly tested under strict methodological settings such as stimulus sizes within the central 3° of vision and strict fixation control. In the present study, subjects with typical left and atypical right language dominance named three-, four- and six-letter words at different fixation locations. An eye-tracking device controlled the fixation position of both eyes and registered naming latencies for all possible letter position fixations. Results showed that left dominant subjects were fastest when fixating at the word beginning whereas the optimal viewing position of right dominant subjects was situated more towards the end of the word. Consequently, visual word recognition models should take into account that interhemispheric transfer is needed for both parafoveal and foveal word recognition.

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**ORAL SESSIONS**  
**Saturday Afternoon**

OS\_22: 14:20-16:00  
OS\_23-OS\_29: 16:20-17:20

• **Motor control** •  
**OS\_22, Room 4**

**(OS\_22.1)**

**The effect of exercise on short-term memory subsystems**

TESSARI, A.<sup>1, 2</sup>, PERAZZOLO, M.<sup>2</sup>, CECILIANI, A.<sup>2, 3</sup> & OTTOBONI, G.<sup>1</sup>. <sup>1</sup>*Department of Psychology, University of Bologna, Italy*, <sup>2</sup>*Faculty of Motor Sciences, University of Bologna, Italy*, <sup>3</sup>*Department of Education Sciences, University of Bologna, Italy*.

Due to the arousal increment, physical exercise has been shown to improve cognitive abilities such as frontal and long-term memory processes. In the present work we aim at understanding whether different types of physical exercise -i.e. team-games, mainly relying on visuo-spatial abilities, and circuits, mainly relying on motor patterns- might specifically modulate different short-term-memory (STM) subsystems. We compared the performances on verbal, visuo-spatial, and motor STM spans in 3 groups of 10-11-years-old children: the control group was tested before and after an Italian class, the second group before and after 40-minutes on a circuit exercise and the third group before and after 40-minutes of team-game. Besides a general incremented performance, a double dissociation emerged: while the circuit improved the motor span, the team-game did the same for the visuo-spatial span. However, no effect emerged in the control group. The finding might cast useful insight about how structuring specific training activities for children with learning deficits because it claims the specific positive effects of sport on different cognitive abilities.

**(OS\_22.2)**

**The brain minds whether we believe in free will**

RIGONI, D.<sup>1, 2, 3</sup>, BRASS, M.<sup>2</sup> & BURLE, B.<sup>1</sup>. <sup>1</sup>*Laboratoire de Neurosciences Cognitives, CNRS, Université de Provence, Marseille, France*, <sup>2</sup>*Department of Experimental Psychology, Ghent University, Ghent, Belgium*, <sup>3</sup>*Dipartimento di Psicologia Generale, Università degli Studi di Padova, Padova, Italia*.

The feeling of being in control of one's own actions is a strong and pervasive subjective experience. Yet, recent discoveries in psychology and cognitive neuroscience challenge the validity of this experience and suggest that free will is just an illusion. This raises a crucial question: What would happen if people started to really disbelieve in free will? Previous research has shown that low control beliefs affect negatively performance and motivation. More recently, it has been shown that undermining free-will beliefs increases antisocial tendencies and aggressive behavior. Here we report a series of neurophysiological studies showing that undermining beliefs in free will affects brain processing related to motor control. In particular, people induced to disbelieve in free will show reduced cortical preparation for action and less intentional inhibition. Our findings indicate that abstract belief systems might have a much more fundamental effect on brain functioning than previously thought.

**(OS\_22.3)**

**Effect anticipation is an integral part of response preparation: New evidence from an interference paradigm**

ZIESSLER, M.<sup>1</sup> & NATTKEMPER, D.<sup>2</sup>. <sup>1</sup>*Department of Psychology, Liverpool Hope University, Liverpool, United Kingdom*, <sup>2</sup>*Department of Psychology, Humboldt University Berlin, Berlin, Germany*.

It has been argued that the preparation of an action includes the anticipation of its proximal and distal effects (forward models). In turn, the selection of actions is assumed to be based on the anticipated effects (inverse models, ideomotor principle). Evidence for the anticipation of action effects comes mainly from experiments in which the effects were actually presented. However, it can be argued that this evidence is an artefact of the method; effect codes were only activated because the effects were presented as external stimuli. Therefore we cannot conclude from these experiments that response preparation would normally include anticipation of effects. We present new experiments avoiding this problem. Participants first learned effects of key-pressing responses (the appearance of hand gestures on the screen). In the following test phase participants were asked to withhold their response to the target stimulus until a go-signal appeared (picture of an object). The go-signal was either compatible or incompatible with the learned effect. Responses were faster in compatible trials. This is strong evidence for an activation of effect codes as part of the preparation of the responses. Only then the compatibility between go-signal and effects could affect response times.

**(OS\_22.4)**

**Higher-order representations of newly learnt action sounds in the human motor system**

WASZAK, F.<sup>1</sup>, SCHUETZ-BOSBACH, S.<sup>2</sup>, WEISS, C.<sup>2</sup> & TICINI, L.<sup>2</sup>. <sup>1</sup>*LPP, CNRS, Paris, France*, <sup>2</sup>*MPI CBS, Leipzig, Germany*.

Our brain is able to recognize action sounds by representing them as motor events. Previous studies have demonstrated somatotopic activation of the listener's motor cortex during perception of the sound of over-familiar motor acts. The present experiments asked (i) how the motor system is activated by the sounds of actions that are newly acquired, and (ii) whether action-related sounds are represented with reference to extrinsic features related to action goals rather than with respect to lower-level intrinsic parameters related to the specific movements. Transcranial magnetic stimulation (TMS) was used to measure the correspondence between auditory and motor codes in the listener's motor system. We compared the corticomotor excitability in response to the presentation of auditory stimuli before and after a short perceptuomotor training, in which voluntary actions were associated with arbitrary perceivable consequences void of a motoric meaning before training. Novel auditory-motor representations became manifest very rapidly. Indeed, passive listening to newly learnt action-related sounds activated a precise motor representation that took into account the variable contexts to which the individual was exposed to. Our results suggest that the human brain embodies a higher-order audiomotor representation of perceived actions, which is muscle-independent and corresponds to the action's goals.

**(OS\_22.5)****Body Schema plasticity without proprioception: evidence from a deafferented patient**

CARDINALI, L.<sup>1,2</sup>, BROZZOLI, C.<sup>3</sup>, LUAUTÉ, J.<sup>1,4</sup>, ROY, A. C.<sup>2,5</sup> & FARNÉ, A.<sup>1,2</sup>, <sup>1</sup>IMPACT, Neuroscience Research Center, Lyon, France, <sup>2</sup>Université Claude Bernard-Lyon1, Lyon, France, <sup>3</sup>Department of Neuroscience, Brain, Body & Self Laboratory, Karolinska Institutet, Stockholm, Sweden, <sup>4</sup>Hospices Civils de Lyon, Service de Rééducation Neurologique, Lyon, France, <sup>5</sup>L2C2, Institut des Sciences Cognitives, Bron, France.

We investigated the plasticity of the body representation for action (Body Schema, BS) by studying tool-use in a deafferented patient, C.D., with a peripheral deafferentation of the right arm. We asked C.D. to grasp an object with both her right (deafferented) or left hand and a mechanical grab. We then analysed her kinematics. We found that double peaks of acceleration and velocity characterized the kinematic of the deafferented hand. The same kinematic profile was present when the same hand was controlling the tool. Moreover, the patient showed a relatively fast process of learning in using the tool, since the kinematics evolved during the training. This pattern was not present for the left hand as there was no difference between first and last block of movements, in line with what we showed in a previous study in normal subjects, who did not show motor learning in using the same tool. Finally, in the post-training, the deafferented hand showed a normal kinematic profile that was still present 6 months later. In conclusion, to use a grabber that normally does not imply motor learning, C.D. shows a process of motor learning that is likely guided by visual information and affects subsequent free-hand movements.

· Working memory ·  
OS\_23, Room 6

**(OS\_23.1)****Where do individual differences in working memory capacity come from? A Time-Based Resource-Sharing account**

LUCIDI, A. & BARROUILLET, P. *Department of Psychology, University of Geneva, Geneva, Switzerland.*

The aim of the present study was to identify the factors underlying individual differences in working memory (WM) capacity. According to the Time-Based Resource-Sharing (TBRs) model, there are at least two factors that should play a crucial role: processing efficiency and the efficiency of the refreshing mechanisms. This hypothesis was tested in three experiments. In Experiment 1, a computer-paced complex span task was used in which low-span and high-span individuals had to maintain series of letters while adding 2 to series of digits. Large individual differences were observed between the two groups. In Experiment 2, processing times were equated between groups by asking low-span individuals to add 1 instead of 2 to each digit. Individual differences were reduced but still significant. In Experiment 3, processing times were again equated and the time available to refresh memory traces was tailored to the processing speed of each group. This last manipulation resulted in a further reduction of individual differences, with no differences between low-span and high-span individuals in some conditions. This strongly suggests that both

processing efficiency and the efficiency of the refreshing mechanisms are main factors underlying individual differences in WM capacity.

**(OS\_23.2)****Time causes forgetting from working memory**

BARROUILLET, P.<sup>1</sup>, DE PAEPE, A.<sup>2</sup> & LANGEROCK, N.<sup>1</sup>. <sup>1</sup>University of Geneva, <sup>2</sup>Ghent University.

The rapid forgetting of information is a ubiquitous and pervasive phenomenon. Surprisingly, after more than one century of investigation, the exact causes of this forgetting remain undecided. A venerable tradition has assumed that memory traces suffer from a temporal decay. However, modern psychology commonly assumes that forgetting is not due to decay, but to representation-based interference created by the intervening events occurring between encoding and retrieval. In two experiments, we show that time plays a causal role in forgetting from working memory. Adults were asked to remember series of items (either letters or spatial locations) while verifying multiplications before recall. The duration of the delay between encoding and recall was manipulated by presenting multiplications either in word (three x four = twelve) or digit format (3 x 4 = 12), the former taking longer to solve. In line with the temporal decay hypothesis, the longer solution times elicited by solving word multiplications resulted in poorer recall performance. Longer delays have the same effect on both verbal and visuo-spatial memory, making difficult to account for the effect by representation-based interference.

**(OS\_23.3)****Attentional demand of maintenance mechanisms in verbal working memory**

CORBIN, L.<sup>1</sup> & CAMOS, V.<sup>2</sup>, <sup>1</sup>LEAD. *Université de Bourgogne. Dijon, France, <sup>2</sup>Université de Fribourg. Fribourg, Switzerland.*

Different mechanisms of maintenance of verbal information in working memory have been described. They vary in depth of processing of the memoranda, from a superficial recirculation of the phonological information by subvocal rehearsal, to the reactivation of the memory traces by attentional refreshing and to the association of the memory items with long-term memory knowledge through elaborative rehearsal. Previous works have shown that deeper processing by refreshing or elaborative rehearsal leads to better recall than when subvocal rehearsal is used. In the present study, we compared the impact on recall of a reduction of attention in a complex span task when participants were instructed to use one of these three maintenance strategies. Results revealed that the benefits of deeper processing are at the cost of higher attentional demand. Thus, increase in recall performance could emerge not through depth of processing but because the memoranda benefit from greater allocation of attention.

· Language production ·  
OS\_24, Auditorium

## (OS\_24.1)

**The effect of lexical preview on the scope of grammatical encoding during spoken sentence production**

WHEELDON, L., OHLSON, N., ASHBY, A. & GATER, S.

*Psychology. University of Birmingham. Birmingham, U.K.*

Previous research has investigated the minimal processing scope employed during the grammatical encoding of spoken sentences. This research suggests that speakers prefer to grammatically encode a sentence initial phrase prior to speech onset and that this scope also applies to lexical access. The aim of this research was to investigate the extent to which speakers can extend their processing scope when they have advanced knowledge of lexical content. Three reaction time experiments will be reported which use a picture preview technique to investigate the effect of advanced lexical knowledge on processing scope. Speakers generated sentences in response to moving arrays of four pictured objects. The number of pictures in the sentence initial phrase was varied. In addition, speakers saw a 1s preview of one of the upcoming pictures. Speakers' awareness of the linear position of the previewed picture was also varied. Significant effects of all variables were observed. The results demonstrate that speakers can extend their processing scope into the second phrase of a sentence in order to incorporate a known lexical item. However, they also show limitations to the extent of this ability and a disassociation between the scope of lexical access and the scope of syntactic planning.

## (OS\_24.2)

**Phonology contributes to writing: Evidence from written word production in a non-alphabetic script**

QU, Q.<sup>1</sup>, DAMIAN, M.<sup>1</sup>, ZHANG, Q.<sup>2</sup> & ZHU, X.<sup>2</sup>. <sup>1</sup>*School of Experimental Psychology, University of Bristol, Bristol, UK,*

<sup>2</sup>*Institute of Psychology, Chinese Academy of Sciences, Beijing, China.*

Is written word production affected by phonological properties? Most researchers agree that orthographic codes can be accessed directly from meaning, but the relative contribution of phonological codes remains controversial, mainly because in studies with alphabetic scripts it is difficult to dissociate sound from spelling. We report a picture-word interference study in which Chinese participants performed written picture naming while attempting to ignore written distractor words which were either phonologically and orthographically related, phonologically related only, or unrelated. Priming relative to the unrelated condition was found for both types of distractors, which constitutes clear evidence that phonological properties constrain orthographic output. Additionally, the results speak to the nature of Chinese orthography, suggesting sub-semantic correspondences between sound and spelling.

## (OS\_24.3)

**Cognate status effects monitoring processes in speech production: Evidence from the 'error-related negativity'**

GANUSHCHAK, L.<sup>1</sup>, ACHESON, D.<sup>1, 2</sup>, CHRISTOFFELS, I.<sup>3</sup> & HAGOORT, P.<sup>1, 2, 3</sup> <sup>1</sup>*Max Planck Institute for Psycholinguistics. Nijmegen, The Netherlands,* <sup>2</sup>*Donders Institute for Brain, Cognition and Behavior. Radboud University. Nijmegen, The Netherlands,* <sup>3</sup>*Leiden Institute for Brain and Cognition. Universiteit Leiden. Leiden, The Netherlands.*

One of the physiological markers of monitoring in both speech and non-speech tasks is the so-called error related negativity (ERN), an event-related potential that is typically observed after error trials. However, the ERN is also observed after correct trials in both manual and verbal tasks, suggesting that it might be a more general marker for the monitoring of response conflict. The present work tests this hypothesis in speech production by exploring a situation where increased response conflict naturally occurs, namely, when multiple speech outputs are simultaneously activated. Event-related potentials were recorded while participants named pictures in their first and second languages. Activation of multiple outputs was manipulated through the form similarity between translation equivalents (i.e., cognate status). Replicating previous results, cognates were faster to name than non-cognates. Interestingly, response-locked analyses not only showed a reliable ERN on correct trials, but that the amplitude of the ERN was larger for cognates compared to non-cognates. Thus, despite being faster to name, cognates seem to induce more conflict during response monitoring. This in turn indicates that the ERN is not simply sensitive to conflicting motor responses, but also to more abstract conflict resulting from co-activation of multiple phonological representations.

· Time and cognition ·

OS\_25, Room 5

## (OS\_25.1)

**The role of predictability in Prospective Memory**

BISIACCHI, P., TARANTINO, V., CONA, G. & ARCARA, G. *dep. general psychology university of Padova Italy.*

The aim of the study was to compare the monitoring processes involved in time and event-based prospective memory (PM). To this aim, a time-based, an event-based and an event & time-based experiment were designed, which shared the same ongoing activity and differed in terms of PM target predictability. The interference effect of the PM task on the ongoing performance was analyzed within and between experiments. Ongoing response times were faster in the time-based PM experiment than the event-based experiment, and intermediate in the event & time-based experiment in which participants could predict the occurrence of the PM target. In the time-based task, an increase of time monitoring frequency was found as the PM deadline was approaching, suggesting a periodicity of the monitoring process involved. The slowing of response times in the event-based and in the event & time-based task in trials containing PM cues suggested that the monitoring process was more continuous. In conclusion, time-based and event-based PM tasks showed qualitatively different monitoring processes.

toring mechanisms, which were influenced by the predictability of PM target.

#### (OS\_25.2)

##### **Short-term memory for durations: are there modality-specific memory systems?**

RATTAT, A.<sup>1,2,3</sup> & PICARD, D.<sup>1,2,4</sup>. <sup>1</sup>*Laboratoire Octogone-ECCD, EA 4156, <sup>2</sup>Université de Toulouse, <sup>3</sup>CUFR Jean-François Champollion, <sup>4</sup>Institut Universitaire de France.*

Although it is well established that temporal information processing draws on memory resources (e.g., Brown, 2006), much remains to be uncovered about the nature of these resources. In particular, one important question is how temporal information is encoded and stored in memory as a function of the signal's sensory modality. The purpose of the present study was to determine the format in which visual, auditory and auditory-visual durations ranging from 400 to 600 ms are encoded and maintained in short-term memory, using suppression conditions. Participants compared two stimulus durations separated by an interval of 8 s. During this time, they performed either an articulatory suppression task, a visuospatial tracking task or no specific task at all (control condition). The results showed that the articulatory suppression task decreased recognition performance for auditory durations but not for visual or bimodal ones, whereas the visuospatial task decreased recognition performance for visual durations but not for auditory or bimodal ones. It is noteworthy that, unexpectedly, whatever the concurrent task performed during the retention interval, recognition performances on bimodal durations were not disrupted. These findings support a modality-specific account of short-term memory for durations.

#### (OS\_25.3)

##### **Time perception: intentional binding for predictable and unpredictable action effects**

HAERING, C. & KIESEL, A. *University of Wuerzburg, Germany.*

When an action produces an effect, both events are perceived to be shifted in time towards each other. However, the mechanisms behind this intentional binding (IB) effect are not clear. One assumption postulates that this shift in time perception occurs for predictable effects because of existing action-effect bindings and the possibility to anticipate the self-produced effect. Yet, alternatively one may assume that IB occurs for any effect caused by the action to facilitate the formation of action-effect bindings. To disentangle both accounts, we compared time perception of actions and predictable or unpredictable effects. We used three measures of time perception, a clock-approach to assess the perceived points in time of actions and effects and two measures of duration estimation. Participants performed freely chosen left or right keypresses that produced either high or low tones after 250 ms. The tones were either predictably or randomly assigned to the two keys. The amount of IB was similar for predictable and unpredictable effects. We assume that IB is not the result of existing action-effect bindings but occurs for any self-produced action effect probably to facilitate action-effect learning.

#### **• Skill acquisition and Attention in aging • OS\_26, Room 4**

#### (OS\_26.1)

##### **Aging and attention capture: Electrophysiological evidence for preserved attentional control with advanced age**

LIEN, M.<sup>1</sup>, GEMPERLE, A.<sup>2</sup> & RUTHRUFF, E.<sup>3</sup>. <sup>1</sup>*Department of Psychology, Oregon State University, Corvallis, Oregon, USA, <sup>2</sup>School of Psychology, University of Sussex, Falmer, UK, <sup>3</sup>Department of Psychology, University of New Mexico, Albuquerque, New Mexico, USA.*

The present study examined whether people become more susceptible to capture by salient objects as they age. Participants searched a target display for a letter in a specific color and indicated its identity. In Experiment 1, this target display was preceded by a non-informative cue display containing one target-color box, one ignored-color box, and two white boxes. On half of the trials, this cue display also contained a salient-but-irrelevant abrupt onset. To assess capture by the target-color cue, we used the N2pc component of the event-related potential, thought to reflect attentional allocation to the left or right visual field. The target-color box in the cue display produced a substantial N2pc effect for younger adults and, most importantly, this effect was not diminished by the presence of an abrupt onset. Therefore, the abrupt onset was unable to capture attention away from the target-color cue. Critically, older adults demonstrated the same resistance to capture by the abrupt onset. Experiment 2 extended these findings to irrelevant color singleton cues. Thus, we argue that the ability to attend to relevant stimuli and resist capture by salient-but-irrelevant stimuli is preserved with advancing age.

#### (OS\_26.2)

##### **Can younger and older adults improve task coordination skills after extended dual-task practice?**

STROBACH, T.<sup>1</sup>, FRENSCH, P. A.<sup>2</sup>, MÜLLER, H.<sup>1</sup> & SCHUBERT, T.<sup>1,2</sup>. <sup>1</sup>*Ludwig-Maximilians-University Munich, Germany, <sup>2</sup>Humboldt-University Berlin, Germany.*

It has been shown for younger adults that practicing two simultaneously presented tasks leads to improved dual-task performance. One mechanism for this improvement is the acquisition of task coordination skills for optimized control of two concurrent task streams. In particular, these skills are acquired during dual-task practice but not during practice of two separate tasks in single-task situations. So far, however, it is unclear whether older adults are also able to improve their dual-task performance and whether the acquisition of task coordination skills during dual-task practice denotes one mechanism for this improvement in this aging group. Therefore, we investigated the dual-task performance after dual-task practice or single-task practice in younger and older adults. A larger improvement of dual-task performance after dual-task contrasted with single-task practice indicates the acquisition of task coordination skills. Our data are consistent with this assumption in groups of younger adults as well as older adults. Thus, both aging groups improve their dual-task performance during practice and this improvement is related to the acquisition of task coordination skills. Further, our findings indicate that the amount of the practice-related improvement of dual-task

performance due these acquired skills is similar in both groups.

### (OS\_26.3)

#### **It takes two-skilled recognition of objects engages lateral areas in both hemispheres**

BILALIC, M. *Tübingen University.*

Our object recognition abilities are fine-tuned to perfection. Left temporal and lateral areas along the dorsal, action related stream, as well as left infero-temporal areas along the ventral, object related stream are engaged in object recognition. Here we show that expertise modulates the activity of dorsal areas in the recognition of man-made objects. Expert chess players were faster than chess novices in identifying chess objects and their functional relations. Experts' advantage was domain-specific as there were no differences between groups in a control task featuring geometrical shapes. The pattern of eye movements supported the notion that experts' extensive knowledge about domain objects and their functions enabled superior recognition even when experts were not directly fixating the objects of interest. fMRI related exclusively the areas along the dorsal stream to chess specific object recognition. Besides the commonly involved left temporal and parietal lateral brain areas, we found that only in experts homologous areas on the right hemisphere were also engaged in chess specific object recognition. Based on these results, we discuss whether skilled object recognition does not only involve a more efficient version of the processes found in non-skilled recognition, but also qualitatively different cognitive processes which engage additional brain areas.

• Learning •  
OS\_27, Room 3

### (OS\_27.1)

#### **Awareness and intentional control in evaluative learning**

BALAS, R.<sup>1, 2</sup> & SWEKLEJ, J.<sup>1, 1</sup> *Warsaw School of Social Sciences and Humanities, <sup>2</sup>Institute of Psychology Polish Academy of Sciences.*

Evaluative conditioning (EC) is a process of changing the evaluation of initially neutral stimulus (conditioned stimulus - CS) due to its repeated exposure with either positive or negative stimulus (unconditioned stimulus - US). There is no consensus whether EC requires subject's awareness of CS-US contingencies as well as awareness of stimuli themselves. The presented research examines whether EC is possible without perceptual and contingency awareness. First two studies examined whether EC is possible with subliminal presentation of the stimuli. To assess contingency awareness a 4 Picture Recognition Test was used. This test requires participants to select an US that was presented together with a CS at the time of conditioning. The third study adopted dissociation logic in contingency awareness check as well as in evaluation. We asked participants to select the item that DID NOT accompany the CS or exclude the possible influence of conditioning on CS evaluations. We found EC effects independent of awareness in all studies. This suggests that affective learning might proceed with no perceptual access to the stimuli. However, we also show that intentional control over responses elicited by conditioned

stimulus is to some extent possible thanks to the awareness of responses not CS-US contingencies.

### (OS\_27.2)

#### **The Stroop task and false recognition: evidence for incidental associative learning of colored items during color-naming**

LEMERCIER, C. *CLLE-LTC, University of Toulouse, Toulouse, France.*

Longer RTs in incongruent Stroop color naming have recently been explained by referring to an associative learning mechanism. Participants are supposed to incidentally learn word/color association while they name their color. To evaluate this hypothesis, which stresses the role of episodic traces being created, we carried out two experiments using the Deese Roediger & MacDermott paradigm. In Experiment 1, participants either performed a color identification task (CI) or made a judgment of pleasantness (JP) on colored words presented list-by-list, with each word being printed in one particular color. JP led to better recognition performances, but false recognition on critical lures was equivalent across the two study conditions. In Experiment 2, all the study lists were presented randomly in the same global list. Words were printed in color, with all words associated with the same critical unstudied word being printed in the same color (i.e., all the words associated with "sleep" were printed in blue). Color therefore provided the only associative link between words. As expected, a decrease in false recognition was observed for the JP condition. Inversely, a significant increase in false recognition was observed in the CI condition. These results support the incidental associative learning hypothesis.

### (OS\_27.3)

#### **The interplay between implicit learning and cognitive control: an assessment of Stroop interference in implicit sequence learning**

DEROOST, N., VANDENBOSSCHE, J., ZEISCHKA, P., COOMANS, D. & SOETENS, E. *Vrije Universiteit Brussel.*

In a series of three experiments, we investigated the interplay between implicit sequence learning and cognitive control. In Experiment 1, we observed an interaction between conflict and learning in a sequential Stroop task. Greater sequence learning was observed in the incongruent than in the congruent trials. Yet, the results could also be explained by reduced Stroop interference in sequenced as compared to random trials. In two additional experiments, we therefore further unraveled the direction of the effect. In Experiment 2, we showed that participants with sequence knowledge where no better at resolving conflict than participants without sequence knowledge. Thus, sequence learning does not enhance conflict resolution. In Experiment 3, we demonstrated that the amount of conflict does not enhance sequence learning either, but it does improve the expression of learning as most knowledge was expressed in conflict trials. These results show that implicit sequence learning processes can be recruited to cope with high cognitive demands.

· Numerical cognition ·  
OS\_28, Room 2

## (OS\_28.1)

**Emergence of a “visual number sense” in hierarchical generative models**

ZORZI, M.<sup>1,2</sup> & STOIANOV, I.<sup>1</sup>. <sup>1</sup>*Dipartimento di Psicologia Generale, University of Padova*, <sup>2</sup>*Center for Cognitive Science, University of Padova*.

Many animal species have evolved a capacity to estimate the numerosity of visual objects. Though foundational to mathematical learning in humans, the nature of the computations underlying this “visual sense of number” remains controversial. Here we show that visual numerosity emerges as a statistical property of images in “deep networks” that learn a hierarchical generative model of the sensory input. Emergent numerosity detectors in the network’s deepest layer had response profiles resembling that of monkey parietal neurons and their activity supported a numerosity estimation task with the same behavioral signature and performance level shown by humans and animals. The unsuspected simplicity of the underlying neural mechanism fits well with the long phylogenetic history of numerosity perception.

## (OS\_28.2)

**Object graspability affects number processing**

RANZINI, M.<sup>1</sup>, ANELLI, F.<sup>1</sup>, BORGHI, A. M.<sup>1,2</sup>, CARBONE, R.<sup>1</sup>, LUGLI, L.<sup>1</sup> & NICOLETTI, R.<sup>1</sup>. <sup>1</sup>*University of Bologna, Bologna, Italy*, <sup>2</sup>*Institute of Cognitive Science and Technology - CNR, Roma, Italy*.

Several studies have described common processing between numerical and physical magnitudes, and between number and action. However, they did not control for object graspability (affordance). This study investigates the relationship between numerical magnitude, object size, and affordances in two experiments, without (Experiment 1) or with (Experiment 2) motor involvement (i.e. participants had to hold/grasp an object during the task). The task consisted in repeating aloud the odd or even digit within a pair depending on the type of the preceding or following object. Numerical magnitude (small vs. large), object size (small vs. large), object type (graspable vs. ungraspable), and order (object-number vs. number-object) were manipulated for each experiment. Experiment 1 showed a facilitation for graspable over ungraspable objects preceded by the numbers presentation, and a numerical magnitude effect after graspable objects presentation. Thus, graspability was more relevant than size for number processing. Experiment 2 demonstrated that motor involvement interfered with graspability, however enhancing the sensibility to both numerical and object size. Overall, these findings demonstrate that not only object size, but also object affordances, which involve the motor system, affect number processing. Crucially, they suggest that abstract and concrete concepts are linked through perception-action systems.

## (OS\_28.3)

**Retrieval-induced forgetting in cognitive arithmetic**

CAMPBELL, J., DOWD, R. & THOMPSON, V. *University of Saskatchewan*.

We investigated retrieval-induced forgetting (RIF) of simple-addition facts ( $2 + 3 = 5$ ) from practice of their

multiplication counterparts ( $2 \times 3 = 6$ ). Experiment 1 demonstrated a response time cost (RIF) for addition with multiplication practiced in word format (three × four) and addition tested later in digit format ( $3 + 4$ ). This is evidence that digit and written-word formats for arithmetic accessed a common semantic retrieval network. In Experiment 2, Chinese-English bilinguals presented RIF when multiplication practice and addition test were in the same language relative to different languages. Languagespecific RIF implies language-specific memory stores for arithmetic.

· Perception and action ·  
OS\_29, Room 1

## (OS\_29.1)

**How sensory anticipations in the human brain control motor action**

PFISTER, R.<sup>1</sup>, MELCHER, T.<sup>2</sup>, KIESEL, A.<sup>1</sup>, DECHENT, P.<sup>3</sup> & GRUBER, O.<sup>2</sup>. <sup>1</sup>*Department of Psychology III, University of Würzburg, Würzburg, Germany*, <sup>2</sup>*Department of Psychiatry and Psychotherapy, Georg-August-University Göttingen, Göttingen, Germany*, <sup>3</sup>*MR-Research in Neurology and Psychiatry, Georg-August-University Göttingen, Göttingen, Germany*.

How does our mind produce physical action of our body? How are goals transformed into overt behaviour? For about 200 years, philosophers and psychologists hypothesized the transformation from mind to body to occur via the anticipation of sensory consequences of an action. And whereas there is ample evidence for this hypothesis in behavioural experiments, the neural underpinnings of action control via sensory anticipations are virtually unknown. Consequently, current neuroscientific models of action control do not account for this mechanism. Using a response-effect compatibility paradigm and functional magnetic resonance imaging, the present study identified the inferior parietal cortex and the parahippocampal gyrus as key regions for this type of action control. These findings set the stage for a neuroscientific framework for explaining action control by sensory anticipations and thus a potential synthesis of psychological and neuroscientific approaches to human action.

## (OS\_29.2)

**Cognitive control and mental rotation speed predict surgical skills**

BAND, G. P.<sup>1,2</sup>, PIEDERET, A.<sup>1</sup>, HULTZER, G.<sup>3</sup> & HAMMING, J.<sup>3</sup>. <sup>1</sup>*Leiden University Institute of Psychology*, <sup>2</sup>*Leiden Institute for Brain and Cognition*, <sup>3</sup>*Leiden University Medical Center*.

Vascular surgery and laparoscopy require complex cognitive and motor skills, such as spatial transformations and flexibility of rule application. We tested the predictive value of cognitive psychological indices for these surgical skills, making use of a skills lab approximation of actual surgery: participants had to perform complex motor operations with indirectly controlled tools, visible through a monitor from an unnatural perspective. Performance in this skills lab has previously been shown to be a valid indicator of performance in actual surgery on human patients. After performing on the Simon, the mental rotation and the task switching paradigm, 32 medicine students without prior surgery experience

engaged in three skills lab tests, alternated with skills lab practice. From the tests, both baseline and improvement scores were derived in subtests such as stringing beads, folding a pipe cleaner, and cutting a circle from a balloon. All cognitive psychological indices explained at least some of the lab skills significantly. The strongest predictor was local switch costs; the speed difference of switch trials versus repetition trials in a block with mixed instructions. These results are a first step towards improving the quality of both surgery training and surgery practice.

### (OS\_29.3)

#### **Top-down modulation of action perception**

CROSS, E.<sup>1,2,3</sup>, LIEPELT, R.<sup>1,4</sup>, PRINZ, W.<sup>1</sup> & HAMILTON, A. F. D. C.<sup>5</sup>. <sup>1</sup>*Department of Psychology, Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany*, <sup>2</sup>*Behavioural Science Institute & Donders Institute for Brain, Cognition & Behaviour, Radboud University Nijmegen, The Netherlands*, <sup>3</sup>*Department of Psychology, Bangor University, Wales, UK*, <sup>4</sup>*Institut für Psychologie, Westfälische Wilhelms Universität Münster, Germany*, <sup>5</sup>*School of Psychology, University of Nottingham, Nottingham, UK*.

In the human brain, top-down modulation has a substantial impact on whether information is processed as 'social' or 'non-social'. Theory of mind studies have used the same stimuli for 'human' and 'computer' conditions, and found that the identical stimulus activates social brain regions when participants believed the observed action originated in another person, not a computer. Here we tested for modulation of actions perceived as social/non-social, based on instructions and the actor's form. Before scanning, participants watched a video instructing how avatars could be animated entirely by computer or by capturing motions of a real human actor. During scanning, participants saw computer-generated 'Poser' figures (one human-like and the other robot-like in appearance) performing simple goal-directed actions. Both figures performed the same actions with identical kinematics, but participants were told that half the videos were created with motion capture, and the other half with computer animation. Imaging data reveal stronger occipital activations when perceiving the robotic versus the human form, and a broad network of regions including inferior occipital, fusiform, and posterior cingulate cortices when participants believed they were watching human-generated actions. The present data thus demonstrate how top-down (instructions) and bottom-up (agent form) features work together to modulate action perception.

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## ORAL SESSIONS

## Sunday Morning

OS\_30, 09:30-11:10

OS\_31, 11:30-13:10

## • Orthographic processing •

OS\_30, Room 6

## (OS\_30.1)

**Effect of graphomotor demands on the time course of spelling: The syllable case**

SAUSSET, S., LAMBERT, E. & OLIVE, T. *Centre de Recherches sur la Cognition et l'Apprentissage (CeRCA), CNRS UMR 6234, University of Poitiers, Poitiers, France.*

This study investigated the influence of graphomotor demands on the time course of spelling. We hypothesized that with low graphomotor demands, the syllables of a word are processed before writing the word, whereas with high graphomotor demands, each syllable is processed just before being written down. The experiment involved four conditions with increasing graphomotor demands: lowercase script, uppercase script, uppercase script with large letters, uppercase script with large letters without visual feedback. Participants copied three times successively 2- and 3-syllable words. We measured the latencies before copies 2 and 3, and duration of the inter-letter intervals within the first syllable and at the boundary before the second syllable. With low graphomotor demands, the latencies were longer than when the demands were higher; the effect of the number of syllables was significant only for the low demanding conditions. The between-syllable inter-letter interval was longer than the within-syllable inter-letter interval, particularly with high graphomotor demands. The findings indicate that with low graphomotor demands syllables are processed before graphomotor execution of the word. With high graphomotor demands each syllable is processed just before being written. These findings are interpreted in a cascading model.

## (OS\_30.2)

**Are there really two syllables in the written word chaos?**

CHETAIL, F. & CONTENT, A. *LCLD, Université Libre de Bruxelles, Brussels, Belgium.*

The nature of functional orthographic units is a central issue in visual word recognition, especially with long multisyllabic words. Although syllable-sized units appear plausible and their role is supported by various strands of evidence, the processes and the cues determining orthographic grouping remain far from clear. Here, we investigated the role of letter category (consonant vs. vowels) in the perceptual organization of letter strings by examining French readers' judgements of syllabic length. Participants were presented with written words matched for the number of spoken syllables and comprising a vowel hiatus or not (e.g. pharaon vs. vagabond). Relative to control words, readers were slower and less accurate for hiatus words for which they systematically underestimated the number of syllables (Experiment 1). The effect was stronger when the instructions emphasized response speed (Experiment 2). It was even more pronounced when the resort to phonological codes was hindered through articulatory suppression (Experiment 3). Taken

together, these results show that the perceptual units extracted from visual letter strings and from spoken words need not correspond to each other. We discuss the implications of this lack of isomorphism between spoken syllables and orthographic units in view of current theories of visual and spoken word recognition.

## (OS\_30.3)

**Is the go/no-go lexical decision task preferable to the yes/no task with developing readers?**

MORET-TATAY, C.<sup>1, 2</sup>, PEREA, M.<sup>2</sup> & ROSA, E.<sup>1</sup>.

<sup>1</sup>Universidad Católica de Valencia, Valencia, Spain,

<sup>2</sup>Universitat de València, Valencia, Spain.

The lexical decision task is probably the most common laboratory visual-word identification task. In the usual setup, participants have to press "yes" when the stimulus is a word and "no" when the stimulus is not a word. A number of studies have employed this task with developing readers; however, error rates and/or response times tend to be quite high. One way to make the task easier for young readers is by employing a go/no-go procedure: "if word, press 'yes'; if not, refrain from responding" (see Perea, Rosa, & Gomez, 2002, M&C, for the advantages of the go/no-go lexical decision task with adult skilled readers). Here we conducted a lexical decision experiment that compared the yes/no and go/no-go variants of the lexical decision task with developing readers (2nd and 4th grade children). Results showed that: i) error rates for words and nonwords were much lower in the go/no-go task than in the yes/no task, ii) lexical decision times were substantially faster in the go/no-go task, and iii) for high-frequency words, there was less variability in the latency data of the go/no-go task. Thus, the go/no-go lexical decision task is preferable to the "standard" yes/no task when conducting experiments with developing readers.

## (OS\_30.4)

**Emotional valence of the neighbour and prime duration influence orthographic priming: An ERP investigation**

GOBIN, P.<sup>1</sup>, FAÏTA-AÏNSEBA, F.<sup>2</sup> & MATHEY, S.<sup>1</sup>.

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Qualité de Vie, EA4139, <sup>2</sup>Université Bordeaux Segalen,

Laboratoire Cognition et Facteurs Humains, EA 487.

The aim of the study was to investigate whether the time course of the orthographic priming effect depends on the emotional valence of the orthographic neighbour and on prime duration. Target words were presented in a primed lexical decision task in which event-related brain potentials (ERPs) were recorded. The neutral targets (e.g., GICLER [squirt], TINTER [ring]) had only one higher-frequency orthographic neighbour. This neighbour was negative for half of the targets (e.g., gifler [slap]) and neutral for the other half (e.g., tenter [tempt]). Target words were preceded by their neighbour or by a non-alphabetic control prime. Two prime durations of 66 ms (Experiment 1) and 166 ms (Experiment 2) were used. In Experiment 1, the results showed an orthographic priming effect on three ERP components (P150, N200 and N400), modulated by the negative valence of the orthographic neighbour. In Experiment 2, the same components were influenced by the orthographic priming effect but their latency was shorter and their amplitude increased. Moreover, the emotional valence of the neighbour no longer influenced the time course of the ortho-

graphic priming effect. Taken together, these results suggest early activation of the affective system whose involvement decreases during word processing.

### (OS\_30.5)

#### **Pirates at parties: Letter position coding in developing readers**

CASTLES, A.<sup>1, 2</sup> & KOHNEN, S.<sup>1, 2</sup>. <sup>1</sup>*Macquarie Centre for Cognitive Science, Macquarie University, Sydney, Australia*, <sup>2</sup>*ARC Centre of Excellence in Cognition and its Disorders, Macquarie University, Sydney, Australia*.

Several cases of developmental letter-position dyslexia have recently been reported, in which the primary symptom is a preponderance of letter-position errors on “migratable” words, (e.g., ‘beard’ read as ‘bread’; Friedmann & Rahamin, 2007). This reading profile has been attributed to a specific impairment in the encoding of letter position. However, it is difficult to evaluate this claim in the absence of data on the extent to which normally-developing readers make such errors and how they relate to other aspects of reading progress. In this study, children in Grades 2, 3 and 4 were tested on migratable words, as well as on letter processing, lexical and nonlexical processing, and lexical “guessing”. Errors on migratable words were prevalent in developing readers, and the proportion of such errors did not decrease with increasing Grade level. However, they were not associated with deficits in other reading processes or with lexical guessing. We conclude that a reading profile characterised by a high proportion of migration errors may not necessarily be indicative of a reading disorder and may reflect an optimally-tuned reading system.

### Sunday Noon

• Executive control •  
OS\_31, Room 5

### (OS\_31.1)

#### **Is response inhibition attention-demanding?**

SUAREZ, I. C., BURLE, B., VIDAL, F. & CASINI, L. *Laboratoire de Neurobiologie de la Cognition, Université de Provence, Marseille*.

This study was aimed at investigating whether inhibition of inappropriate response elicited by irrelevant information needs attention to be implemented. A conflict task, the Simon reaction time (RT) task, was performed either as a single task or concurrently to a secondary task (dual-task condition, DT). In Simon RT task, it is classically observed that RTs are shorter for congruent stimulus-response associations than for incongruent stimulus-response associations. Nowadays, one admits that in the incongruent stimulus-response association, the non-required response automatically activated must be inhibited and the attention refocus on the relevant response to be implemented. Interestingly, the efficiency of selective response suppression can be evaluated through the analysis of RT distribution. In Experiment 1, the secondary task was a temporal task known to be very attention demanding. RT distribution analysis revealed that the DT did not alter the inhibition process. In Experiment 2, the secondary task was a visual tracking task involving more motor control. Results showed that the DT impaired the efficiency of inhibition, suggesting that

the inhibitory processes do require attentional resources but drawn from motor resources rather than perceptual ones.

### (OS\_31.2)

#### **Now you see it, now you don't: Controlling for contingencies and stimulus bindings eliminates the Gratton effect**

SCHMIDT, J. & DE HOUWER, J. *Ghent University*.

The Gratton (or sequential congruency) effect is the finding that conflict effects (e.g., the Stroop and Eriksen flanker effects) are larger following congruent trials relative to incongruent trials. The standard account given for this is that a cognitive control mechanism detects conflict when it occurs and adapts to this conflict on the following trial. Others, however, have questioned the conflict adaptation account and suggested that sequential biases might account for the Gratton effect. In two experiments, contingency biases were removed from the task and stimulus repetitions were deleted to control for stimulus bindings. This eliminated the Gratton effect in the response times in both experiments, supporting a non-conflict explanation of the Gratton effect. A Gratton effect did persist in the errors of Experiment 1; however, analyses supported the hypothesis that congruency switch costs accounted for this result. In all, the conflict adaptation account fared poorly in explaining any of the reported data. Implications for future work on cognitive control are discussed.

### (OS\_31.3)

#### **Speed-accuracy trade-offs in response times: Better use deadlines or response signals?**

DAMBACHER, M.<sup>1, 2</sup> & HÜBNER, R.<sup>1</sup>. <sup>1</sup>*Cognitive Psychology, University of Konstanz, Germany*, <sup>2</sup>*Zukunftskolleg, University of Konstanz, Germany*.

Deadlines (DL) and response signals (RS) are two well-established tools for the investigation of speed-accuracy trade-offs (SATs). While DL require responses before a pre-specified period has elapsed, responses to RS must be made immediately after an explicit signal. Thus, the detection of an additional signal in RS paradigms potentially reduces performance in the main task. Here, we compared the two techniques in a flanker task where participants indicated the parity of target digits in the presence of neutral or response-incompatible flankers. Five response intervals with upper limits from 375 to 750 ms were used in separate DL and RS sessions. Both methods yielded robust SAT functions, i.e., faster and less accurate responses for shorter intervals. Overall, the range of response times was more extended with RS. Yet, response times for late RS showed a bimodal distribution, and the flanker effect, as indicated by faster and more accurate responses for neutral than for incompatible stimuli, was smaller with RS than with DL. The data suggest that responses to RS are not a pure measure of the current state of stimulus processing but partly reflect waiting periods for the signal, potentially limiting RS-based inferences about evidence accumulation.

**(OS\_31.4)****Towards a functional view on cognitive control areas in task-switching: adaptation of different task set components**

DE BAENE, W.<sup>1, 2</sup>, ALBERS, A. M.<sup>1, 2</sup> & BRASS, M.<sup>1, 2</sup>.  
<sup>1</sup>*Department of Experimental Psychology, Ghent University, Belgium,* <sup>2</sup>*Ghent Institute for Functional and Metabolic Imaging, Ghent University, Belgium.*

Although there is general agreement on which brain areas are involved in task-switching, little is known about the functional role of these cognitive control areas in different sub-processes involved in task-switching. In the present study, we used an adaptation approach to differentiate the brain areas selectively representing one of two task set components involved in task preparation: goal setting and activation of the relevant stimulus-response mapping (S-R). When selectively repeating the task goal without repeating the S-R mappings, adaptation was found in left LPFC, IPS, precuneus and posterior cingulum. These areas showed no adaptation when the S-R mappings were repeated, suggesting that these areas exclusively encode task goal information. Selectively repeating the S-R mappings, by contrast, resulted in adaptation in bilateral motor-related areas (such as pre-PMd and M1). These motor-related areas encode primarily, but not exclusively information on the S-R mappings: also repetition of the task goal led to adaptation in these areas. Adaptation to both task goal and S-R mappings was found in left SPL, IFJ and pre-SMA.

**(OS\_31.5)****The hot hand fallacy in cognitive control**

DUTHOO, W.<sup>1</sup>, WÜHR, P.<sup>2</sup> & NOTEBAERT, W.<sup>1</sup>.  
<sup>1</sup>*Department of Experimental Psychology, Ghent University, Ghent, Belgium,* <sup>2</sup>*Institut für Psychologie, Technische Universität Dortmund, Dortmund, Germany.*

In two series of studies, the role of expectations in cognitive control was put to the test. Going back to the original interpretation of the congruency sequence effect (Gratton, Coles, & Donchin, 1992), we sought evidence for a congruency repetition bias steering attentional control. In a first experiment, we investigated how participants' explicit predictions influenced subsequent Stroop performance. Similar to the fallacious hot hand belief in gambling, subjects overpredicted repeating stimulus events. Moreover, behavioural adjustments (i.e., a Gratton effect) were only found when subjects predicted a congruency repetition, whereas alternation predictions did not impact the Stroop effect. In a following series of studies, we manipulated expectations more implicitly. Therefore, we compared two Stroop conditions in which the amount of either congruency repetitions or congruency alternations was raised. Only in the repetition condition a Gratton effect was found, which disappeared completely when alternations outnumbered repetitions. Taken together, these findings point out the importance and validity of expectancy-based proactive control. Therefore, we propose that repetition expectancy is a variable that should be given more attention in current theorizing and modelling of cognitive control, which is characterized by an emphasis on reactive, conflict-induced control adjustments.

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### ORAL SESSIONS Sunday Afternoon

OS\_(32-38): 15:40-16:40  
OS\_(39-45): 17:00-18:00

• Cognitive development •  
OS\_32, Room 5

#### (OS\_32.1)

##### Family ecology and cognitive development in two-year-old children

VELASCO, D.<sup>1</sup>, EGURZA, M.<sup>1</sup>, LERTXUNDI, A.<sup>1, 2, 4</sup>, ARANBARRI, A.<sup>1, 4</sup>, BEGIRISTAIN, H.<sup>4</sup>, SANTA MARINA, L.<sup>2, 3, 4</sup>, BASTERRECHEA, M.<sup>2, 3, 4</sup>, IBARLUZEA, J.<sup>2, 3, 4</sup> & ARRANZ, E.<sup>1</sup>. <sup>1</sup>University of Basque Country, Spain, <sup>2</sup>Spanish Consortium for Research on Epidemiology and Public Health (CIBERESP), Spain, <sup>3</sup>Public Health Division of Gipuzkoa, Basque Government, Spain, <sup>4</sup>Health Research Institute, Biodonostia, San Sebastián, Spain.

The National Institute of Child Health and Human Development has reported that high scores in family context were associated with higher scores in cognitive development as measured by the Bayley Scales in areas such as cognitive and language development as well as motor skills. The aim of our study was to analyze the relationship between family ecology and cognitive development in kindergarten-age children. The working sample is drawn from 461 families in the INMA-Gipuzkoa cohort. Cognitive development was assessed using the Bayley scales while the quality of family context was evaluated using the "Etxadi Gangoiti" scale for 2 year olds. Results show that the higher the scores in family ecology, the higher scores obtained in cognitive development. Moreover, it is very important to note that we found differences in cognitive development depending on the quality of "the stimulation of cognitive and linguistic development" and on "social-emotional stimulation". In conclusion, family context is closely related to cognitive development. Moreover, a higher quality of family context favors children's cognitive development and should be taken into account when conducting clinical and educational research into children's cognitive development.

#### (OS\_32.2)

##### Organochlorine exposure and neurodevelopment in preschool children from the Gipuzkoa-INMA project

LERTXUNDI, N.<sup>1, 4</sup>, LERTXUNDI, A.<sup>1, 3, 4</sup>, FANO, E.<sup>1</sup>, BASTERRECHEA, M.<sup>2, 3, 4</sup>, SANTA MARINA, L.<sup>2, 3, 4</sup>, BEGIRISTAIN, H.<sup>4</sup>, ARRANZ, E.<sup>1</sup>, VEGAS, O.<sup>1</sup> & IBARLUZEA, J.<sup>2, 3, 4</sup>. <sup>1</sup>University of Basque Country, Spain, <sup>2</sup>Public Health Division of Gipuzkoa, Basque Government, Spain, <sup>3</sup>Spanish Consortium for Research on Epidemiology and Public Health (CIBERESP), Spain, <sup>4</sup>Health Research Institute, Biodonostia, San Sebastián, Spain.

Background and Aims: Persistent organochlorine compounds (POCs) were widely used in the past. Diet is the major route of exposure to these compounds. The aim of this study was to assess the effects of prenatal POC exposure on neurodevelopment. Methods: 489 mothers and their 14-month-old children ([www.proyectoima.org](http://www.proyectoima.org)) participated in this study. Data were collected during pregnancy, at birth and at 14 months of age, including: socio-demographic characteris-

tics, medical and reproductive history and diet. Cognitive and psychomotor development of the children was assessed using the Bayley Scales. Polychlorinated biphenyls (PCBs) and pesticides (HCB,  $\beta$ -HCH,  $\gamma$ -HCH, p,p'-DDE and p,p'-DDT) were measured in maternal serum in the 12th week of gestation. In addition, Hg levels were measured in umbilical cord serum. Multivariate linear regression models were developed to further assess the relationship between COPs and neurodevelopment. Results: We found a significant relationship between level of PCBs and cognitive development  $\beta$ : -6.72 (95% CI: -2.12;-11.32) and psychomotor development  $\beta$ : -7.24 (95% CI: -1.71;-12.77). Conclusions: Prenatal exposure to PCBs may have a negative influence on cognitive and psychomotor development at early stages in children. We believe that it is important to analyse the influence of COPs at older ages using more accurate and reliable instruments.

#### (OS\_32.3)

##### Family context and cognitive development

ARRANZ, E.<sup>1</sup>, VELASCO, D.<sup>1</sup>, OLABARRIETA, F.<sup>1</sup>, EGURZA, M.<sup>1</sup>, GALENDE, N.<sup>1</sup>, MANZANO, A.<sup>2</sup>, MARTIN, J. L.<sup>2</sup>, IBARLUZEA, J.<sup>3</sup>, SANCHEZ DE MIGUEL, M.<sup>1</sup> & LERTXUNDI, A.<sup>3</sup>. <sup>1</sup>Basque Country University, <sup>2</sup>Etxadi, University Center, <sup>3</sup>Subdirección Salud Pública Guipuzcoa.

The goal of a series of studies conducted by groups Etxadi and Inma was to test the influence of family context variables on several fields of children's cognitive development. Protocols to assess in depth the quality of family context were carried out, on samples of children aged from 2 to 10 years, in order to analyze its influence on cognitive development, measured through reliable instruments. Family context variables, as general quality of context, mother's educational level, the use of scaffolding strategies during play and family conflict, among others, showed significant associations with theory of mind development, general intelligence, social comprehension skills and special talents in gifted children. The family context influence should be taken into account to find out its moderation relationship with other influencing factors on cognitive development. Data obtained support the development and implementation of family context enrichment programs aimed to improve cognitive development in children.

• Social cognition •  
OS\_33, Room 6

#### (OS\_33.1)

##### Influences of social hierarchy in a visual discrimination task. "I am a better competitor if you are a good competitor"

SANTAMARÍA GARCÍA, H., PANUNZI, M., DECO, G. & SEBASTIÁN-GALLÉS, N. *Brain And Cognition Unit Universidad Pompeu Fabra Barcelona.*

Many studies have shown that the hierarchical status can influence the behavior and some cognitive process in humans. In a computerized game we constructed a social hierarchy. Based on skills in a visual discrimination task we evaluated if comparisons with the other participants can influence the performance during the task. Participants were always in the second place during the game and compared their results with two other simulated players, an upper and a lower. Globally, participants were

better and faster when they made the task comparing their results with the results of the high status player. In addition they gradually improved their performance in this context. Secondly observing the time course of the event related potentials, we compared the register elicited when participants were playing the previous visual discrimination task with superior and inferior players. Two time windows were analyzed, reflecting differences in early perceptual process (< 300 ms) and the late /attentional decisional process (300 and 700 ms). Our results support a significant influence of social status on human behavior and the primary cognitive processes. A possible top down modulation of the social hierarchy can be produced even in the early stages of the decisional process.

### (OS\_33.2)

#### **Synchrony, bodily merging, and social relations**

SCHUBERT, T.<sup>1</sup>, TOSCANO, H.<sup>1</sup>, SEIBT, B.<sup>1</sup>, MAZZUREGA, M.<sup>2</sup>, PALADINO, M.<sup>2</sup> & PAVANI, F.<sup>2</sup>. <sup>1</sup>CIS, ISCTE-IUL, Lisbon, Portugal, <sup>2</sup>University of Trento.

Synchrony between sensations tags what gets integrated in the bodily representation. When the own body is stimulated in synchrony with perceived stimulation of another body part, representations of the other and the own body merge (rubberhand illusion). Experiencing such an inclusion of another person's body in the own bodily representation leads to feelings of closeness and conformity with the other. We argue that this process underlies formation and change of social relations. Here, we show in two studies that the rubberhand illusion impacts attitudes towards the other's group. Participants' hands were brushed in synchrony or asynchrony with perceived brushing of either an ingroup or an outgroup member's hand (different skin color or different age). Synchronous experiences led to the bodily illusion of felt ownership for the stranger's hand and a sense of overlap to that person. Group membership had little impact on the illusion. After experiencing synchrony with an ingroup member and asynchrony with an outgroup member, participants identified more exclusively with their ingroup, and preferred their ingroup more over the outgroup (compared to experiencing synchrony with an outgroup member and asynchrony with an ingroup member). Overlap of bodily representations is one of the embodiments underlying social identification with groups.

• Implicit learning •  
OS\_34, Room 4

### (OS\_34.1)

#### **Individual differences in implicit learning process**

POPLAWSKA, A., KOLAŃCZYK, A., STERCZYŃSKI, R. & ROCZNIEWSKA, M. *Warsaw School of Social Sciences and Humanities. Sopot, Poland.*

Implicit learning is described as process where individual differences are minimal relative to individual differences in explicit cognition (e.g., Reber, 1993). However, some researchers found correlation between implicit learning and intuitive cognitive style (Woolhouse & Bayne, 2000), the intuition facet of the Myers-Briggs Type Indicator (Kaufman et al., 2009), NEO-PI-R openness to feelings (Norman, Price & Duff, 2005), and aspects of self-reported personality (Kaufman et al. (2010). The aim of the

presented studies is to establish the role of motivation (promotion and prevention) and cognitive style (global vs. local, measured by Navon test) in artificial grammar learning task (AGL). Förster and Higgins (2005) found that promotion focus was positively correlated with global processing, whereas the reverse was true for prevention focus. In presented studies participants performed the AGL task, Navon test and their motivation was manipulated in preventive and promotive way. There was also manipulation of the instruction in AGL (liking task versus rule-conformity judgments). The results indicate that motivation has influence on implicit learning process, especially in interaction with cognitive style and instruction type. The hypothesis that the instruction in AGL task can modify influence of cognitive style and motivation on effectiveness of implicit learning is discussed.

### (OS\_34.2)

#### **Effects of mood on learning in the serial reaction time task**

JONES, E.<sup>1</sup> & NORMAN, E.<sup>1, 2</sup>. <sup>1</sup>University of Bergen, <sup>2</sup>Haukeland University Hospital.

According to the mood-as-information model (Schwartz & Clore, 2003) a sad mood may facilitate a systematic processing style involving increased attention to detail. We apply this model to implicit learning in order to investigate whether the implicit system will use a negative mood to indicate it needs to learn more. Healthy participants (N=80) were trained on a serial reaction time (SRT) task where the target stimulus was always a picture of a human face. For participants in the sad mood condition, the target stimulus was always a sad face. For participants in the happy mood condition it was always a happy face. Mood was assessed with PANAS-X (Watson & Clark, 1994). RSI was either 0 or 500 ms. There was a significant interaction between mood and RSI on the amount of learning: At RSI-500 there was a trend for sad participants to show more learning than happy participants. At RSI-0 there was no effect of mood on learning. We discuss the results in relationship to the mood-as-information model, and relate our findings to a recent study by von Helversen et al. (2011). The clinical implications of our findings are also discussed.

### (OS\_34.3)

#### **The implicit learning of metrical and non-metrical rhythms in a serial reaction-time task**

SCHULTZ, B.<sup>1, 2</sup>, STEVENS, C.<sup>1</sup>, TILLMANN, B.<sup>2</sup> & KELLER, P.<sup>3</sup>. <sup>1</sup>MARCS Auditory Laboratories, University of Western Sydney, Australia, <sup>2</sup>Lyon Neuroscience Research Center, CNRS-UMR 5292, INSERM U1028, Université de Lyon, France, <sup>3</sup>Max Plank Institute for Human Cognitive and Brain Sciences, Leipzig, Germany.

Implicit learning (IL) of musical rhythm and its properties (e.g. meter) has received minimal attention. According to the Dynamic Attending Theory (DAT; Jones, 2009), metrical frameworks facilitate temporal expectancies. It was hypothesized that learning occurs more readily for metrical patterns (MP) than non-metrical patterns (NMP). Experiment 1 used a serial reaction-time task (SRT) where learning is characterized by: RT decreases over blocks containing the exposure rhythm; RT increases when new rhythms are introduced; and RT recovery when the exposure rhythm is reintroduced. A generation

task using the Process Dissociation Procedure (Jacoby, 1991) assessed IL. Experiment 1 demonstrated IL of MPs and NMPs but the presence of meter did not improve the rate of learning. However, there was evidence of metric binding: the presentation of novel rhythms with different metrical frameworks resulted in greater RT increases than novel rhythms with the same meter. The generation task indicated that learning of MPs and NMPs was implicit. Overall, Experiment 1 indicates that metrical and non-metrical rhythms can be learned implicitly and, as per DAT, metrical frameworks can facilitate temporal expectancies. Facilitation from meter in sequence-reproduction tasks is investigated in Experiment 2 using SRT and serial recall tasks. Results for Experiment 2 are forthcoming.

• **Executive control** •  
**OS\_35, Room 3**

**(OS\_35.1)**

**Is awareness needed to achieve (partial) error cognitive control?**

ROCHET, N., CASINI, L., THIERRY, H. & BURLE, B. *Laboratoire de Neurobiologie de la Cognition, Université de Provence/CNRS, Marseille, France.*

In conflicting situations, incorrect responses tend to be activated. Subjects consciously and reliably detect suprathreshold activations leading to error commission (>90%). However, electromyographic recording in such tasks reveal that most of the incorrect activations remain subthreshold. In such trials, the subliminal activations were interrupted and corrected, revealing the involvement of cognitive control mechanisms. The question as to whether those subliminal incorrect activations are consciously perceived remains an important open issue since it has been argued that cognitive control processes require conscious experience. Awareness of incorrect response activation was assessed by asking the participants, after every trial, to report how confident they were to have activated the incorrect response. Signal Detection Theory was used to characterise subject detection performance. Mean  $d'$  and beta were high, indicating that subjects were able to detect their partial errors, but reported such detection only when they were certain. Furthermore, subjects took longer to correct detected incorrect activations. The amplitude of incorrect EMG activation correlates with subjects detection. This suggests that subjects are aware of having produced an incorrect motor command and that awareness delays correction. In most cases, cognitive processes implicated in partial error control remain unconscious.

**(OS\_35.2)**

**Dissociating top-down and bottom-up influences on intentional decisions within the medial prefrontal cortex**

DEMANET, J.<sup>1</sup>, DE BAENE, W.<sup>1</sup>, ARRINGTON, C. C.<sup>2</sup> & BRASS, M.<sup>1</sup>. <sup>1</sup>*Ghent University*, <sup>2</sup>*Lehigh University*.

The question how top-down and bottom-up influences of intentional decisions are implemented in the brain has never been systematically investigated. By combining voluntary task switching with functional magnetic resonance imaging, we investigated the involvement of the median pre-frontal cortex (PFC) in both components of intentional control. A bottom-up bias was established in

a training phase by associating a subset of stimuli with one task and another subset of stimuli with another task. By comparing voluntary task choices that are compatible (stronger bottom-up component) or incompatible (stronger top-down component) to the stimulus-induced bias, we were able to capture the brain circuits related to both components. The imaging results showed evidence for a functional dissociation within the median PFC, with the rostral cingulate zone more involved in the top-down component and the ventro-median PFC (vmPFC) more involved in the bottom-up component. Especially the involvement of the vmPFC in intentional control is an intriguing finding because it suggests that this region may be hosting implicit processes that are responsible for the formation of intentions.

**(OS\_35.3)**

**Top-down vs. bottom-up: When instructions overcome automatic retrieval**

KIESEL, A.<sup>1</sup>, WASZAK, F.<sup>2</sup> & PFISTER, R.<sup>1</sup>. <sup>1</sup>*University of Würzburg*, <sup>2</sup>*University Paris Descartes & CNRS*.

Research on human action has extensively covered controlled and automatic processes in the transformation of stimulus information into motor action, and how conflict between both systems is solved. However, the question of whether automatic S-R translation per se depends on top-down control states has received comparatively little attention. The present study addressed this issue by manipulating top-down control state (instructed S-R mapping) and automatic bottom-up processing (retrieval of S-R memory traces) independently from each other. Using a color/shape task-switching paradigm, we compared cross-talk triggered by distractor stimuli, for which the instructed S-R mapping and the S-R associations compiled at the beginning of the experiment matched, with the cross-talk triggered by distractor stimuli, for which (re)instructed mapping and compiled S-R associations did not match. The results show that the latter kind of distractors did not yield any cross-talk at all, demonstrating that automatic S-R retrieval only takes place if the S-R associations concur with the currently valid S-R mapping.

• **Judgment and decision making** •  
**OS\_36, Room 2**

**(OS\_36.1)**

**Mental representations moderate the deliberation without attention effect in complex decision making**

ABADIE, M.<sup>1</sup>, TERRIER, P.<sup>1</sup> & VILLEJOUBERT, G.<sup>2</sup>. <sup>1</sup>*CLLE-LTC Institute, University of Toulouse, France*, <sup>2</sup>*Psychology Research Unit, Kingston University, UK*.

Recent research suggests that when face a complex decision, people are likely to make better choice if their attention is distracted from the problem rather than focused on it while they deliberate on the best alternative (Dijksterhuis, 2004). The current study aimed to establish whether the nature of the decision task and the presentation format of the choice alternatives a) elicit different levels of mental representation and b) affect decision quality following a period of deliberation with or without attention. In a first experiment, we used a complex quantitative choice task. Results revealed that a detailed format allowed all participants to hold precise verbatim representations and resulted in better decision

only when deliberation was conscious. In contrast, a global format led all participants to form fuzzier representations and resulted in improved decisions only when deliberation occurred without attention. In a second experiment, we used a qualitative version of the task. A global format resulted in fuzzier representations and led to better decisions than a detailed format. Altogether these findings suggest that the effect of deliberation type on decision performance is dependent upon the representation elicited by the task. Implications of dual-memory approaches for the study of decision-making will be discussed.

(OS\_36.2)

**Mortality salience and morality: Thinking about death makes people less utilitarian**

TRÉMOLIÈRE, B.<sup>1</sup>, DE NEYS, W.<sup>1, 2</sup> & BONNEFON, J.<sup>1, 2</sup>.  
<sup>1</sup>CLLE. Toulouse. France, <sup>2</sup>Centre National de la Recherche Scientifique. Toulouse. France.

According to the dual-process model of moral judgment, utilitarian responses to moral conflict draw on limited cognitive resources. Terror Management Theory, in parallel, postulates that mortality salience (being reminded of one's own mortality) mobilizes these resources to suppress thoughts of death out of focal attention. Accordingly, we predicted that individuals under mortality salience would be less likely to give utilitarian responses to moral conflicts involving to harm one person in order to save several. A series of experiments shows that utilitarian responses to these non-lethal harm conflict scenarios are less frequent when participants are reminded of their mortality before reading the scenario. Effects of these reminders of death on utilitarian judgments are then analyzed in terms of cognitive processes by the use of a working memory load manipulation. Finally, these findings raise the question of whether private judgment and public debate about controversial moral issues might be shaped by mortality salience effects, since these issues (e.g., assisted suicide) often involve matters of life and death.

(OS\_36.3)

**The effect of state shame and guilt on risky decision-making behaviour**

HANCOCK, E. N., MCCLOY, R. & BEAMAN, P. *Psychology Department, The University of Reading, Reading, United Kingdom.*

Affective state prior to and during decision-making plays an important role in determining the level of risk people are willing to take. However few studies have taken an emotion-specific approach to exploring this. This study explored the role of two negative emotions, shame and guilt, on risky decision-making behaviour. Fifty-four undergraduate psychology students were assigned to either a state shame induction, state guilt induction or a neutral control group, they then took part in a gambling task, designed to assess risky decision-making (the Iowa Gambling Task; Bechara, et al., 1994). The results showed that state guilt induction significantly increased risky decision-making in comparison to the neutral control group, however the shame induction had no effect on level of risky decision-making compared to control participants. These findings provide support for the key role played by current affective states in risky decision-making. They also highlight the importance of adopting

an emotion-specific approach to this research area, as two arguably similar emotions were found to have very different effects on risky decision-making behaviour.

• Perception and action •

OS\_37, Room 1

(OS\_37.1)

**Action-effect blindness for response-related effects**

HEINEMANN, A.<sup>1</sup>, JANCZYK, M.<sup>1</sup>, PFISTER, R.<sup>1</sup>, THOMASCHKE, R.<sup>2</sup> & KIESEL, A.<sup>1</sup>. <sup>1</sup>Julius-Maximilians-University Würzburg, <sup>2</sup>University of Regensburg.

In the present study we investigated the perception of newly learned, arbitrary action effects. Participants associated two actions with two effects in a learning phase. In a test phase, preparing a specific action impaired the detection of the associated effect in a visual search display. Thus, our results suggest a blindness for intended action effects. The data is in line with the code-occupation hypothesis (Stoet & Hommel, 1999) which was put forth to explain a similar finding for effects whose identity is unrelated to the actions they follow (Müsseler & Hommel, 1997). Furthermore, our results indicate that action-effect blindness occurs on all stages of action control and corroborates its functional role for shielding the action-perception system against potentially conflicting stimuli.

(OS\_37.2)

**Is "Simon" responsible for the social Simon effect?**

DITTRICH, K., ROTHE, A. & KLAUER, C. *Department of Social Psychology and Methodology. University of Freiburg. Freiburg. Germany.*

In previous research, it has been demonstrated that spatial compatibility effects (SCE) are eliminated in Simon tasks when stimuli from only one response category are responded to in a single Go/NoGo condition, whereas SCE re-emerge when two participants work together in a joint Go/NoGo condition - the social Simon task. While most researchers explain the so-called social Simon effect with shared task representations, an alternative explanation is provided by the salience of the spatial dimension enhanced in the social Simon task. A first experiment intensified salience of the spatial dimension in single Go/NoGo conditions by using different response devices: Results showed larger SCE for participants responding with a joystick compared to a standard key-press condition indicating that even in single Go/NoGo conditions salience of the spatial dimension can induce SCE. The second experiment manipulated salience of spatial information by the compatibility of participants' seating alignment and spatial orientations of the stimuli in a social Simon task. Only the compatible condition but not the incompatible condition showed SCE. Overall, results suggest that the salience of spatial components can account for social Simon effects more parsimoniously.

(OS\_37.3)

**Effects of visuo-motor adaptation on the kinematics of reaching**

GIANELLI, C. & RANZINI, M. *University of Bologna.*

In the present study we applied a visuo-motor adaptation paradigm to test the motor effects of adaptation and its time course during action execution through kinematics



analysis. Action observation is known to modulate action execution, in particular facilitating the motor performance as a function of the similarity between the two actions. To date, no adaptation paradigm was used to study the kinematics effects after repeated visual exposure to actions performed by others. Participants executed three series of reaching-grasping movements of an object in three different conditions: baseline (no adaptation); congruent visuo-motor adaptation (CVMA: observation of reaching-grasping movements for 40 s); incongruent visuo-motor adaptation (IVMA: observation of pointing movements for 40 s). Each session started with the baseline recording, followed by CVMA or IVMA (counterbalanced). Results indicated that action execution was modulated by CVMA, but not by IVMA, as compared to baseline. Specifically, the accelerative phase of the reach component was modulated with a peculiar temporal pattern: indeed, facilitation effects emerged 10-15s after the end of the adaptation phase. This study suggests that motor facilitation may arise from adaptation processes as showed by the presence of long-lasting behavioral effects.

• **Language comprehension ·**  
**OS\_38, Auditorium**

**(OS\_38.1)**

**Neural basis of semantic and syntactic interference resolution in sentence comprehension**

GUO, Y.<sup>1</sup>, MARTIN, R.<sup>1</sup>, HAMILTON, A. C.<sup>1</sup>, VAN DYKE, J. A.<sup>2</sup> & TAN, Y.<sup>1</sup>. <sup>1</sup>*Department of Psychology, Rice University, Houston, TX, USA*, <sup>2</sup>*Haskins Laboratories, New Haven, CT, USA*.

Interference in sentence comprehension has been observed when a noun phrase that intervenes between a long distance subject-verb dependency has semantic or syntactic features that make it an appropriate subject of the verb (e.g., “customer” causes both semantic and syntactic interference in “The hostess who the customer ignored was talking loudly” because “customer” is a subject noun that is semantically plausible as the agent of talking). In a 2 (low vs. high semantic interference) × 2 (low vs. high syntactic interference) fMRI study, activation was measured during sentence and comprehension question processing to determine the brain regions involved in resolving semantic and syntactic interference (p corrected by cluster threshold < 0.01). One region in the left inferior frontal gyrus (LIFG; BA45) showed greater activation for the high than the low syntactic interference conditions following the onset of sentences. Interestingly, a largely overlapping region in the LIFG (BA45) also showed greater activation for the high than the low semantic interference conditions, but following the onset of comprehension questions. The results suggest that a region in the LIFG is involved in the resolution of both semantic and syntactic interference during sentence comprehension, but at different time points in processing.

**(OS\_38.2)**

**The rostroventral-caudodorsal gradient of the caudate nucleus at 7T**

MESTRES MISSÉ, A., TURNER, R. & FRIEDERICI, A. D. *Max Planck Institute for Human Cognitive and Brain Sciences*.

Lateral prefrontal cortex and basal ganglia work together to mediate working memory and top-down regulation of cognition. This system regulates the balance and interactions between automatic and high-order control responses. Using ultra-high-field high-resolution functional magnetic resonance imaging (fMRI), the present study examined the role of subcortical structures in cognitive control during language processing in humans. Participants were asked to judge the grammaticality of ambiguous, unambiguous and ungrammatical sentences. Unambiguous sentences require an automatic response, while ambiguous and ungrammatical sentences conflict with the automatic response and, hence, require a high-order control response. Furthermore, ambiguity and ungrammaticality represent two different dimensions of conflict resolution, while for ambiguity a correct alternative is available, that is not the case for ungrammaticality. The results reveal a rostroventral-caudodorsal axis in the head of the caudate nucleus with more rostroventral regions supporting higher levels of cognitive processing. This functional architecture mirrors the rostrocaudal hierarchical organization within the prefrontal cortex.

**(OS\_38.3)**

**Interference and working memory in sentence comprehension**

TAN, Y. & MARTIN, R. *Psychology Department, Rice University, Houston, USA*.

During sentence processing, interference effects have been obtained when comprehenders have to retrieve earlier information to link with later information across intervening material with features that partially match the target information. For example, for the sentence, “The resident who the manager evicted complained loudly,” interference is obtained from “manager” when retrieving the subject of “complained” because “manager” is a syntactic subject and is semantically plausible as the agent of “complained.” The working memory resources involved in retrieval and interference resolution were investigated using an individual differences approach. Ninety-six subjects read sentences in a self-paced, phrase-by-phrase fashion followed by a comprehension question. The degree of semantic and syntactic interference in the intervening material was manipulated factorially. During sentence processing, semantic interference effects were negatively correlated with semantic retention capacity, even after partialling out vocabulary knowledge. Syntactic interference during sentence processing was related only to reading span, a complex measure which involves syntactic processing. A measure of phonological retention capacity was found to be unrelated to any of the interference effects. The results are consistent with a multiple capacities approach to verbal working memory that includes separable phonological, semantic, and syntactic components, with only the latter two being relevant for sentence comprehension.

**ORAL SESSIONS**  
**Sunday Evening**

OS\_(39-45): 17:00-18:00

· **Implicit learning** ·  
**OS\_39, Room 4**

**(OS\_39.1)**

**Grammatical judgments and simultaneous reports: No evidence of implicit artificial grammar knowledge**

MARESCAUX, P.<sup>1,2</sup> & ROUJON, D.<sup>1,2</sup>. <sup>1</sup>LAPSCO - CNRS UMR 6024, <sup>2</sup>Université Blaise Pascal - Clermont Ferrand - France.

Implicit learning was early described as the acquisition of abstract knowledge about rule-governed environments that takes place largely in the absence of explicit knowledge about what was acquired. Although it was further acknowledged that this rendition constituted an oversimplification, few studies have tried to analyze verbal reports and their relation to actual performance. Two experiments on artificial grammar learning were devoted to this issue. In Experiment 1, participants having been exposed to strings generated by an artificial grammar took a grammaticality judgment test in which they were immediately asked to explain each decision they made. Verbal reports contained mainly justifications in terms of admissible/inadmissible bigrams or trigrams with additional information about their position sometimes. A computed verbal performance measure positively correlated with performance on the grammaticality test. In Experiment 2, verbal reports from each original trained participant were summarized on a sheet delivered to a yoked participant who achieved the grammaticality test without prior exposure to the grammar. Performances of original and yoked participants on the grammaticality test were indistinguishable. Overall, the findings suggest that when full opportunities are given for explicit knowledge to emerge, implicitly acquired knowledge may be wholly elicited.

**(OS\_39.2)**

**Subliminal exposure and indirect test: Evidence of passive processing in artificial grammar learning**

ROUJON, D.<sup>1,2</sup> & MARESCAUX, P.<sup>1,2</sup>. <sup>1</sup>LAPSCO - CNRS UMR 6024, <sup>2</sup>Université Blaise Pascal - Clermont Ferrand - France.

Is implicit learning a non-intentional cognitive process? Much empirical evidence supporting this issue comes from standard artificial grammar learning experiments. However, paradigms used in these studies offer some opportunities for explicit processing to occur. At encoding, time is allowed to examine the material to be memorized. At retrieval/use of the stored information, the usual grammaticality test requires to tell about the rule-based nature of the material. In two experiments, these potential pitfalls were eliminated or not by presenting grammatical strings either subliminally (29-ms), sub-optimally (100-ms) or optimally (5000-ms) at study time and by giving subsequently either a liking or a grammaticality test. In Experiment 1, new strings were rated individually for grammaticality or for liking. Grammatical items were rated higher than ungrammatical ones only in the grammaticality task and this, regardless of prior exposure duration. In Experiment 2, the new strings

(grammatical and ungrammatical) were presented in a forced choice test. Grammatical items were preferred to ungrammatical items in all conditions. However, more grammatical items were chosen in the grammaticality compared to the liking test. Overall, the findings support that implicit learning can be purely non-intentional. Nevertheless, our cognitive system tends to exploit each opportunity for additional explicit treatment.

**(OS\_39.3)**

**A statistical account of the starting small effect on learning a complex hierarchical grammar in AGL**

POLETIEK, F. *Leiden University*.

In an artificial grammar learning (AGL) study, Lai & Poletiék (2011) found that human participants could learn a centre embedded recursive grammar only if the input during training was presented in a staged fashion. Previous AGL studies with randomly ordered input, failed to demonstrate learning of such a centre embedded structure. In the account proposed here, the staged input effect is explained by a fine tuned match between the statistical characteristics of the incrementally organized input and the development of human cognitive learning over time, from low level and linearly associative, to hierarchical processing of long distance dependencies. Interestingly, the model suggests that staged input seems to be effective for learning hierarchical structures only, and is unhelpful for learning linear grammars.

· **Bi/Multi-lingualism** ·  
**OS\_40, Room 3**

**(OS\_40.1)**

**Traces of Lost Language: Using the relearning procedure to explore L1 that seemed to have lost**

KREINER, H. & MAIMON, N. *Linguistic Cognition Lab, Ruppin Academic Center, Emeq-Hefer, Israel*.

While many studies of bilingualism examine language attrition, few investigate the memory of L1 that hasn't been used for many years. The present study used Ebbinghaus' relearning procedure to explore traces of L1 in individuals who claim to have no conscious memory of their L1. Ebbinghaus demonstrated that relearning is faster than new learning and argued that this effect reflects subtle memory traces that cannot be measured in direct memory tests. In Experiment 1 dominantly Hebrew speakers, who acquired Russian as L1 and lost it, learned 30 word-pairs composed of a Russian word and its translation to Hebrew. Their learning-curves were compared to these of a control group who never learned Russian. In Experiment 2 we used similar procedure to compare 3 groups: French L1, French L2 and a control group. The learning-curves from both experiments show slow learning for the control group, and much faster learning for the Russian/French L1 group. Surprisingly the learning-curves from French L2 were similar to those of the L1 group. The findings clearly demonstrate that the relearning procedure can reveal unconscious traces of a lost language. The implications of these findings to our understanding of language attrition and language learning will be discussed.

## (OS\_40.2)

**Increased inhibitory capacity helps bilinguals resolve within- and between language competition during natural language production**

PIVNEVA, I., DELPERO, E. & TITONE, D. *McGill University.*

We investigated whether individual differences in inhibitory capacity modulate within- and between-language competition during bilingual speech production. 24 French-English bilinguals produced short sentences in response to a picture array ("The hose and the stove are above the bridge"). Filler arrays varied the syntactic forms produced ("The tape is above the rug and the car"), and parafoveal preview of upcoming pictures was blocked using gaze-contingent methods. Our dependent measure was the time participants fixated the second picture of each array before naming it (gaze-speech latency). Participants performed an L1-only block, L2-only block, and an L1-L2 mixed block. Participants also completed an executive function and language proficiency battery. As expected, gaze-speech latencies were shorter for L1 vs. L2 speech production, and for pictures with only one plausible name vs. multiple plausible names. More interestingly, increased inhibitory capacity was associated with shorter gaze-speech latencies in the L2-only block for pictures that had more than one plausible name, and with a reduced L2 production cost for all pictures in the more demanding L1-L2 mixed block. Thus, increased inhibitory capacity helps bilinguals resolve within- and between-language competition during natural language production over and above the effects of L2 proficiency.

• Language comprehension •  
OS\_41, Room 2

## (OS\_41.1)

**Taxonomic vs. thematic processing: A case of Serbian thematic preference!**

ILIĆ, O. & KOVIĆ, V. *Department of Psychology. University of Novi Sad. Novi Sad, Serbia.*

In this study we investigated thematic vs. taxonomic processing in Serbian language. Thematic relationship refers to a kind of associations which are related in time, space, function or cause, as opposed to taxonomic (or semantic) associations which share similar properties as a group. In an eye-tracking study participants were presented with an auditory cue (e.g. "monkey"), followed by presentation of three visual items. One of the three items was thematically related to the auditory label (e.g. "banana"), another one was taxonomically related (e.g. "giraffe") and the third item was unrelated to the preceding word (e.g. "bench"). Out of the 24 triads used in the study, participants deliberately chose thematic relationship for the 23 of them. The thematic preference was also evident in the greater number of fixations, and percent of the time spent on the thematically related items. Given that our participants were first year undergraduate students, the level of education or developmental shifts cannot explain the here present preference. We argue that these results call upon a need for some of the thematic-taxonomic explanations to be revisited.

## (OS\_41.2)

**Effects of spatial distance on incremental comprehension of abstract sentences**

GUERRA, E. & KNOEFERLE, P. *Cognitive Interaction Technology Excellent Cluster, Universität Bielefeld, Bielefeld, Germany.*

Embodied language research provides evidence for the involvement of perceptual processes during language comprehension. Moreover, it has been proposed that abstract concepts (e.g., similarity) are linked to experiential concepts (e.g., distance). This hypothesis was recently experimentally studied and results suggest that the distance between objects/words influences how people judge their similarity. However, no studies have examined this hypothesis during incremental language comprehension. Complementarily, psycholinguistic research has shown that non-linguistic visual information can rapidly inform language comprehension when language refers to visual context. To examine both the comprehension of abstract sentences and visual context effects further we asked whether a) visually depicted distance can affect incremental semantic interpretation of abstract sentences, and whether b) a visual context without explicit links to linguistic content can modulate real-time language comprehension. Analyses of data (N=32) from two eye-tracking reading studies revealed first-pass effects of word (Experiment 1) and card (Experiment 2) distance on incremental semantic interpretation of abstract sentences, implicating more than just a referential mechanism. The rapid (first-pass) and extended time course of the effects suggests further that relating spatial distance to abstract content is instantaneous and part and parcel of ongoing semantic interpretation.

## (OS\_41.3)

**Catching objects through words**

SCOROLLI, C.<sup>1</sup>, DAPRATI, E.<sup>2</sup>, NICO, D.<sup>3</sup> & BORGHI, A. M.<sup>1,4</sup>

<sup>1</sup>Department of Psychology, University of Bologna, Italy,

<sup>2</sup>Department of Physiology, University of Rome, "Tor Vergata", Italy, <sup>3</sup>Department of Psychology, University of Rome, "La Sapienza", Italy, <sup>4</sup>Institute of Cognitive Sciences and Technologies, CNR, Rome.

According to "embodied" theories language is founded on action. This study aims to verify if words can be intended as kinds of actions. If this is the case, then word use should determine a bodily extension, similarly to tools. In the first experiment we presented participants with objects located in the peripersonal, extrapersonal and "border" space, i.e. reachable extending the arm and the back. Before and after a training session participants had to estimate the objects distances and to push a toy-car towards the objects' location. During the "tool-yes" and "word-yes" training they used a rake or the right linguistic label to reach the far objects. In the "tool-no" and "word-no" conditions the tool and the word were not effective in accomplishing the task. Participants consciously perceived the reachable space as extended only after the "tool-yes" training; crucially analyses on the toy-car kinematics revealed a symmetric modulation also in the "word-yes" condition. In the second experiment we introduced a "switch-yes" training: participants pushed a button to reach the objects. The analogous shift on spatial representation produced by "tool", "switch" as well as "linguistic-label" trainings argues in favour of a

rearrangement of body schema determined by the social experience of language.

· **Consciousness** ·

**OS\_42, Room 6**

#### (OS\_42.1)

##### **Gaining access to conscious perception**

CHICA, A.<sup>1</sup>, BOTTA, F.<sup>2</sup>, LUPIÁÑEZ, J.<sup>2</sup> & BARTOLOMEO, P.<sup>1</sup>  
<sup>1</sup>INSERM-UPMC UMR-S 975, <sup>2</sup>Universidad de Granada.

The relationship between spatial attention and conscious perception (CP) remains highly controversial. While theoretical models and experimental data support their interdependence (Chica et al., 2010; 2011; Dehaene et al., 2006; Mack & Rock, 1998), recent studies claim that at least some forms of attention -endogenous or top down spatial attention- are neither sufficient nor necessary for CP (Koch & Tsuchiya, 2007). We will present an electrophysiological study in which endogenous and exogenous orienting mechanisms are orthogonally manipulated from CP. By analyzing two different cue-related components, our results demonstrated that while endogenous attention was electrophysiologically dissociated from CP, exogenous attention was not. Additionally, targets elicited a larger N100 component when they were presented at unattended vs. attended locations, independently of conscious reports. Our results therefore support previous claims of dissociations between some forms of spatial attention and CP, but also highlight the importance of exogenous orienting on the selection of information for conscious access.

#### (OS\_42.2)

##### **Comparing measures of consciousness in an artificial grammar learning task**

WIERZCHON, M.<sup>1,2</sup>, ASANOWICZ, D.<sup>1</sup> & CLEEREMANS, A.<sup>2</sup>  
<sup>1</sup>Institute of Psychology, Jagiellonian University, Krakow, Poland, <sup>2</sup>Consciousness, Cognition & Computation Group, Université Libre de Bruxelles, Belgium.

Consciousness can be measured in different ways, and different measures unfortunately often yield different conclusions about the extent to which awareness relates to performance. The challenge of correctly identifying which measure is best is thus substantial. Here, we compare five different subjective measures of rule awareness in the context of an artificial grammar learning task. Participants (N=217) had to express their rule awareness by means of one of five different scales: confidence rating (CR), post-decision wagering (PDW), rule awareness (RAS, a modified PAS scale), the Sergeant-Dehaene continuous scale (SDS), and feeling of warmth (FOW, a new measure). All scales were found equally sensitive to conscious knowledge, but PDW and SDS are affected by risk aversion (suggesting that CR, RAS, and our new scale FOW should be preferred). We observed that CR captures the largest range of states of consciousness (yielding the largest difference in accuracy between the highest and lowest scale points), but also that only CR fails to indicate unconscious knowledge by means of the guessing criterion (chance performance when guessing). CR's unique features suggest that it may be used in conjunction with RAS or FOW to enable finer assessment of subjective states of awareness.

#### (OS\_42.3)

##### **How to measure unconscious perception? A trial-based assessment approach**

VAN DEN BUSSCHE, E.<sup>1</sup> & REYNVOET, B.<sup>2</sup>. <sup>1</sup>Department of Psychology, Vrije Universiteit Brussel, Brussels, Belgium, <sup>2</sup>Department of Psychology, Katholieke Universiteit Leuven, Leuven, Belgium.

Unconscious processing can reach a sophisticated cognitive level. Therefore, researchers have recently been investigating what distinguishes conscious and unconscious processing. However, many of these studies suffer from critical problems. First, objective tests were used to assess prime visibility, which are heavily debated. Second, the visual strength of the stimuli critically differed in the conscious and unconscious conditions. Third, different experimental paradigms were used, making studies difficult to compare. We therefore developed a paradigm to measure unconscious perception avoiding these problems. A Stroop priming design is used, but additionally participants have to indicate on each trial how certain they are about the identity of the prime using a five-point PAS scale. Critically, this design avoids previous methodological problems: a subjective assessment of prime awareness on a single-trial basis is used; conscious and unconscious trials are separated based on the prime awareness measure, guaranteeing the same stimulus strength in both conditions; this design can be used to study a range of cognitive effects, making results more easily comparable. A series of pilot studies were conducted to optimize this paradigm. Importantly, we observed Stroop priming for both conscious and unconscious trials, making this design a fruitful approach to measuring unconscious perception.

· **Attention** ·

**OS\_43, Room 5**

#### (OS\_43.1)

##### **The bisection of words and lines depends on different mechanisms: Evidence from spatial neglect**

VERONELLI, L.<sup>1,2</sup>, VALLAR, G.<sup>1,3</sup>, MARINELLI, C. V.<sup>4,5</sup>, PRIMATIVO, S.<sup>4,5</sup> & ARDUINO, L. S.<sup>6,7</sup>. <sup>1</sup>Department of Psychology, University of Milano-Bicocca, Milan, Italy, <sup>2</sup>Department of Neuro Rehabilitative Sciences, Casa Di Cura Privata del Policlinico, Milan, Italy, <sup>3</sup>IRCCS Istituto Auxologico Italiano, Milan, Italy, <sup>4</sup>Department of Psychology, University of Rome La Sapienza, Rome, Italy, <sup>5</sup>Neuropsychological Research Centre, IRCCS Foundation Hospital Santa Lucia, Rome, Italy, <sup>6</sup>Department Of Psychology, LUMSA University, Rome, Italy, <sup>7</sup>ISTC-CNR, Rome, Italy.

In a line bisection task, right-brain damaged patients with unilateral spatial neglect (USN) set the midline to the right with respect to the objective midpoint, while unimpaired participants (UP) show a reversed bias ('pseudo-neglect'). In a recent study with UP, Arduino, Previtali and Girelli (2010) demonstrated that length differently affects the bisection of lines and orthographic stimuli, suggesting that different mechanisms may be involved in word and line bisection. The present study investigated these stimulus-dependent biases in USN patients. In Experiment 1 eleven patients and matched controls were asked to bisect words of different lengths (5-13 letters) and comparable lines. Experiment 2 focused on ortho-phonological features, requiring the bisection of words

with different final sequences (stressed on the penultimate or antepenultimate syllable). Despite an overall rightward error modulated by stimulus length, in a few patients the directional biases for words and lines conjured up a double dissociation (Exp. 1), supporting the existence of partially independent mechanisms in word and line bisection. Results from Experiment 2 indicate that the final part of a word could be used by USN patients as a cue during bisection. Globally, both visuo-spatial and lexical mechanisms seem to influence the bisection of word in USN patients.

#### (OS\_43.2)

##### **Attention to within-string position in letter-in-string identification**

MARZOUKI, Y.<sup>1</sup>, JOUANIN, M.<sup>2</sup> & GRAINGER, J.<sup>3</sup>. <sup>1</sup>Aix-Marseille University & CNRS, <sup>2</sup>Aix-Marseille University, <sup>3</sup>CNRS.

Two experiments combined exogenous spatial cueing with a letter-in-string identification task in order to examine whether attention could be directed to within-word position independently of retinal location. In Experiment 1, a spatial cue appeared in one of three horizontally aligned boxes mimicking the spatial layout of 3-letter target strings. Cues could be at the same within-string position as the target letter, or at one of the two other positions. Spatial overlap was manipulated by having targets aligned with the boxes, displaced to the left or to the right, or by reducing inter-letter spacing. Spatial cueing effects were found to be driven uniquely by within-string position independently of spatial overlap. Experiment 2 demonstrated that spatial cueing effects disappeared in the displaced and squashed conditions when the boxes were removed, confirming that attention to within-string position was driving the effects in these conditions in Experiment 1. This pattern suggests a key role for object-based attention in letter-in-string identification.

#### (OS\_43.3)

##### **Covert and overt inhibition of return in ventral and dorsal brain regions**

BOURGEOIS, A.<sup>1</sup>, CHICA, A.<sup>1</sup>, MIGLIACCIO, R.<sup>1,3</sup>, THIEBAUT DE SCHOTTEN, M.<sup>1,4</sup>, VALERO CABRE, A.<sup>1</sup> & BARTOLOMEO, P.<sup>1,2,3</sup>. <sup>1</sup>Inserm-UPMC UMRS975, <sup>2</sup>AP-HP, Groupe hospitalier Pitié-Salpêtrière, Paris, France, <sup>3</sup>Department of Psychology, Catholic University, Milan, Italy, <sup>4</sup>Natbrainlab, Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, King's College, London, UK.

When two consecutive events appear at the same spatial location, responses to the second event are slower than those to the first. This effect, known as inhibition of return (IOR), reflects a bias to preferentially attend to novel locations, which is necessary to explore our environment efficiently. We demonstrate that patients with right brain damage and left neglect present an impaired IOR under cover orienting situations, while saccadic IOR (overt orienting) is preserved (Bourgeois et al., under review). Neuroanatomical data demonstrate that all neglect patients with impaired covert IOR presented parietal damage or fronto-parietal disconnection. We used then an off-line repetitive Transcranial Magnetic Stimulation (rTMS) to determine the role of two parietal regions (right intraparietal sulcus -IPS, and right temporo-

parietal junction -TPJ) in covert and overt IOR in healthy participants. We demonstrate that TMS over TPJ replicates IOR impairments observed in neglect patients. TMS over IPS affects both covert and overt orienting. Understanding the neural basis of covert and overt IOR is crucial for understanding attentional orienting and their underlying neural mechanisms in both the healthy and damaged brain.

#### • Emotions •

#### OS\_44, Auditorium

#### (OS\_44.1)

##### **Automatic affective processing is modulated by feature-specific attention allocation**

EVERAERT, T., SPRUYT, A. & DE HOUWER, J. *Ghent University*.

We present a series of studies that suggest that, in contrast to popular beliefs, automatic affective processing takes place only if attention is assigned to the affective stimulus dimension (Spruyt, De Houwer, & Hermans, 2009). In four experiments, we encouraged one group of participants to attend the affective stimulus dimension (the affective group) and another group to attend a non-affective, semantic stimulus dimension (the non-affective group). We used different tasks to measure affective processing in each study. In Experiment 1 and 2, we used more traditional measures of affective processing: the emotional Stroop task and the dot probe task. In Experiment 3, we performed a multidimensional scaling procedure on participants' similarity judgments. This procedure yielded the weights participants assigned to the affective stimulus dimension and a non-affective stimulus dimension. In Experiment 4, we employed EEG to compare the size of the P3a component elicited by an affective and non-affective oddball stimulus. In all experiments, automatic affective processing was more pronounced in the affective group. In the non-affective group, we observed similar effects with regard to the non-affective stimulus dimension. Feature-specific attention allocation thus appears to play a crucial role in automatic affective processing.

#### (OS\_44.2)

##### **Learning names for fearful faces - on the interaction of emotion and learning**

KEUPER, K.<sup>1</sup>, BEINTNER, R.<sup>1</sup>, PETER, Z.<sup>2</sup> & DOBEL, C.<sup>1</sup>. <sup>1</sup>Institute for Biomagnetism and Biosignalanalysis, University of Münster, <sup>2</sup>Department of Psychiatry, University of Münster.

Adaptive behavior requires the brain to deal with a variety of demands such as detecting biologically meaningful events and associating them with significant contextual cues. A huge corpus of research has shown that normal observers exhibit fast involuntary responses to emotional stimuli, in particular, when these are related to potential threats, such as faces with fearful expressions (e.g. Öhman, Esteves, & Soares, 1995, Vuilleumier, Armony, Driver, & Dolan, 2001). However, little is known about the interaction of such processing advantages with other cognitive demands relevant to daily life, like associating people's names with their faces. The present study intended to shed light on this question by combining a statistical learning paradigm (Dobel et al., 2010) with behavioral and physiological measures (simul-

taneous EEG and MEG). Twenty participants were required to learn associations of visually presented pseudo names with fearful or neutral faces. Both, behavioral and physiological data reveal that new names were rapidly learned and subsequently activated the underlying conceptual representations. Further, behavioral results (cued recall and various implicit measures) display a learning advantage for neutral faces. This finding suggests that the prioritized processing of fearful faces leads to attenuated learning which might partly be due to an avoidance reaction.

### (OS\_44.3)

#### **Slow to anger: Emergence of emotionally loaded words and faces from interocular suppression**

VINSON, D.<sup>1</sup>, ANDERSON, A.<sup>1</sup>, RATOFF, W.<sup>1</sup>, BAHRAMI, B.<sup>2,3</sup> & VIGLIOCCO, G.<sup>1</sup>. <sup>1</sup>*Cognitive, Perceptual and Brain Sciences Research Department. University College London. London, United Kingdom*, <sup>2</sup>*Institute of Cognitive Neuroscience. University College London. London, United Kingdom*, <sup>3</sup>*Institute of Anthropology, Archaeology and Linguistics. Aarhus University and Centre of Functionally Integrative Neuroscience. Aarhus, Denmark*.

The involvement of emotion in lexical processing has gained a great deal of attention, with many studies showing differential processing of words with negative emotional content. It is unknown, however, whether these effects of emotion are restricted to conscious perception, or extend to preconscious processing as well. In the present study we examine the role of emotional content on preconscious face and word processing, taking advantage of interocular suppression to render a stimulus invisible for a short duration, and using an orthogonal spatial task (location discrimination) to identify the time at which a stimulus emerges from visual suppression. Consistent patterns were observed for emotional content across modality: negative stimuli (angry faces and negative words) took longer to emerge than positively valenced (happy faces and positive words) or neutral stimuli (neutral faces and words). The direction of this effect is, however, in contrast to previous studies in which negative stimuli show an advantage, rather than a disadvantage as we observe here. We discuss how differences in task demands can produce apparently incompatible patterns of results, and show how these different results can be reconciled within attentional accounts of negativity bias.

· Working memory ·  
OS\_45, Room 1

### (OS\_45.1)

#### **Declarative and procedural working memory: analogous processing principles?**

SOUZA DA SILVA, A., OBERAUER, K., GADE, M. & DRUEY, M. *University of Zurich*.

Oberauer (2009) distinguishes two working memory (WM) sub-systems: The declarative WM provides information input (memory-sets) for processing; whereas the procedural WM provides access to the processing operations themselves (task-sets). The present study tested the assumption that these sub-systems select representations in analogous ways. Participants selected a memory-list and a digit within the list (declarative representations). They selected a task-set to be applied to the digit,

and a response within that task-set (procedural representations). The number of lists (one, two, or three) and the number of tasks (one, two, or three) to be switched between were manipulated independently. Switching between lists and switching between tasks produced time costs (list-switch and task-switch costs, respectively). List-switch costs increased as a function of the number of lists (two versus three); whereas task-switch costs were not affected by the number of tasks to be switched between. Increasing the number of lists also affected task-switch costs, indicating some degree of interaction between the sub-systems. Furthermore, analogous patterns of list-mixing and task-mixing costs were observed. These findings support the hypothesis of analogous, but not completely independent, WM sub-systems.

### (OS\_45.2)

#### **Declarative and procedural working memory - two separate systems?**

GADE, M., DRUEY, M. & OBERAUER, K. *University of Zurich, Institute for Psychology, General Psychology (Cognition)*.

Oberauer (2010) proposed a two-fold working memory system underlying the human ability to pursue goal-directed actions: a declarative working memory and a procedural one. Whereas the declarative part is thought to maintain and ensure access to representations of goal-relevant objects, the procedural part contains the representations of goal-relevant cognitive or overt operations. Capacity limits in declarative working memory have been studied in the working-memory literature. Capacity limits on procedural working memory have been revealed by research on action control, showing that people can typically hold only one task set available for direct control of action. The question of our research is whether the two systems have separate capacity limits or must share a common capacity. We combined classical tasks from both research areas in a dual-task experiment: letter recognition with varying memory set size served to manipulate declarative load, and digit classification with varying number of stimulus-response rules served to manipulate procedural load. The data suggest that declarative and procedural working memory operate independently. Two control experiments show that loading either one system with two tasks creates interference due to the irrelevant load in the second task.

### (OS\_45.3)

#### **How to distract the focus of attention in working memory**

HEIN, L. & OBERAUER, K. *Department of Psychology (Cognitive Psychology Unit), University of Zurich, Switzerland*.

The study investigates how the single-item focus of attention (foa) in working memory can be distracted. The foa is assumed to hold on to the last item processed, such that sequential operations on the same item are faster than switches to a different item in working memory. To explore whether the foa can be detracted from an item by perceptual input, we used an interruption paradigm. We combined a sequential arithmetic memory-updating task with rare interruptions by perceptual stimuli, to which an immediate choice response was required. If the last item processed before the interruption remains in the foa after the interruption, object-

repetition benefits should remain when updating is resumed after the interruption. Results indicate that memory items do not remain in the foa after interruptions by responses to perceptual stimuli. Interruptions by infrequent unfilled time intervals of the same duration as the responses to the interruption task had the same effect. However, repetition benefits remained when unfilled intervals were interspersed more frequently and hence, were not surprising. We conclude that the foa can be detracted by surprise, as indicated by the disappearance of repetition benefits after infrequent events, but not when the same events occur frequently.

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## POSTER SESSION 1

## Friday Evening

Author Present: 17:20 – 19:20

## · Applied Cognitive Psychology ·

## (PS\_1.001)

**Cannabis, frontal lobe functioning and schizotypy - What is the nature of the association?**

HERZIG, D.<sup>1, 2, 3</sup>, NUTT, D.<sup>4</sup> & MOHR, C.<sup>1, 2</sup>. <sup>1</sup>*Institut de Psychologie, Université de Lausanne, Lausanne, CH,* <sup>2</sup>*Department of Experimental Psychology, University of Bristol, Bristol, UK,* <sup>3</sup>*Institut universitaire de médecine sociale et préventive Lausanne, Lausanne, CH,* <sup>4</sup>*Psychopharmacology Unit, Imperial College London, London, UK.*

Cannabis use negatively affects certain frontal lobe functions, particularly in psychotic and psychosis-prone individuals. Schizotypy -a milder form of schizophrenia symptoms in the general population- also negatively influences these functions. Interestingly, cannabis use is elevated in schizotypy, making schizotypy a likely risk candidate to predict use and harmfulness of cannabis use. We therefore followed up 12 pure cannabis users and 30 non-cannabis users (controls), and assessed their schizotypal symptoms and frontal lobe functions (response inhibition, cognitive flexibility, verbal short-term memory and working memory) at baseline, 6 months and 12 months later. Results showed that cannabis users had a significantly worse verbal short-term memory performance than controls at baseline. Response inhibition performance improved over time in both groups. Neither frequency of cannabis use nor schizotypy related to task performance. These results suggest that cannabis use a) is associated with attenuations in verbal short-term memory, b) does not lead to a worsening of frontal lobe functioning within a year, and c) and schizotypy do not predict attenuations in frontal lobe functions measured here. Future studies should consider testing non-student populations, and further elucidate whether previous reports on detrimental effects of cannabis might be explained by polydrug rather than cannabis use.

## (PS\_1.002)

**Task switching in mild job burnout: An event-related potential study**

SOKKA, L.<sup>1, 2</sup>, KALAKOSKI, V.<sup>1</sup>, HAAVISTO, M.<sup>3</sup>, KORPELA, J.<sup>1</sup>, HENELIUS, A.<sup>1</sup>, LUKANDER, J.<sup>1</sup> & HUOTILAINEN, M.<sup>1, 2</sup>

<sup>1</sup>*Finnish Institute of Occupational Health, Brain and Technology Team. Helsinki, Finland.* <sup>2</sup>*Institute of Behavioural Sciences. University of Helsinki. Helsinki, Finland.* <sup>3</sup>*Psychology Publications. Helsinki, Finland.*

Frequent switching between different cognitive tasks is required in a variety of real life situations and work assignments. We studied whether a major concern across occupations, i.e. job burnout, is associated with the task switching ability. Studies on cognitive performance and task switching in job burnout are scarce. The participants in our preliminary study were 17 currently working IT experts and managers with different degrees of burnout. The severity of burnout symptoms were determined by the total score of the Maslach Burnout Inventory - General Survey. The burnout group and healthy comparison

participants were matched on age, gender and education. The Number-Letter task was used to measure task switching cost. Performance data and event-related potentials (ERP) were recorded. The results of the ERP data showed differences in the two groups: burnout participants displayed larger P3a amplitudes than the control group in both the repetition and the task switching trials. In the performance data, no differences were found in switching costs between the groups. Consequently, our results indicate differences in physiological functioning in relation to task switching even in a fairly mild burnout group compared to healthy comparisons.

## (PS\_1.003)

**The effects of prolonged attentional bias training on mood and interpretive bias in social anxiety**

PAULEWICZ, B.<sup>1</sup>, BLAUT, A.<sup>2</sup> & GRONOSTAJ, A.<sup>2</sup>. <sup>1</sup>*Warsaw School of Social Sciences and Humanities, Katowice, Poland,* <sup>2</sup>*Jagiellonian University, Krakow, Poland.*

Attentional bias training seems to be effective in altering social anxiety but the mechanism of changes induces is currently unknown. In order to investigate whether interpretive bias could be part of this mechanism 50 students with high level of social anxiety (SAS) were divided into attentional training (AT, n=25) and control groups (n=25). The dot-probe task with neutral and angry faces was used to measure or train attentional bias. At pretesting mood and cognitive biases were measured with PANAS, STAI, Attentional Control Scale, dot-probe and (verbal) emotional version of the Posner's task. Before the first session of the dot-probe task participants rated neutral facial expressions on the threatening-friendly continuous scale. Later both groups performed 3 sessions of the dot-probe task, one in the laboratory and two at home during a 10 day period. In the posttest phase effects of training were assessed with PANAS, STAI, Interpretive Bias Scale, dot-probe, emotional version of the Posner's task and facial expressions interpretation task. The results seem to indicate that effectiveness of attentional bias training in social anxiety depends interactively on at least several affective and cognitive factors.

## (PS\_1.004)

**The influence of clinical symptoms on the efficacy of cognitive remediation program in schizophrenia**

BENGOETXEA, E.<sup>1</sup>, PEÑA, J.<sup>1</sup>, GARCÍA, A.<sup>1</sup> & OJEDA, N.<sup>1, 2</sup>

<sup>1</sup>*Faculty of Psychology and Education, University of Deusto. Bilbao, Spain,* <sup>2</sup>*CIBERSAM, Centro de Salud Biomédica en Red de Salud Mental. Spain.*

Introduction: The efficacy of cognitive rehabilitation in patients with schizophrenia and first episode psychosis (FEP) has been widely recognized. Nevertheless, the pattern of cognitive improvement remains unclear. Our goal was to identify if sociodemographic, cognitive reserve or clinical variables predict the patients' cognitive improvement. Method: 52 FEP and schizophrenia patients were recruited to attend REHACOP cognitive remediation program. All subjects underwent pre and post treatment clinical and neuropsychological assessments. Results: Regression analyses showed that the improvement in cognition after REHACOP is partially predicted by some baseline clinical characteristics. Depression had an influence on general cognition improvement, explaining the 26% of the variance

( $\beta=-0.45$ ;  $p=0.049$ ). Depression explained the 31% and 48% of the variance in verbal memory ( $\beta=-0.56$ ;  $p=0.013$ ) and verbal fluency ( $\beta=-0.49$ ;  $p=0.013$ ), respectively. Simultaneously, verbal fluency is influenced by mania ( $\beta=-0.45$ ;  $p=0.021$ ) basal ratings explaining 48% of the variance. On the other hand, positive clinical symptoms explained up to 32% of the variance both in processing speed ( $\beta=-0.57$ ;  $p=0.009$ ) and executive functioning ( $\beta=0.57$ ;  $p=0.027$ ) improvements. Conclusions: Results suggest that specific baseline clinical symptoms partially predict improvement obtained after cognitive remediation. According to these findings, we could partially predict the profile of patients that will benefit more from cognitive rehabilitation programs.

#### (PS\_1.005)

##### **Esthetics ratings differ drastically from balance ratings and physical equilibrium ratings**

SAMUEL, F. & KERZEL, D. *FPSE. Université de Genève. Geneva, Switzerland.*

In a three-part experiment we presented compositions with two black rectangles on a white surface in order to investigate which stimulus variables influence esthetics ratings, balance ratings, and physical equilibrium ratings. The three questions for the ratings where: Is the composition nice? Are the black rectangles distributed in a balanced way in the white surface? On which side and to what extent is there more "weight" on one side of the composition? The systematic variation of the stimuli allowed us to see clear differences between the three ratings: We found that a large difference between the sizes of the two rectangles influenced the perceived esthetic value positively, while it influenced the perceived balance value negatively. We also observed that the balance ratings correlated only for a few participants with the positions of the center of mass of the two black surfaces, but for all participants the physical equilibrium ratings correlated very much with the positions of the center of mass. Our findings highlight that esthetic judgments should not be considered equivalent to balance judgments and only for a few people does balance correspond to physical equilibrium.

#### • Visual Perception •

#### (PS\_1.006)

##### **How to analyse eye-movements patterns in moving images environments? The example of car driving**

NAVARRO, J. *University of Lyon II.*

Eye-tracking devices are now very common in almost all cognitive psychology research fields. These devices have initially been designed to record and analyse gaze position on still images. Gaze position recordings are therefore perfectly adapted for cognitive activities such as reading. However, cognitive activities on moving images are also of interest. For instance, a large community in the cognitive ergonomics field is working on car driving, involving moving images situations. Eye-trackers manufacturers have developed softwares to analyse the eye data recorded, but those softwares are not adapted to moving images situations. Indeed these softwares analyse gaze directions using the moving images display as system of reference and not the images themselves. The

present presentation will focus on quantitative and objective analysis of gaze position data collected on moving images environments. The different methods currently used in the car driving area will be presented and discussed according to their advantages and drawbacks. Then, what happened to be the most appropriate method, according to the comparison of the different methods presented, will be proposed as a standard method

#### (PS\_1.007)

##### **Rapidly presented letters, faces, shapes: On the left visual-field advantage in RSVP task**

ASANOWICZ, D.<sup>1</sup>, ŚMIGASIEWICZ, K.<sup>2</sup> & VERLEGER, R.<sup>2</sup>.  
<sup>1</sup>*Institute of Psychology, Jagiellonian University, Krakow, Poland,* <sup>2</sup>*Department of Neurology, University of Lübeck, Lübeck, Germany.*

In the dual rapid serial visual presentation task, two simultaneous different streams of letters with two targets (T1 & T2) embedded among distractors are rapidly presented in the left and right visual fields. Importantly, T2 is identified markedly better in the left than in the right visual field. In a series of experiments we tested two alternative explanations of the left visual field advantage (LVFA). According to the first one, the LVFA may reflect right hemisphere (RH) dominance in attentional processes. Alternatively, the asymmetry may be caused by left hemisphere (LH) disadvantage, since the LH may be overloaded by rapidly presented letters due to its specialization in processing verbal stimuli. In the first three experiments we gradually reduced distracting stimuli in order to decrease the postulated LH overload. In the next two experiments we employed stimuli for which the RH is specialized, human faces (exp.4) and shapes (exp.5). The LVFA remained consistently present across all experiments, despite the manipulations in procedure and the variation of stimuli. Therefore, the studies seem to falsify the hypothesis of LH overload, and instead suggest that RH superiority, possibly in attentional processing, underlies the LVFA in the dual RSVP task.

#### (PS\_1.008)

##### **Measuring the timing of letter identification processes**

MADEC, S.<sup>1,2</sup>, ARNAUD, R.<sup>1,2</sup> & GRAINGER, J.<sup>1,2</sup>. <sup>1</sup>*CNRS, France,* <sup>2</sup>*Laboratoire de Psychologie Cognitive, Aix-Marseille University, Marseille, France.*

How long does it take to identify a simple visual symbol like a letter? We address this general issue by measuring letter identification times for five participants (1) in a naming/delayed naming task and (2) in a perceptual identification task. To obtain an index of letter identification times from the first task, we subtract delayed naming times (indexing voice-key constraints and output processes) from naming times. We found that the resulting mean letter identification times were strongly correlated between participants and within each task. However, the correlation between mean response times per letter across tasks were surprisingly quite low ( $r[24] = .24$ ) and while letter frequency was correlated with the first task ( $r[24] = -.49$ ), this was not the case for the second task ( $r[24] = .07$ ). These results suggest that different task-dependent cognitive processes are involved in each of these experimental paradigms and that there are no task-independent ways of measuring identification

times. Simulations done with a simple interactive activation model of letter processing indicate that, in the naming/delayed naming task, lateral inhibition connections at the letter level plays a major role while feedback connections are more important in the perceptual identification task.

#### (PS\_1.009)

##### **Measuring experimental software timing errors in the presentation of visual stimuli**

GARAIZAR, P.<sup>1, 2</sup>, VADILLO, M. A.<sup>3</sup> & MATUTE, H.<sup>3</sup>.  
<sup>1</sup>*Departamento de Telecomunicaciones. Universidad de Deusto. Bilbao, Spain,* <sup>2</sup>*DeustoTech. Universidad de Deusto. Bilbao, Spain,* <sup>3</sup>*Departamento de Fundamentos y Métodos de la Psicología. Universidad de Deusto. Bilbao, Spain.*

Nowadays psychology researchers have a wide range of experimental software alternatives to meet their visual stimuli presentation needs. Nevertheless, most of these tools have to deal with two main issues: most devices used for the presentation of the stimuli have low refresh rate (typically at 60-85 Hz) and the most widely used platforms (e.g. Microsoft Windows on a PC) are not real-time systems. This study analyses the discrepancies between the experimental timing conditions defined by the researcher when using specialized software and the actual onset and offset times of the visual stimuli detected through the Black Box Toolkit photosensors. As expected, the accuracy of timing was found to be affected not only by the experimental software itself but also by the presentation devices and the underlying platform responsiveness.

#### • Perception and Action •

#### (PS\_1.010)

##### **Dissociation between perception and action in pseudo-neglect**

MASSEN, C.<sup>1</sup>, RIEGER, M.<sup>2</sup> & SÜLZENBRÜCK, S.<sup>1</sup>. <sup>1</sup>*Leibniz Research Centre for Working Environment and Human Factors,* <sup>2</sup>*Frankfurt University.*

An important question in visual cognition is whether processing visual input for perceptual judgment differs in a fundamental way from processing visual input to guide one's actions. Many studies, e.g. on visual illusions, have supported this view, but have typically focused on simple action requirements like grasping for an object. In this study, we investigated dissociations between perception and action using more complex tool-use actions. In a line bisection task, participants had to either mark the centre of a line with a pencil or cut the line in two halves using a pair of scissors. Results indicated the typical leftward bias (pseudoneglect) in the pencil task, but no such bias in the scissors task. These results indicate that the distinctiveness of processing visual input for action can be demonstrated in tasks other than grasping and support the notion of functional differences between vision for perception and vision for action.

#### (PS\_1.011)

##### **The effects of direction and identity of pointing hand stimulus on manual key press responses**

NISHIMURA, A.<sup>1, 2</sup>, ARIGA, A.<sup>3</sup> & MICHIMATA, C.<sup>1</sup>.  
<sup>1</sup>*Department of Psychology. Sophia University. Tokyo, Japan,* <sup>2</sup>*JSPS. Tokyo, Japan,* <sup>3</sup>*Department of Psychology. Ritssho University. Tokyo, Japan.*

We investigated the effects of direction (left, right), identity (left hand, right hand), and finger (index finger, little finger) of a task-irrelevant pointing hand stimulus on bimanual left/right key press responses with index or little fingers. Participants made left or right key press response according to the color of a centrally presented target. Before the onset of the target, a pointing hand stimulus, which was irrelevant to the task, was briefly presented at the center of the screen. The spatial correspondence effect based on the pointing direction and the response key position was larger for the hand stimulus of index finger pointing than of little finger pointing, indicating the spatial compatibility effect based on others' intention. The stimulus-response hand correspondence exerted a positive effect when the responses were made with little fingers, but the effect was negative when the responses were made with index fingers. The results indicate the importance of controllability of the effector in automatic imitation. The present study showed multiple automatic influences induced by perception of others' pointing hand on our own action.

#### (PS\_1.012)

##### **When articulation influences finger imitation: An event-related dual-task study**

NAKAYAMA, M.<sup>1, 2</sup> & SAITO, S.<sup>1</sup>. <sup>1</sup>*Graduate school of education. Kyoto University. Kyoto, Japan,* <sup>2</sup>*Japan Society for the Promotion of Science. Tokyo, Japan.*

The cognitive functions of language and imitation are both unique to humans. Moreover, the brain regions responsible for these functions (i.e., Broca's area) overlap somewhat. Kühn and Brass (2008) recently investigated the functional commonality of articulation and imitation using a dual-task technique. They showed that concurrent articulation facilitated finger imitation in a simple response task, which lead to the assumption that Broca's area was pre-activated. The present study explored the temporal dynamics of this facilitation effect. Specifically, we manipulated the relative timing ( $0 \pm 250$  ms) of articulation and imitation, requiring that participants pace their articulations (i.e., event-related dual tasking). An additional experimental manipulation involved the presence of an articulation preceding stimulus onset. Our results showed a facilitative effect of finger imitation, which was strongly affected by the relative timing, but not by the presence, of the preceding additional articulation. The present study highlighted the mechanism underlying the interaction and commonality of two cognitive functions, language and imitation.

## (PS\_1.013)

**The role of oculo-motor coordination in affordance**OTTOBONI, G.<sup>1</sup>, BORGHI, A. M.<sup>2</sup> & TESSARI, A.<sup>1</sup>.<sup>1</sup>*Department of Psychology, University of Bologna, Italy,*<sup>2</sup>*Institute of Cognitive Sciences and Technologies, National Research Council, Rome, Italy.*

Recently Ellis and Tucker (2000) proposed that “micro-affordances” are a consequence of object-based attention. Behavioural studies on affordances typically use asymmetrical common-use objects. To study affordance aside from the asymmetrical confound, we used a new symmetrical object (8-shaped object) whose orientation was manipulated to get the graspable part closer to participants’ hands or eyes. In Experiment 1 the entire object was coloured, in Experiment 2, only the central part of the object was. Participants (adults and children) answered according to the colours by pressing one of two lateralized keys. We had expected affordance effect for both the objects and groups, however, no effect arose in Experiment 1, maybe because attention was devoted over the whole object. In Experiment 2, instead, both the groups showed the effect but only for the graspable part close to participants’ eyes and not for that close to their hand: children showed the effect for the lower part of the object, adults for the upper part of it. The result suggests that affordances are not automatic but task-dependent. Most importantly, they indicate that the ocular components plays a crucial role allowing the affordance to emerge.

## (PS\_1.014)

**Handle-to-hand correspondence effects: Disambiguating Location Coding and Affordance Activation Accounts**  
PELLICANO, A. & BINKOFSKI, F. *University Hospital RWTH Aachen, Germany.*

Reaction times to object-tool stimuli are often faster when the task-irrelevant handle location corresponds with the response location than when it does not. According to a location coding account, object spatial coding depends on the location of its salient portion. This perceived asymmetry facilitates same-sided responses compared to opposite ones. Alternatively, an affordance activation account states that this effect depends on the activation of grasping actions towards the handle with the corresponding hand. The aim of this study was to provide disambiguating evidence whether handle-to-hand correspondence effects are produced by simple location coding or more complex affordance activation patterns. We selected pictures of tools with one salient, but non-graspable, tip and one opposite graspable, but non-salient, tip (non-jutting handle). When the graspable portion was not also visually salient, no correspondence effect was observed between its left/rightward orientation and the left/right responding hand. Conversely, a spatial correspondence effect was produced between the orientation of the salient portion and the responding hand. Results clearly support the location coding account: performance was influenced by the simple spatial coding of a visually salient property of the object. Accurate control of saliency will be crucial for future investigations on affordance effects.

## (PS\_1.015)

**Assimilation-error in tool use as a question of reference system**LADWIG, S., SUTTER, C., MÜSSELER, J., WENDLER, K. & BADE, F. *Department of work and cognitive psychology. RWTH Aachen University. Aachen. Germany.*

In tool use non-corresponding proximal and distal action effects appear to have solid impact on motor performance. Recent findings show motor behaviour assimilates towards perturbed visual feedback. In the present experiments we investigated if and to what extent these deviations will also occur in a cross-modal task of sensorimotor control. Different gains for the x-axis perturbed the relation between hand movements on the digitizer tablet and cursor movements on a display. The covered hand movement was held constant while the cursor amplitude was shorter, equal or longer, and vice versa in the other condition. Participants were asked to replicate either their initial hand amplitude (hand judgement) or the displayed cursor amplitude (display judgement) without gaining visual feedback. First, the replicated hand amplitudes varied in accordance with the non-corresponding distal effect, showing the expected solid impact of visual distractors. Furthermore, deviations remarkably increased in the cross-modal task. When participants were asked to replicate the initially seen cursor movement judgements assimilated by 56% towards the proximal distractor. To sum up, in the cross-modal task kinaesthetic/proprioceptive feedback dominated action control and overruled the visual predominance.

## • Attention •

## (PS\_1.016)

**Capturing spatial attention: Do salience and relevance have multiplicative effects?**RISOM, S.<sup>1</sup>, LIEN, M.<sup>1</sup> & RUTHRUFF, E.<sup>2</sup>. <sup>1</sup>*Oregon State University,* <sup>2</sup>*University of New Mexico.*

Many previous studies have suggested that salient-but-irrelevant objects (e.g., a flashing object) cannot capture our spatial attention if we are looking for something else. The present study examined whether salience might nevertheless be able to enhance attention capture by objects that resemble whatever are searching for. Participants were instructed to search the target display for a letter in a specific color (e.g., red) and indicate its identity (L vs. T). The target display was always preceded by a non-informative cue display. The key manipulation whether the cue contained (a) only a relevant (target-related) feature, (b) only a salient-but-irrelevant feature, or (c) a combination of salience and relevance. The cue could appear in the same location as the target (valid trials) or in a different location (invalid trials); the difference between these conditions (the cue validity effect) provides an index of attention capture by the cue. The critical question is whether validity effects are greater for objects that are both relevant and salient than objects that only relevant.

## (PS\_1.017)

**ERP correlates of effects of divided attention on directed forgetting**

MENOR DE GASPAR, J. *Department of Psychology. University of Oviedo. Oviedo. Spain.*

The aim of this study was to test the hypothesis that the reduction of attentional resources affect to the processing of items to be forgotten (TBF). The directed forgetting procedure (item-method) was used and the divided attention was manipulated between-subjects. The dual-task group performed the directed forgetting task while carried out a testing task sums. The single-task group only made the directed forgetting task. EEG was recorded and ERPs were obtained during the recognition test. The dual-task group recognized less items to be remembered (TBR) and more TBF-items than the single-task group. In 150-300 ms period, TBF items elicited ERPs more positive than TBR items on frontal electrode sites only in single-task group. In 500-700 ms period, the differences observed in single task-group between the ERPs evoked by TBR and TBF items were reduced in the dual-task group. These results challenge the view that directed forgetting in the item-method procedure is due to the passive decay of items to forget. Instead, they show that the withdrawal of processing resources during the study phase affects both the recognition of TBR and TBF items, indicating that intentional forgetting is an active process that requires attentional resources.

## (PS\_1.018)

**Hemispheric differences in the modulation of preparatory attention**

LAURA GABRIELA, F. & SIÉROFF, E. *Laboratoire de Psychologie et Neuropsychologie Cognitives CNRS FRE 3292. Université Paris Descartes. Paris, France.*

A crucial component in attentional control is the ability to prepare to the occurrence of an upcoming stimulus. LaBerge, Auclair, and Siéroff (2000) have developed the Attentional Preparatory Test (APT), which measures the ability of subjects to modulate (enhance) their preparatory attention to a target location when the probability of a distractor occurrence varies in several blocks (0%, 33%, 67%). We investigated the role of each hemisphere in preparatory attention, using a lateralized version of the APT, with targets in the right (RVF) or left (LVF) visual fields. Four experiments were conducted, varying the instructions (explicit or not about the proportion of trials with distractor) and the task (detection, localization). Although response times in the LVF were slower when distractors were present, without difference between the 33% and 67% blocks, response times in the RVF showed a linear increase as a function of the proportion of distractor trials (with the explicit instruction and regardless of the task). The results are explained by a differential hemispheric modulation of preparatory attention directed to the target and/or distractor, and are in agreement with a frequency matching strategy in the left hemisphere.

## (PS\_1.019)

**Increasing the attentional spotlight: stimulus rarity boosts attention to surrounding stimuli**

VERMEULEN, N.<sup>1,2</sup>, CHANG, B.<sup>1</sup> & MERMILLOD, M.<sup>3</sup>.

<sup>1</sup>Université catholique de Louvain (UCL), Belgium, <sup>2</sup>National Funds for Scientific Research (FRS-FNRS), Belgium, <sup>3</sup>University of Clermont-Ferrand, France.

It is well-known that attentional resource capacities are limited, though it was recently found that detecting a target can facilitate the encoding of a simultaneously presented background image, an effect called "Attentional Boost" (Swallow & Jiang, 2010). However, it is not clear whether this effect is due to the target status of the target stimulus (i.e. the status of being responded to), or to the rarity of the target stimulus. We investigated this issue in two experiments by manipulating the frequency of target and distractor stimuli. In an oddball task, half the participants pressed the spacebar in response to the rare stimulus (i.e., the target was rare and the distractors were frequent), while the other half pressed the spacebar in response to the frequent stimulus (i.e., the target was frequent and the distractor was rare). Results showed that the presence of rare stimuli increased the recognition rates of background stimuli, regardless of whether the rare stimuli were targets or distractors. These findings demonstrated that the attentional boost effect is caused by stimulus novelty/rarity, rather than target status.

## (PS\_1.020)

**Modulation of automatic and controlled processes of visual search for words by task-set**

DAMPURE, J., ROUET, J., ROS, C. & VIBERT, N. *CeRCA, CNRS - Université de Poitiers, Poitiers, France.*

Two experiments were designed to investigate whether attentional sensitization of task-congruent processing pathways modulated both controlled and automatic processes during visual search for words (attentional sensitization model, Kiefer & Martens, 2010). According to visual search models, item processing through the parafoveal/peripheral visual field would be automatic, whereas full item identification would require foveal vision. In Experiment 1, participants searched for given target words in displays where semantically-related (SW), orthographically-similar (OW) or unrelated words (UW) were present. In Experiment 2, other participants searched for the same words within the same displays, but the target words were only defined by their categories. Eye movements were recorded with a Tobii® eye-tracker. In Experiment 1, OW were fixated more often and for longer durations than UW. SW attracted participants' gaze but were not fixated for longer durations. Detailed analyses demonstrated that the parafoveal/peripheral vision of SW attracted gaze only if another SW was currently fixated, whereas OW attracted participants' gaze unconditionally. In Experiment 2, both OW and SW attracted participants' gaze and were fixated for longer durations than UW, but none of them attracted gaze unconditionally. These results argue for a top-down control of both controlled and automatic processes of visual search by task-set.

**(PS\_1.021)****Social status modulates social attention in humans**

DALMASO, M., PAVAN, G., CASTELLI, L. & GÁLFANO, G.  
D.P.S.S., University of Padova, Padova, Italy.

Humans tend to shift attention in response to the averted gaze of a face they are fixating, a phenomenon known as gaze-mediated orienting. In the present study, we aimed to address the extent to which the social status of the cuing face could modulate this phenomenon. Participants were asked to look at the faces of sixteen individuals and read a fake CV associated to each of them that could describe the person as high or low status. The association between each specific face and either high or low social status was counterbalanced between participants. The same faces were then used as cuing faces in a gaze-cuing task. The results showed a significant gaze-cuing effect for high-status faces but not for low-status faces, independently of the specific identity of the face. These findings confirm previous evidence regarding the important role of social factors in shaping social attention. Moreover, differently from previous research which manipulated facial features and physiognomic traits of the cuing faces, here we show that a modulation of gaze-mediated orienting can be observed even when social information are explicitly associated to an individual.

**(PS\_1.022)****Stroop effect in a non-emotional and emotional task**

PANADERO SANCHIS, M. A., CASTELLANOS, M. C. & TUDELA GRAMENDIA, P. *Experimental Psychology, University of Granada, Granada, Spain.*

Being the aim of the study to study the Stroop Effect in an emotional task, and compare it with a cognitive task, we conducted an experiment, using ERPs (128 electrodes) and emotional faces of fear and happiness that could be either men or women. In the cognitive task we have conflict using the word MALE or FEMALE. The response was to the gender of the face. The emotional conflict was created by using the words FEAR and HAPPINESS. The response was to the emotion of the face (Egner et al,2008). Results showed a clear main effect of task type and conflict, in the amplitude of the same group of electrodes and within the same time window between 380-690 miliseconds. Latency was influenced only by task type. The emotional task was slower and more positive in central frontal sites than the cognitive task. In central parietal electrodes the emotional task was also slower and more negative than the cognitive task. As for the conflict variable, incongruent trials showed greater negativity in central parietal electrodes and greater positivity in frontal sites than congruent trials. No interaction between types of task and conflict was found.

**(PS\_1.023)****Temporal expectancy generalizes across response locations and effectors**

THOMASCHKE, R. & DREISBACH, G. *Institut für Psychologie, Universität Regensburg, Regensburg, Germany.*

We conducted two experiments to investigate whether temporal expectancy is specific to response effectors or response locations. In a speeded binary forced-choice task, participants used four different response buttons, two (up and down) left buttons and two (up and down)

right buttons, operated by the index (down) and middle (up) finger of a given hand. Participants had to switch between the left and right button set from trial to trial. One stimulus was assigned to the upper (left/right) button, while the other was assigned to the lower button. In Experiment 1, both button sets were operated by different hands, so that fingers could rest on the buttons throughout the procedure, while in Experiment 2, participants had to operate both sets with one hand, so that fingers had to switch buttons from trial to trial. In both experiments, foreperiods (600 and 1800 ms) correlated with the two stimuli only for one button set but did not correlate with the buttons of the other set. Results show that on both button sets, responses were faster for frequent stimulus-foreperiod combinations than for infrequent ones. Thus, temporal expectancy generalizes over different effectors and response locations.

**(PS\_1.024)****The role that global reaction time and accuracy play as indirect measures of vigilance when assessing the functioning of the three attentional networks: Convergent evidence from four studies**

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The study of human attention is a key issue in understanding drivers' behaviour and preventing road traffic accidents. Recent research has attempted to develop a quick means of measuring attentional performance and to analyse the role played by each attentional function (executive control, attentional orienting, phasic alertness, and also tonic alertness) in various cognitive psychology studies and also in applied contexts, such as in driving-related studies. In the current work, the ANTI-Vigilance (i.e., a variation of the Attentional Networks Test for Interactions that includes an additional measure of vigilance) has been used and data from a series of four different studies have been analysed together to make main findings more robust. Convergent evidence from more than 150 participants shows that the ANTI-Vigilance provides a useful direct measure of vigilance, in addition to the usual ANTI measures. Significant correlations between global performance measures (global reaction time and global accuracy averaged across conditions) and Signal Detection Theory measures of vigilance were found. These results support the idea that the global measures are indirectly related to vigilance performance. The role that these measures played in previous studies using the ANT or the ANTI tasks, especially in driving behaviour research, are now further discussed.

## • Emotions •

## (PS\_1.025)

**Interference effects in recognition of facial expressions and feelings**

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In order to decide whether someone is happy or sad, we evaluate his/her facial expression. Facial expressions are universal and each emotional state can be measured on the basis of several facial dimensions (Ekman, 2009). There are two features that mainly determine the recognition of face expressions and feelings: mouth and eyes (Ambadar, Cohn, & Reed, 2009). When a person is happy or sad, morphological characteristics of mouth and eyes follow a specific configuration based on several parameters (opening, amplitude, symmetry). In this study we evaluate the consequences of presenting emotionally incongruent parameters of facial expressions. Participants were required to judge whether a person was happy or sad by evaluating eyes expressions. There were congruent faces (smiling eyes and mouth), control faces (smiling eyes and neutral mouth) and incongruent faces (smiling eyes and sad mouth). Relative to control faces, participants showed better recognition performance with congruent faces and worse recognition performance with incongruent faces. These results suggest that people consider eyes and mouth when recognizing feelings and that they get confused when face dimensions are incongruent.

## (PS\_1.026)

**Emotional anticipation in high-functioning autism**

JELLEMA, T. & PALUMBO, L. *Department of Psychology, Hull University, Hull, United Kingdom*.

Contributions of 'bottom-up' and 'top-down' influences to perceptual judgments of dynamic facial expressions were explored in adults with either typical development (TD) or Asperger's syndrome (AS). We examined the roles played by basic perceptual processes (such as sequential contrast effects and adaptation) and by 'emotional anticipation', i.e. the involuntary anticipation of the other's emotional state of mind based on the immediately preceding perceptual history. Short video-clips of faces displaying emotional expressions (100% joy or 100% anger) that morphed into a (nearly) neutral expression were presented. Both TD and AS individuals judged the final expression of the joy-videos as slightly angry and the final expression of the anger-videos as slightly happy ('overshoot' bias). However, a change in identity of the actor just before the final neutral expression was reached removed the overshoot bias in the TD group, but not in the AS group. Another manipulation, involving neutral-to-emotion-to-neutral sequences, again differentiated between the TD and ASD participants. These findings suggest that in TD individuals but not in AS individuals, the perceptual judgments of other's facial expressions are influenced by emotional anticipation (a low-level mindreading mechanism). Individuals with AS may have applied compensatory mechanisms.

## (PS\_1.027)

**Working memory updating and emotional intelligence**

ORZECZOWSKI, J.<sup>1</sup>, SMIEJA, M.<sup>2</sup> & ASANOWICZ, D.<sup>2</sup>. <sup>1</sup>*Warsaw School of Social Sciences and Humanities*, <sup>2</sup>*Jagiellonian University*.

Emotional Intelligence (EI) is defined as the ability to process emotional information; hence, its relation to elementary cognitive processes should be strong. However, to date empirical findings in this area are disappointing. According to our previous studies, showing that EI level was related to some WM measures when the task of emotional information updating was used, we assumed that EI could be related to more complex rather than elementary cognitive performance. The aim of the current research is to prove the relationship between working memory updating (WMU) and EI. WMU, understood as the ability to maintain relevant representations of information changing over time, has been successfully used to predict higher cognitive abilities (e.g. fluid intelligence level). Therefore, we suppose that efficiency of WMU concerning complex emotional information will be positively related to EI level. We used n-back task with neutral and emotional visual content (International Affective Picture System), and paper-and-pencil test of EI in the study.

## (PS\_1.028)

**Negative neighbours are activated faster than neutral ones: Evidence from a generation task**

MATHEY, S.<sup>1</sup>, DUMAY, N.<sup>2</sup> & FAUROUS, W.<sup>1</sup>. <sup>1</sup>*Bordeaux University, France*, <sup>2</sup>*BCBL, Spain*.

This research investigates whether the emotional attributes of lexical neighbours affect orthographic processing. Participants were presented with pseudo-word strings that had only one orthographic neighbour which participants had to retrieve and articulate as soon as possible. This unique neighbour had either a negative and arousing, or a neutral and nonarousing content (e.g., leprasy-leprosy vs. galaxy-galaxy). The two conditions were matched on many lexical and sublexical variables (i.e., grammatical class, length, frequency, phonological neighbourhood and bigram frequency). To test the generality of the findings, the experiment was carried out in both English and French. Given that the generation task required identifying the neighbour, we predicted that the faster and stronger activation of negative over neutral neighbours would return better performance for pseudowords that have an emotionally negative neighbour. This is exactly what we found, even after partialling the variance due to differences in onset consonants. Furthermore, the facilitation was enhanced in blocked compared to mixed presentations. Findings are interpreted in an interactive-activation model of visual word recognition and production incorporating an affective system. Ncount= 172

## (PS\_1.029)

**The dot-probe task with emotional faces reveals an attentional bias toward threat stimuli and allows to predict emotional vulnerability**

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Research showed that high trait anxiety (HTA) is associated with an attentional bias toward threat stimuli. This bias could be a vulnerability factor for stress but literature lacks of empirical evidence. Using the emotional Stroop task, MacLeod and Hagan (1992) and Van den Hout et. Al. (1995) found that subjects showing attentional bias for subthreshold threat stimuli, reported more distress under stressful conditions. Because of its ability to study the attentional allocation resources, the dot-probe task could test the same prediction more accurately. Thus, using this task with neutral and threatening faces, the aim of our study was to a) replicate results showing that HTA exhibit an attentional bias toward threatening stimuli b) address the prediction that processing bias toward threat stimuli contribute to vulnerability for stress. HTA and LTA subjects were exposed to pairs of faces presented for 500 ms or 17 ms and subsequently masked. Subjects returned a week after and were exposed to a stress condition. Anxiety was assessed with two questionnaires (STAI, POMS). Our results show that the dot-probe task permits to replicate the awaited results on bias. This task is a good candidate for predicting the anxiety level of subjects under subsequent stressful conditions.

## (PS\_1.030)

**The effects of induced sadness on the orienting of attention**

PÊCHER, C. & LEMERCIER, C. *CLLE-LTC, University of Toulouse 2. Toulouse, France*.

In the present study, we further evaluated the impact of sadness on orienting, questioning the benefits and the costs of directing attention to an expected or unexpected location. In our experiment, participants were first induced either in a neutral state or sadness, with a combined vignettes and music procedure. Then, they performed the exogenous version of Posner's orienting task, with or without a sad musical reinforcement. Analyses confirmed first that sadness was efficiently induced in participants, before performing the orienting task. In regard with RTs to Posner's task, we observed deleterious effect of sadness on orienting. The major finding was a reduction of benefits related to the presentation of valid cues, for sad participants who listened to sad music during the task, compared to controls and sad participants (without music reinforcement). Costs due to the presentation of invalid cues remained similar in the three groups. Results are discussed with regard to the literature on emotion and cognition and specific sadness-related biases that operate on attention.

## (PS\_1.031)

**Affective ratings for spanish words belonging to three semantic categories**

MOLDOVAN, C.<sup>1, 2</sup>, FERRÉ, P.<sup>1, 2</sup>, GUASCH, M.<sup>1, 2</sup> & SÁNCHEZ-CASAS, R.<sup>1, 2</sup>. <sup>1</sup>*Universitat Rovira i Virgili, CRAMC*.

In the last years, there has been an increasing interest in the study of the processing of emotional words. One of the questions of interest is to investigate the relationship between semantic and affective properties of words. Experimental paradigms such as semantic and affective priming have been used to address this question with tasks that can require the inclusion of words belonging to different semantic categories. There are several word databases that include affective ratings. One of the most frequently used is the ANEW (Bradley & Lang, 1999), adapted to Spanish by Redondo et al. (2007). However, in this data base the words of different semantic categories are not equally represented and it may be difficult for researchers to find enough number of words belonging to specific categories. In this study we present affective ratings for 400 Spanish words that were not included in the ANEW. There were 119 words referring to animals, 156 referring to objects and 125 related to persons. The norms were collected with 315 Spanish speakers who rated the words according to their valence, arousal, concreteness and familiarity. These ratings will help researchers to select stimuli for experiments where semantic and affective characteristics of words are manipulated.

## · Executive Control ·

## (PS\_1.032)

**Cognitive control in task switching assessed with imperative probes**

SACKUR, J. *Laboratoire de Sciences Cognitives et Psycholinguistique, École Normale Supérieure, Paris, France*.

Task switching is one of the major paradigms used to explore the flexibility of executive control of cognition. In the task-cuing procedure, a cue instructs the subject which task is to be performed on a target that affords two possible tasks. Switch costs are obtained by comparing performances in repeated trials versus switch trials. Although this procedure can be refined so as to disentangle effects of cue and task switches, the level at which switches impact performances may still be unclear. Here, I introduce a novel procedure to probe task-set reconfiguration and cognitive control modulation: a third task, based on imperative targets unrelated to the cues is interspersed among traditional task switching trials. This third task enables me to probe modulations of cognitive control irrespective of any performance effects on primary, cue-related targets. Results show that probe trials are slowed after a switch, and that this effect is reduced for long cue-stimulus intervals. This shows that task switching cues induce endogenous adaptations of cognitive control that cannot be explained by stimulus-level factors.



## (PS\_1.033)

**Response selection in the premotor cortex: a transcranial magnetic stimulation study**

BARDI, L. & MAPELLI, D. *Department of General Psychology, University of Padova, Padova, Italy.*

Response activation and selection in situations of conflict have been shown to recruit a large frontoparietal network. Within this network, a critical role in response selection has been attributed to premotor cortex. We applied single-pulse TMS over left and right premotor cortex (PM) at different timing after stimulus onset (SOAs) while participants were performing a spatial conflict task (the Simon task). In the Simon task a conflict arises because irrelevant spatial information competes for response selection either facilitating or interfering with performance. Responses are faster when stimulus and response position correspond than when they do not. Results showed that temporary interference with the left PM caused a suppression of the Simon effect due to a delay of corresponding trials in a early timing (160 ms SOA) while an increase of the Simon effect, due to a delay of non-corresponding trials, was observed in a later timing (250 ms SOA). These outcomes suggest that PM plays a critical role both in the activation of the corresponding response and in conflict resolution when the corresponding response has to be overcome. Moreover, our finding extends the idea of the left-hemisphere lateralization of the network for action selection in right-handed subjects.

## (PS\_1.034)

**Trait anxiety and attentional networks: An ERP study**

PACHECO UNGUETTI, A. P., RUEDA, M. R., CASTELLANOS, M. C., ACOSTA, A. & LUPIÁÑEZ, J. *Department of Experimental Psychology and Behavioural Physiology. University of Granada. Granada, Spain.*

When studying the functioning of attentional networks (orienting, alerting, and executive control) in individuals with different type and level of anxiety, we have previously observed poorer efficiency of the executive attention network in high trait-anxiety individuals as well as an overfunctioning of the alerting and orienting networks associated with state-anxiety compared to age matched controls. In the current study we aim at examining brain activation during performance of a modified version of the Attention Network Test as a function of trait-anxiety using a high-density event-related potentials technique. Participants (n=50) are individuals with high and low STAI trait-anxiety scores. Preliminary data show the most important difference between High and Low anxiety on the flanker interference effect, an index of efficiency of the executive control network. High anxiety participants show a delayed N2b effect (i.e. larger negative amplitude for incongruent compared to congruent trials) over fronto-parietal channels compared to the Low-anxiety group. Additionally, the N2b is left-lateralized for the High-anxiety group and right-lateralized for the Low-anxiety group. Further, the fronto-central P3 effect appears to be larger for the high-anxiety group. These results are consistent with the idea that anxious individuals have poorer efficiency of regulatory mechanisms important for attentional control.

## (PS\_1.035)

**On the origin of task confusions in task switching**

STEINHAUSER, M. *Department of Psychology, University of Konstanz, Konstanz, Germany.*

When participants rapidly switch between tasks that share the same stimuli and responses, task confusions can occur. The present study investigated whether these task confusions result from failures of endogenous control (i.e., task preparation) or from failures of exogenous control (i.e., stimulus-induced task conflicts). In a series of task-switching experiments, the frequency of task confusions was estimated by considering distractor errors which result when participants erroneously respond to a distractor stimulus associated with the alternative task. The efficiency of exogenous control was manipulated by varying the temporal order of target and distractor presentation. The efficiency of endogenous control was manipulated by varying the time available for preparing the task in advance. The data show that only the efficiency of exogenous control but not the efficiency of endogenous control influenced the proportion of distractor errors. This suggests that task confusions are more related to failures in exogenous control.

## (PS\_1.036)

**Task switching with a 2:1 cue-to-task mapping: Separating cue disambiguation from task-rule retrieval**

KLEINSORGE, T. *Leibniz Research Centre for Working Environment and Human Factors.*

An study is reported that investigated switching among two numerical judgment tasks with a factorial variation of the cue-to-task mapping (1:1 versus 2:1) for each of the tasks. In addition, the precuing interval (CSI) was varied. The results suggest that with a long CSI of 1,100 ms, switching performance is almost completely determined by the task-specific conditional probability of a task switch given a cue switch. This effect probably reflects the complexity of task-rule retrieval. Without preparation (CSI = 0 ms), the complexity of cue disambiguation as a function of the number of cues across tasks seems to account for most part of the additional variance observed in this condition. The latter observation is in line with suggestions that increasing the number of cues per task from one to two introduces additional demands on the level of cue processing that reflect the transition from an isomorphic to a homomorphic mapping function.

## (PS\_1.037)

**Retrieval-induced forgetting depending on an affective regulation of attentional control**

KOLAŃCZYK, A., RESZKO, M. & MORDASIEWICZ, P. *Warsaw School of Social Sciences and Humanities Faculty in Sopot.*

The retrieval-induced forgetting (RIF) depends on WM. RIF has been observed only in telic memorization. Pursuing a goal, which in this case is "remember", requires attentional control, which flexibly adjusts mental operations to situational requirements (e.g. unrelated distractors or even related tasks as retrieval practice). If WM is overloaded, attention controls only current task, not the main goal. The present studies verify the hypothesis that valuations direct attention toward goal-relevant, important objects, and devaluations divert attention from unimportant, "rubbish" objects. RIF could be the result of

devaluation (inhibition) of non-practiced words from practiced category (Rp-) or of a valuation (positive valuation & control) of non-practiced category (NRP). Individual differences in attentional control are the hypothetical moderator of RIF and goal-relevant evaluations. Therefore, stronger attentional control should produce more pronounced valuations, devaluations and RIF. The Attentional Control Scale and the affective priming task (for implicit evaluations) were introduced to RIF paradigm. The three experiments employing different amount of presented material and different number of retrieval trials, show that implicitly measured affect reflects goal orientation only in subjects who score high on Attentional Control Scale. RIF could be the result of NRP control (valuation), not only RP- inhibition.

#### (PS\_1.038)

##### **Do acute bouts of physical exercise prior to cognitive control training enhance training effects?**

ZINKE, K., EINERT, M., PFENNIG, L. & KLIEGEL, M. *Department of Psychology. Technische Universität Dresden. Dresden, Germany.*

Cognitive training can enhance performance in executive control tasks. Performance in these tasks has also been shown to be influenced by short bouts of physical exercise. Current study was designed to explore whether acute bouts of exercise (cycling on a stationary bike) directly prior to cognitive training (practicing task switching) can enhance training effects. For that purpose, a group of adolescents (10-14 years) that received a three-week cognitive training was compared to a group that received the same cognitive training but who exercised before each training session. Additionally, a no-contact and an exercise-only control group were included. All groups comprised 20 participants that were matched in age, gender, and basic cognitive functioning. Analyses indicated that both training groups significantly reduced their switching costs over the course of the training sessions and also reduced their mixing costs in a near transfer task more than the non-trained control groups. Interestingly, there was tendency for the exercise-and-cognitive-training group to commit fewer errors during training compared to the cognitive-training-only group. These findings indicate that cognitive control can be enhanced in adolescents through training and prior exercise may influence some aspects of these training effects.

#### · Motor Control ·

#### (PS\_1.039)

##### **Negative priming as an account for context-dependent sequencing behavior**

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Research suggests that retrieval of learned information is better when the original learning context is reinstated during testing than when this context is changed. Recently, such context-dependencies have been demonstrated for sequential motor skills too. The present study explored the mechanism underlying context-dependent sequencing performance. Participants practiced two 7-key sequences by responding to sequences of visual

stimuli in a particular color while ignoring a sequence of stimuli in another color. In two subsequent test blocks participants responded to either the previously ignored sequence or to an unfamiliar sequence. Results showed that responses to the previously ignored sequence were slower than to the unfamiliar sequence. During practice the participants seem to have learned to ignore locations of irrelevant (context) stimuli in order to optimize their performance on the relevant stimuli. When this formerly ignored series of locations requires responding, negative priming (inhibition) continues to affect responding and performance declines. We propose that sequential context information that is potentially interfering can be learned to be inhibited by developing a spatial inhibition strategy.

#### (PS\_1.040)

##### **Role of movement complexity and visual feedback in a sensorimotor learning task**

KIRSCH, W. *Department of Psychology, University of Wuerzburg, Wuerzburg, Germany.*

The purpose of the study was to examine the impact of sequence complexity and of visual feedback on the representation acquired during practice of hand movement sequences. The task required the participants to repeatedly hit a series of spatial targets in a fixed order. There were two target conditions and two feedback conditions: (1) a sequence of targets could consist of 5 or 7 elements; (2) during the movements the next target location could visually be presented or had to be retrieved from memory. After some practice blocks a test phase was introduced, in which participants were asked to perform the task with the untrained hand according to the original sequence of stimuli or to a mirrored version of them. We found that transfer to the same spatial locations was significantly better than transfer to the homologous muscles when the sequence was rather complex. For the simple sequence condition, in contrast, the transfer in motor coordinates was comparable to the transfer in visual-spatial coordinates. These results seem to support the view that complex movement sequences are efficiently coded in visual-spatial coordinates, whereas in simple movement sequences motor codes are given more weight.

#### (PS\_1.041)

##### **Dynamical properties of repetitive finger movements and intelligence level estimation**

DRESZER-DROGORÓB, J.<sup>1</sup>, SZELAG, E.<sup>1, 2, 3</sup> & OSINSKI, G.<sup>1</sup>. <sup>1</sup>*Cognitive Science Project, Nicolaus Copernicus University,* <sup>2</sup>*Laboratory of Neuropsychology, Nencki Institute of Experimental Biology,* <sup>3</sup>*Warsaw School of Social Sciences and Humanities.*

Neuroscience evidence has suggested that intelligence might be defined as a system ability to dynamic adaptation to changes in environment. According to this thesis, the most important dimension shared by all adaptation levels is time, conceptualized as temporal structure appearing in human behavior. Personal tempo (PT) can be considered as a promising measure of both dynamics of a human action and intelligence as well. PT may be understood in many ways. For the purposes of this study, PT will be taken to mean as opposite to maximum tempo (MT). The present study investigated 120 students' dynamical properties of temporal control of repetitive

finger movements in PT and in MP. The Raven's Advanced Progressive Matrices was applied as a measure of intelligence. Nonlinear elements for the reconstruction of dynamical properties of PT and MT were performed. We found intelligence-related differences in fractal properties of repetitive finger movements in PT. The data would seem to suggest that speed and complexity (fractal properties) of PT were related with complexity and variability of MT. That outcome of the present study encourages us to conclude that temporal structure differences is a good index for intelligence level estimation.

#### (PS\_1.042)

##### **Effect-based control of social action**

KUNDE, W.<sup>1</sup>, LOZO, L.<sup>2</sup> & NEUMANN, R.<sup>3</sup>. <sup>1</sup>*Department of Psychology. University of Wuerzburg*, <sup>2</sup>*Department of Psychology. University of Technologies Dortmund*, <sup>3</sup>*Department of Psychology. University of Trier*.

Goal-oriented actions, by definition, aim at producing certain changes in the environment. Such actions have to be governed by codes of anticipatable action consequences. We explored whether actions that produce consequences in the social environment (such as facial expressions) are governed by anticipatory codes of social effects as well. In agreement with such a proposal, we found that the generation of facial expressions was harder when participants produced predictable facial feedback from a virtual counterpart that was incompatible with their own facial expression, such that e.g. smiling produced the presentation of a frowning face. Further experimentation confirmed that this expression-effect compatibility effect was due to the mimic content of the feedback rather than to more peripheral visual properties. These results comply with the assumption that the anticipation of social consequences of facial expressions plays a substantial role in the generation of these facial actions.

#### (PS\_1.043)

##### **Congruent and incongruent cues in highly familiar audiovisual action sequences: An ERP study**

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In a previous fMRI study we found significant differences in BOLD responses for congruent and incongruent semantic audiovisual action sequences (whole-body actions and speech actions) in bilateral pSTS, left SMA, left IFG and IPL. Here our main goal was to examine the time-course of these differences using event-related potentials (ERPs). A one-back task was performed while 128 channel EEG data was recorded. ERPs in response to congruent and incongruent audiovisual actions were compared to identify regions and latencies of differences. Responses to congruent and incongruent stimuli differed between 240 - 280 ms, 320 - 400 ms, and 400 - 700 ms after stimulus onset. A dipole analysis (BESA) revealed that the difference around 250 ms can be partly explained by a modulation of sources in the vicinity of the superior temporal area, while the responses after 400 ms are consistent with sources in inferior frontal areas. Our results are in line with a model that postulates early recognition of congruent audiovisual actions in the pSTS, perhaps as a sensory memory buffer, and a later role of

the IFG, perhaps in a generative capacity, in reconciling incongruent signals.

#### · Numerical Cognition ·

##### (PS\_1.044)

##### **Brain activity during multiplication in more- and less-skilled adults: an event-related potential study**

SOBANSKA, M., SZUMSKA, I., WARAKOMSKI, D. & JASKOWSKI, P. *University of Finance and Management*.

It is widely assumed that high-skilled adults use retrieval strategy to solve single-digit multiplication problems more frequently than others, who often base on more time-consuming and more error-prone procedural strategy. The latter is usually applied in problems of large products which may be a source of so-called problem-size effect. The aim of the present study was to compare the brain activity during multiplication in more- and less-skilled adults. Previously Jost et al. (2004) showed that topography of a slow negative wave, associated with the implicate production of multiplication result, varied with the problem type (small v. large), finding which was explained in terms of using different solution strategies (retrieval v. non-retrieval). However the level of participants' arithmetic skills was not controlled. To investigate the cause of the topographical differences described before we used the same implicit production task with event-related potentials (ERPs) recorded from 64 scalp positions in 70 subjects. Basing on the behavioral data, e.g. speed and accuracy of simple arithmetical problems solving, we established two groups: 11 more-skilled participants, and 15 less-skilled participants. Further analysis will be carried out and discussed in the framework of models of mental arithmetic.

##### (PS\_1.045)

##### **A study on the operand-order effect in single-digit multiplications in Italian and English mother tongues**

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In order to better understand the internal organization of the memory network that encodes arithmetic facts we studied the effect of operand-order on the speed of solution of one-digit multiplications. 24 Italian participants were asked to report the result of the operations. The analysis of the RTs showed an interaction between the size of the problem (both operands larger than 5, e.g. 7x8; one larger and the other smaller than 5, 3x7; and both smaller than 5, 3x4) and the order of the operands (first larger, 8x4; and second larger, 4x8). When both operands were larger than 5, the problems with the second operand larger were solved faster, e.g. RT(7x8)<RT(8x7). When one operand was larger and the other was smaller than 5, the problems with the first operand larger were solved faster, RT(7x3)<RT(3x7). Similar results were obtained in a second experiment in English (24 participants). We exclude the interaction is due to the operand-order during the acquisition of the multiplication table, given that the two languages differ in the order of operands during the table learning. The results can be rather explained by a model of retrieval with an asymmetric right skewed activation of multiples around ties.

**(PS\_1.046)****Numerical abilities in deaf children with Cochlear Implant. Evidences from magnitude comparison tasks**

IZA, M., RODRIGUEZ, J. M., CALLEJA, M., GARCIA, J. & DAMAS, J. *University of Malaga*.

Usually deaf children show lower scores in numerical tasks than normal hearing peers. Explanation of mathematical disabilities in hearing children are based on a quantity representations deficit (Geary 1994) or on an access deficit to such representations (Rousselle&Noël 2008). The aim of this study is to verify whether deaf people show a deficit in representation or in access to numerical representations by using both symbolic (Arabic digits) and non-symbolic (dot constellations and hands) magnitude comparison tasks. 10 profoundly deaf children using cochlear implants (mean age 9) and 10 normal-hearing children, matched in IQ, visual STM, oral language skills and age, participated in the study. Numerical distance (1vs3-4) and magnitude (1-5vs5-9) were manipulated. RT analysis show a significant interaction TaskxGroup [ $F(2,36)=3.68$ ;  $p=.035$ ]: No differences were found between both groups in non-symbolic comparison tasks, however deaf participants were slower than hearing participants in the symbolic task. Magnitude and distance effects were found across groups and tasks. Our results suggest that magnitude representations are similar in both groups. However, deaf children seem to have difficulties in accessing magnitude representations through symbolic codes. Following Budgen&Ansari (2011), a slower activation of semantic numerical information might explain deaf children lower scores in numerical tasks.

**(PS\_1.047)****What is important for numerical-spatial association?**

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<sup>1</sup>University of Murcia, <sup>2</sup>University of Granada.

A debated question in cognitive psychology regards to the origin of the numerical-spatial associations that are usually found when individuals process numbers. Recent works have shown that visuospatial or verbal short-term representations of numerical information could be responsible of these spatial effects. Moreover, ordinal information, instead the longstanding assumed magnitude information, seems to have a prominent role when participants perform a parity task. In the present work, we conducted a series of experiments in which different types of non-verbal information (ordinal, visual or spatial) had to be maintained while participants performed a comparison task or a parity judgment task. The results showed that type of information to be maintained produced a differential effect on the numerical-spatial association. However, it is also dependent on the numerical task.

**(PS\_1.048)****Discrete and continuous quantity judgment in adults: Number counts more than area!**

NYS, J. & CONTENT, A. *Laboratoire Cognition Langage Développement (LCLD), Université Libre de Bruxelles (ULB), Brussels, Belgium*.

A Stroop-like paradigm was used with 57 adult participants who were asked to perform (1) a number judgment and (2) an area judgment on dot collections orthogonally

varying along a discrete dimension (number of dots) and a continuous dimension (cumulative dot area). In the number comparison task, as expected, incongruent trials for which the largest number of dots corresponded to the smallest cumulative area led to larger error rate and reaction times than congruent trials for which number and area covaried positively. This finding suggests that area is automatically processed and integrated during a discrete quantity judgment task. Interestingly, a similar interference effect was observed in the area comparison task, providing evidence that adults are unable to ignore numerical features of the stimuli even when task-irrelevant. Moreover, participants tended to select the numerically largest collection when cumulative area, the task-relevant dimension, was equal for both sets. By contrast, in the number comparison task, they showed no preference for the set with the largest area when the number of dots was identical for both collections. Contrasting with earlier statements, these results support the view that, in adults, number is automatically extracted and acts as a more salient cue than area.

**(PS\_1.049)****The stability of the SNARC effect - can we reach it?**

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The SNARC (Spatial Numerical Association of Response Codes) effect is regarded as an index of the association of numbers and space. Although the SNARC effect has been consistently replicated, almost no studies reported between-groups differences. This led some to question the sensitivity of the SNARC effect to individual differences. Here we examined whether the lack of differences is due to poor estimation. The impact of sample size, number of repetitions per condition, and intraindividual variability on the probability of finding a non-zero SNARC effect was investigated. Simulations revealed that the most important factor determining the probability of detecting non-zero SNARC effect was the number of repetitions per condition. Moreover, very small sample sizes jeopardize the detection of SNARC, particularly when the number of repetitions is small. Therefore, failures to find significant between-groups differences is due foremost to lack of power to detect them, rather than to the absence of those differences. Fortunately, an adequate estimation of the SNARC effect is possible even with modest sample sizes when using 20 or more repetitions per condition. We conclude that the SNARC effect has the potential to reveal much more individual differences than what was reported before.

## • Patient Studies •

## (PS\_1.050)

**Prader-Willi Syndrome: Is the executive deficit independent from mental retardation?**

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The Prader-Willi syndrome (PWS) is a genetically determined neurodevelopmental disorder characterized by a mild intellectual impairment and a maladaptive behaviour including hyperphagia, temper tantrums, and obsessive/compulsive traits. The aim of this study is to determine if the SPW is associated with a deficit of executive functions and whether the executive deficit is related to mental retardation or represents a clearly separable complaint. Thirteen adults with PWS were compared to age-matched control adults on three executive functions tasks. The results show that PWS individuals have poorer performance than controls in the updating task, in the planning task, and in the four subtests of the cognitive estimation task ; Weight estimation; Quantity estimation; Time estimation, Dimension estimation. After controlling Total IQ, the effect of group persists only on the Quantity estimation. The results confirm that the SPW have an impairment of executive functions which seems related to a mental retardation.

## (PS\_1.051)

**A neuro-computational account of lexical development in Williams Syndrome children**

MAYOR, J. *Basque Center on Cognition, Brain and Language, Donostia, Spain.*

Williams Syndrome (WS) children possess relatively large vocabularies when compared to their other, impaired, cognitive skills. However, their language acquisition is delayed, their vocabulary spurt is less marked than for typically-developing infants, categorisation skills are weak when their vocabulary is already large and they do not respond taxonomically. This pattern of findings led Nazzi and Bertoncini (2003) to suggest that WS children acquire a large "proto-lexicon" by gradually attaching several exemplars of a category to their appropriate sound pattern in an associationist mechanism. This hypothesis is tested by hindering the formation of visual categories in a model of early word learning (Mayor and Plunkett, 2010) so as to mimic WS weak categorisation skills. In the absence of lesions, the model accounts for the emergence of taxonomic responding and displays a vocabulary spurt. Generalisation of word-object associations relies on categorical representations. In contrast, when categorisation is impaired, lexical acquisition is delayed, a vocabulary spurt is absent and word-object associations are not generalised. However, through repetitive labelling events, the system is still able to map several object exemplars to their appropriate sound patterns in a fashion described in Nazzi & Bertoncini (2003), thereby leading to the formation of a surprisingly large vocabulary.

## (PS\_1.052)

**Rhythms can overcome temporal orienting deficit after right prefrontal damage**

TRIVIÑO, M.<sup>1</sup>, ARNEDO, M.<sup>2</sup>, LUPIÁÑEZ, J.<sup>2</sup>, CHIRIVELLA, J.<sup>3</sup> & CORREA, A.<sup>2</sup>. <sup>1</sup>Hospital Universitario San Rafael. Granada, Spain, <sup>2</sup>Departamento de Psicología Experimental y Fisiología del Comportamiento. Universidad de Granada. Granada, Spain, <sup>3</sup>Hospital Nisa Aguas Vivas. Valencia, Spain.

The main aim of this study was to explore whether the use of automatic temporal preparation processes can overcome the deficit in the controlled temporal preparation processes shown by patients with frontal damage (i.e. Temporal Orienting and Foreperiod effects). Two tasks were administered to a group of 15 frontal patients, and a group of 15 matched control subjects: a Symbolic Cued task where the predictive information was provided by a symbolic cue (short line-early vs. long line-late) and a Rhythm Cued task where the predictive information was provided by a rhythm (fast rhythm-early vs. slow rhythm-late). Firstly, in the Symbolic Cued task, patients with right frontal damage showed a specific deficit in Temporal Orienting effect, while the Foreperiod effect was impaired in both groups of patients. Secondly, in the Rhythm Cued task, there was an improvement of both Temporal Orienting and Foreperiod effects in right frontal group, while the left frontal group showed a significant deficit of both effects. These findings show that automatic processes of temporal preparation facilitate the use of implicit temporal information, as well as they provide a novel suggestion for a neural model in which automatic temporal preparation is left-lateralized and controlled temporal preparation is right-lateralized.

## (PS\_1.053)

**Exploring APOE e4 genotype effects in healthy young adults: structures or cognitive strategies?**

RUSTED, J.<sup>1</sup>, BROULIDAKIS, J.<sup>1</sup>, DOWELL, N.<sup>2</sup> & RUEST, T.<sup>1</sup>. <sup>1</sup>Sussex University, Brighton, UK, <sup>2</sup>Brighton and Sussex Medical School, Brighton, UK.

The APOE e4 genotype is associated with higher risk for cognitive impairment and dementia in older adulthood. In younger adults, however, a number of studies report carriers of this allele perform better on cognitive tasks than their age-matched non-e4 peers. We present behavioural and structural imaging data to explore differences between healthy e4 carriers and their non-e4 counterparts. First we examine structural MR imaging data, to examine whether there are subtle differences in normal appearing brain tissue that might produce cognitive benefits in e4 carriers. Second, we collected verbal fluency data, using switching and clustering indices, to distinguish any strategy differences that may account for a previously reported advantage of e4 over non-e4 carriers on this task. Behavioural results suggest e4 carriers may use more effective cognitive strategies; structural imaging data identified higher density white matter in e4 carriers, suggesting also greater neural efficiency. We discuss the implications of these findings in relation to the APOE genotype effects observed in older adults.

## (PS\_1.054)

**Reading and spelling in deaf children with cochlear implant in primary school**

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Objective: The aim of this study was to examine the literacy skills of deaf children in primary school with cochlear implantation ("CI") and exposed to Cued Speech ("CS", manual system aimed at resolving the ambiguity inherent in lipreading). We predicted (1) an effect of the early implantation; (2) a contribution of early exposition to CS. Participants: 120 deaf and hearing children from grade 2 to 5 took part in the study; deaf sub-groups were formed on the basis of the age at implantation (earlier vs later) and exposition to CS (earlier vs later). Method: Phonological, silent reading (word recognition and sentence comprehension), word spelling and vocabulary tests were administered. Results: They showed (1) a significant contribution of CI after having controlled chronological age in different scores only at the beginning of the learning (grades 2 and 3), suggesting a decrease of this effect in the time; (2) that CS exposition contributed to 2-3% of the overall variance in scores but was not significant in the different grades, suggesting that the conditions in which CS is proposed to implanted children could be a more precise factor to examine its potential contribution in learning to read and spell. Researches are pending.

## • Judgement and Decision Making •

## (PS\_1.055)

**Split-second decisions: Emotional modulation effect on response bias activation in weapon identification**

LUINI, L. P., MARUCCI, F. S. & MASTROBERARDINO, S. *Psychology Department "Sapienza" - University of Rome; Italy.*

Cognitive psychology research focused on the relationship between automatic and controlled cognition referred to split-second decisions (Payne, 2001) and examined the effect that race as ethnic group factor leading to a response bias had on shooting decisions using video-game-like tasks (Correll et al., 2002, 2006). A weapon bias was reported in judgment denoted as a perceptual weapon/tool classification (Payne, 2001) and as a behavioural shoot/do not shoot decision (Correll et al., 2002; Greenwald et al., 2003). The aim of this study was to investigate the impact of arousal, valence and content of IAPS pictures on measures of perceptive sensitivity ( $d'$ ), response bias and RT. Four weapon identification tasks were performed manipulating emotional and arousing contents of visual stimuli. Results showed a significant interaction between valence and prime on: 1) Criterion (C); 2) hit and false alarm rate; 3) RT. A significant effect of arousal on Criterion (C) was found and an amplification of effect size was observed when visual stimuli with

negative valence represented crime or violence scenes as compared to non-crime or non-violence ones. Findings are consistent with the hypothesis that affective modulation influences response bias activation and performance, and that content of stimuli amplifies the effect size.

## (PS\_1.056)

**Pain-related goal conflict under uncertainty: Its effect on decision making behaviour and pain perception**

SCHROOTEN, M.<sup>1,2</sup> & VLAEYEN, J.<sup>1,2</sup>. <sup>1</sup>Maastricht University, The Netherlands, <sup>2</sup>University of Leuven, Belgium.

Decision making is often accompanied by intra-personal conflicts between incompatible goals. Little is known about the functional role of goal conflicts in pain. Therefore, this study examined the effects of pain-related goal conflicts on choice patterns and pain perception. Seventy five undergraduates performed a choice task with on every trial a certain probability of delivery of painful stimulation and/or money. In each trial, participants choose between decreasing the probability of receiving painful stimulation vs. increasing the probability of receiving money (approach-approach conflict), between increasing the probability of receiving painful stimulation vs. decreasing the probability of receiving money (avoidance-avoidance), between increasing vs. decreasing both probabilities (approach/avoidance-approach/avoidance). Following each choice, there was 80% chance that probabilities changed. For each stimulation delivered, participants rated painfulness, unpleasantness, threat value, and fear of a subsequent painful stimulus. Mood was rated four times throughout the task. Conflict strength was derived from choice latency and number of switches between choice alternatives. First results suggest that in the avoidance-avoidance conflict situation, the number of switches predicted pain-related threat and fear, with these effects being mediated by current mood. This finding supports a motivational view on pain, focussing on pain perception and behavior in the context of multiple goals.

## (PS\_1.057)

**Perceptual decision-making: Information integration or a two stage process?**

KEUKEN, M.<sup>1,2</sup>, FORSTMANN, B. U.<sup>1</sup> & VAN MAANEN, L.<sup>1</sup> <sup>1</sup>Cognitive Science Center Amsterdam, University of Amsterdam, Amsterdam; The Netherlands, <sup>2</sup>MPI for Human Cognitive and Brain Sciences, Leipzig; Germany.

A popular paradigm in perceptual decision-making is the random-dot motion task (RDM). In this task participants have to indicate the direction of motion of a cloud of moving dots. Typically, the targets are perpendicular to the central axis, but previous research has shown that the location of targets influences the decision-making process. In Experiment 1 participants performed an RDM task with different target locations. We found that behavior becomes faster and more accurate when the angular distance between the targets increases to 90 degrees but inverts when the distance increases more. There are two possible explanations for this pattern. The first is that motion perception is a two-stage process in which first the movement axis is determined, and then the direction of motion. The second is that information on the movement axis and the motion-direction is integrated over time until a choice is made. In Experiment 2, these

explanations were tested by letting participants rate their confidence after each choice. According to the two-stage process, we predicted an increase in confidence ratings for incorrect choices with an increasing angular distance. According to the information integration, the opposite pattern was expected. Results from experiment 2 clearly favor the information integration explanation.

## (PS\_1.058)

**The speed and accuracy of perceptual decision making in a Random-Tones Pitch task**

MULDER, M. J., FORSTMANN, B. U. & WAGENMAKERS, E. *Department of Psychology, University of Amsterdam, Amsterdam, The Netherlands.*

Research in perceptual decision making is dominated by paradigms that tap the visual system. For example, a popular paradigm used to measure the speed and accuracy of a perceptual decision is the random-dots motion (RDM) task. In this task, participants have to decide quickly whether a cloud of dots is moving to the left or to the right on a computer screen. Although this two-alternative forced choice task has proven to be extremely useful to study simple decision processes, results are limited to the visual modality. To investigate whether the underlying dynamics of perceptual decisions apply to the auditory field as well, we developed an auditory version of the RDM paradigm where tones correspond to dots and pitch corresponds to motion. Psychophysical features underlying the auditory stimulus were kept similar to those used in the visual task. We will show that the stimulus strength of the random-tones pitch (RTP) task has a similar effect on the speed and accuracy of a perceptual decision. Furthermore, by combining the two tasks we will be able to investigate the effects of simultaneously presented audio and visual stimuli on the decision process. Results will help understand how humans use information from different modalities to optimize their choice behavior.

## (PS\_1.059)

**The cognitive strategies of expert poetry composition**

BEATTY, E. & BALL, L. *Lancaster University.*

Poetry composition represents an excellent, if understudied, domain to examine from a cognitive perspective. It requires idea generation, balancing choices amongst multiple options, planning, revision and finally evaluation. While anyone can write a poem it takes a certain set of skills to write a good poem. Our research methodology is twofold. First, we have been conducting interviews with poets to gather reflective data on their creative processes and sources of inspiration. Second, we have been conducting laboratory-based studies of expert poets undertaking writing tasks while verbally reporting their thoughts using a 'think aloud' technique. The results of our studies indicated that initial idea generation is quite associative and is often related to items or instances that are close in proximity and/or time to the poet. Once an idea has been selected a search is again conducted focused around that idea and during this process an initial line is produced. This first line is greatly influential to the progress of the poem. While the writing is ongoing the poets seem to engage in self-questioning behaviour in response to writing blocks. It is the value and impact of the self directed questions that are explored in this analysis.

## (PS\_1.060)

**The monitoring of task conflict and response conflict**

BRAVERMAN, A. & MEIRAN, N. *Ben Gurion University of the Negev, Be'er Sheva, Israel.*

Using a task switching paradigm, the authors independently manipulated two kinds of conflict: task conflict (with information that potentially triggers the relevant or the competing task rule/identity) and response conflict (with information potentially triggering the relevant or the competing manual response). Blocks with high/low proportion of task/response conflict trials were included. It was found that performance was poorer with conflict than without conflict, indicating task conflict effect (TCE) and response conflict effect (RCE). Importantly, the RCE diminished in blocks with high proportion of conflict trials, regardless of conflict type whereas the TCE was unaffected. Implications for theories of conflict monitoring are discussed.

## · Human Learning/Implicit Learning ·

## (PS\_1.061)

**Positive feedback at the end of an unsolvable test (but not at the beginning) makes students believe they did well**

ORGAZ, C., MATUTE, H. & VADILLO, M. A. *University of Deusto, Bilbao, Spain.*

Recent research has shown that providing easy items at the beginning of a test makes students believe they do better in it. This could be due to the earlier items being easier, but it could also be due to students' subjective, auto-administered positive feedback during the first part of the task. In two experiments we kept the test items constantly unsolvable and manipulated whether positive or negative feedback was presented during the first or the second part of the test. In Experiment 1, the students showed recency. That is, they thought that they did better when they received positive feedback during the last part of the test and they thought that they did worst when they received negative feedback during the last part of the test. Experiment 2 replicated this result and showed that this recency effect vanishes after one hour, which is consistent with the abundant literature on recency-to-primacy shifts in various experimental paradigms. Thus, well-known learning and memory effects such as recency, primacy, and spontaneous recovery affect not only the contents of memory but also perceived self-efficacy.

## (PS\_1.062)

**On the interplay between information, behavior and judgments in the illusion of causality**

YARRITU CORRALES, I. & MATUTE, H. *Universidad de Deusto, Bilbao, Spain.*

In two experiments we test how the presentation of biased information before the actual experiment can induce causal illusions. The potential cause was a fictitious medicine and the effect was recovery from a health crisis. Group Induced was pre-informed about the number of patients in which the effect (recovery from the crisis) occurred when they took the medicine. Group Warned was pre-informed about the number of patients that had recovered without taking the medicine. Both

groups were then presented with 100 trials (one per patient). In Experiment 1 the patient could have taken the medicine or not and could feel better or not. The drug-recovery contingency was zero. However, participants in Group Induced showed an illusion that the drug was effective. In Experiment 2 the medicine had to be administered (or not) by the participant (rather than the patient). In this case, our pre-information manipulation resulted in participants in Group Induced administering the drug significantly more often than participants in Group Warned. This in turn produced a larger number of coincidences between the drug and the recovery and a larger illusion. In other words, the illusion of causality was mediated by the behavioral increase produced by the pre-information manipulation.

#### (PS\_1.063)

##### **The representation and activation of evaluative connotations - behavioral and ERP correlates of the evaluative priming effect**

SCHMITZ, M. & WENTURA, D. *Saarland University*.

A long-standing debate in the field of cognition and emotion deals with the question of how evaluative connotations are represented in semantic memory. For this purpose, evaluative priming (i.e., processing valent targets following either valence-congruent primes or incongruent primes) with non-evaluative tasks (e.g., semantic categorization task) was considered a useful paradigm. However, published results are still inconsistent: congruence effects, null results, and even incongruence effects were found. We put forward the assumption that congruence effects may be traced back to the target-encoding facilitation by a valence-congruent prime, whereas incongruence effects may be attributed to the prime-activation maintenance by a valence-congruent target and a subsequent increase of response conflicts. To test this assumption, we used the semantic categorization task (person vs. animal) and a negative stimulus-onset asynchrony between prime and target to minimize target-encoding facilitation and to maximize prime-maintenance. As expected, response priming effects (i.e., faster responses if prime and target are response compatible compared to incompatible) were only found given valence-congruence of prime and target thereby indicating that only evaluatively congruent primes are activated sufficiently to interfere with the target response. ERP correlates (N2, lateralized readiness potential) corroborate the behavioral findings. Implications for the representation of evaluation are discussed.

#### (PS\_1.064)

##### **Comparing effects of orientation and structure in implicit learning of serial actions with three most recent methods**

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We hereby examine the influence of orientation to learn and stimulus structure on performance in the serial reaction time task - implicit learning paradigm involving sequentially structured visual stimuli. In six conditions inducing different interactions of these two factors, we assess the nature of the knowledge acquired by participants. Using the methods of PDP - comparison of transfer

contrasts with post-test recognition scores-, ANCOVA - comparing reaction times and their covariance with the material's probability structure - and SDT - analysis of confidence judgements in recognition -, all three analyses converge and confirm weak explicit learning compensated by implicit influences when the probability of the material is intermediate between deterministic and pseudorandom. However, effects of orientation for that same material condition are only captured by the second and third methods, showing that participants explicitly engaged in the learning process effectively acquire a large amount of explicit knowledge, but of poor quality. Thus implicit learning would automatically occur in relation with the material structure, whereas explicit learning would depend on both the orientation to learn and an ability to match the material structure with the coherent mental models allowing control of the acquired knowledge.

#### (PS\_1.065)

##### **Cognitive control of sequential knowledge in children and children with autism**

PICHON, C., KISSINE, M. & DESTREBECQZ, A. *Free University of Brussels*.

The card-sorting test is a well-known test of cognitive control. In this task, subjects have to classify cards according to one of two dimensions (i.e., either the color or the shape of the stimuli). Based on explicit instructions, children are unable to switch rules before the age of 4. Recently, Bremner et al. (2007) found that 2-years-old children acquire the ability to manipulate and inhibit mental representations when learning is implicit. These results suggest that inhibition seems to develop in early stages of life. Despite the proven difficulty of autistic children with executive functions (including inhibition), implicit learning remains largely unexplored in this population. Hence, in the present study, we trained children with a deterministic sequence of six elements. We compared the ability of normal and autistic children to learn flexibly and to reproduce a visual sequence (inclusion condition) or to produce a different sequence (exclusion condition). Our results show that children with autism are able to learn a visual sequence and also to inhibit the production of the first sequence. These results are discussed regarding the potential importance of implicit learning for cognitive control in autism.

#### (PS\_1.066)

##### **Perceptual sequence learning without eye movements?**

COOMANS, D., DEROOST, N., VAN DEN BUSSCHE, E. & SOETENS, E. *Department of Cognitive Psychology. Vrije Universiteit Brussel. Brussels, Belgium*.

We examined whether pure perceptual sequence learning occurred in a serial reaction time task in which eye movements were avoided. Participants had to respond to the identity of a target letter pair ("XO" required a left button press, "OX" a right button press,) appearing in one of four locations between similar distractor letter pairs ("YQ" or "QY"). While target identity, and therefore manual responses, changed randomly, target location followed a fixed sequence. To avoid eye movements as much as possible, (1) the letter pairs appeared around a fixation cross with a small visual angle and (2) stimulus duration was only 100 ms, a period too short to allow eye movements. At the end of the training, a block in which



the trained fixed sequence was replaced by a new fixed sequence was inserted to be able to assess learning. The results showed that the perceptual location sequence was learned in this experiment, as participants responded slower in this 'new sequence' block than in the surrounding 'old sequence' blocks. Consequently, pure perceptual sequence learning does not rely on eye movements and cannot be considered as a sort of motor learning.

• Memory •

(PS\_1.067)

**How does collaboration facilitate recognition? A study using the remember-know paradigm**

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Collaboration impairs free recall (Weldon & Bellinger, 1997; Wright & Klump, 2004), but facilitates recognition (Clark et al., 2006). The present study investigated the effects of pair collaboration and word-frequency on recognition memory, using the "remember/know" procedure. The aim was to test the predictions of the information-exchange hypothesis (Clark et al., 2000), which states that collaborative facilitation occurs when participants are able to share recollective memories with other members of the group. Results showed that recognition performance was significantly better in the collaborative than in the individual condition, and better for low- than for high-frequency words. The advantage of collaborating pairs was produced by an increase of correct hits, coupled with a significant reduction of false alarms. The analysis of the "remember" (R) and "know" (K) responses indicated that the effects of group collaboration and word-frequency were larger on recollection than on familiarity processes. It is concluded that both variables influence the retrieval of the contextual details associated with the target words. It is also proposed that a reduction in the probability to accept new items on the basis of familiarity (K) responses may account for the decrease in false alarms in collaborative groups.

(PS\_1.068)

**Prospective memory for cheaters**

HORN, S., BELL, R., BAYEN, U. & BUCHNER, A. *Heinrich-Heine-Universität Düsseldorf*.

Prospective memory (PM) refers to self-initiated remembering of intended actions after a delay. One influential perspective in evolutionary psychology implies that the human mind comprises cognitive modules for social exchange, including a module serving to enhance memory for cheaters. We assumed that PM tasks may be particularly sensitive and ecologically valid in this regard, given the high importance for any future interaction to remember cheaters. In our study, participants first played a trust game with computerized opponents who either cooperated, defected, or were neutral in terms of social exchange. In a subsequent PM task, faces of the previous cooperators, defectors, and neutral persons appeared as target events, mixed with distracter faces that did not occur in the trust game. A multinomial model analysis

revealed that the prospective component of the PM task (i.e., remembering that something needs to be done) was increased for defectors relative to cooperators or neutral persons. These findings indicate that event-based PM is particularly sensitive to socially relevant targets.

(PS\_1.069)

**A common process to compute typical size difference and perceptual size difference?**

RIOU, B. & VERSACE, R. *Laboratoire d'Etudes des Mécanismes Cognitifs (EMC). Université Lumière Lyon 2. Lyon, France.*

This study assesses whether memory and perception share common processes. We used a visual priming paradigm to test if a typical size (size in real life) difference could improve the detection of a perceptual size difference. The primes were pairs of familiar objects displayed simultaneously. The two objects had either the same or different typical sizes. Two squares, with the same or a different displayed physical size, were presented as targets. The participants were instructed to decide whether the two squares displayed simultaneously had the same or different size. Our results showed a priming effect: the latencies to detect the target physical size difference were shorter when the typical size between the primes was also different rather than the same. Further, when both the typical size of primes and the physical size of targets were different, latencies were shorter when, at a same location of the screen, the typical size of one of the primes mismatched the physical size of one of the targets. We therefore discuss the results following the embodied cognition framework. We conclude that memory and perception could share a common process to compute typical and perceptual size difference.

(PS\_1.070)

**Do judgments of learning lead to improved memory?**

LARSSON SUNDQVIST, M., TODOROV, I. & JÖNSSON, F. *Department of Psychology, Stockholm University.*

Judgments of Learning (JOL) that are made after a delay, instead of immediately after study, are more accurate in terms of predicting later recall (the delayed JOL effect). The Self-Fulfilling Prophecy (SFP) theory describes the delayed JOL effect as the result of a testing effect. In this experiment we tested the prediction that performing delayed JOLs leads to a memory improvement. During learning, 79 participants studied Swahili-Swedish word pairs, immediately followed by a cued recall test, and then made either one single or three repeated, spaced JOLs. A final cued recall test was given after either 5 minutes or 1 week. Making repeated JOLs did not increase memory performance compared to the single JOL condition, hence lending no support to the SFP theory.

(PS\_1.071)

**Investigating secondary-distinctiveness-based effects in ageing**

YANNICK, G. & SERGE, N. *Paris Descartes University.*

Secondary distinctiveness effect means that items that are unusual compared to one's general knowledge stored in permanent memory are better remembered than common items. The present research investigated two typical cases of secondary-distinctiveness-based effects

in ageing: the bizarreness effect and the orthographic distinctiveness effect. Experiment 1 confirmed that ageing diminishes the facilitative effects of bizarreness in a mixed list design with equal numbers of bizarre and common images. We suggest that the absence of bizarreness effect in older adults (above age 70) may be due to reduced attentional resources, since a similar pattern of results was observed for younger adults in the divided attention condition. Experiment 2 studied the orthographic distinctiveness effect in ageing for the first time. Surprisingly, an orthographic distinctiveness effect was observed for all participants including older adults and younger adults in a divided attention condition. Because reduced attentional resources due to normal ageing or to experimental manipulation did not impair the facilitative effects of orthographic distinctiveness, our results suggest that the orthographic distinctiveness effect may be mediated by more automatic processing.

(PS\_1.072)

**Emergence of knowledge: generalization and specification mechanisms**

CHERDIEU, M., MAZZA, S. & VERSACE, R. *Laboratory EMC. University Lyon 2. Lyon, France.*

The aim of the present study was to investigate the sensory nature of memory and knowledge. Different studies based on the idea that knowledge is multimodal highlighted that all the sensory components of a memory trace can be reactivated if the participant is confronted with an object previously associated to this trace (whatever the sensory modality). We used in this study a paradigm divided into two phases. The first phase consisted in learning an association with a shape (a circle or a square) and a sound (a white noise). We also manipulated the sound frequency in each category obtaining a high frequency category: one shape presented without sound among shapes presented with sound; and a low frequency category: one shape presented with sound among shapes presented without sound. The second phase consisted in a priming task where the prime shape (without sound) preceded an object (associated or not with a noise in memory). We hypothesized that the presentation of a shape previously associated with a sound, facilitated the treatment of a "noisy" object. Furthermore we also expected the appearance of generalization and specification mechanisms as found in other studies.

(PS\_1.073)

**The role of completion strategy in implicit word fragment task**

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Performances on implicit test (priming) refer to facilitation to perform a task consequently to previous experiences but without to require its recollection (Schacter, 1987). But, it is not always certain whether an implicit task is performed solely on the basis of implicit memory. In order to investigate this possibility, first we manipulated factors which classically affect explicit performances but not priming on implicit memory test: repetition mode and age (Stevens, Wig, & Schacter, 2008) and, second we used a post-test questionnaire about completion strategy of participants. Based on the questionnaire,

we differentiated two completion strategies: pure implicit strategy vs. explicit contamination (use, at least partially, intentional recollection). Interestingly, in the "implicit" group, young and elderly actually did not differ significantly on priming and priming was equivalent between repeated words in a massed vs. spaced fashion. Whereas young and elderly differed significantly on priming and priming differed too as a function of repetition mode, in the "explicit contamination" group. To conclude, we emphasized the necessity to check completion strategy of subject during implicit completion task. So, it will be interesting to develop a more objective method to check intentional recollection use in order to detect explicit contamination on priming.

(PS\_1.074)

**Semantic information of scene contexts disturbs recognition of target objects**

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Natural scenes are reported to be processed rapidly and automatically. We investigated how and what kind of information of scene contexts affects memory of target objects presented in them. We conducted a delayed match sampling test presenting meaningful or scrambled scenes in the background and measured performances of object recognition when background context was unchanged, changed or absent in the recognition phase. The results showed; (1) response time was longer with different background compared to same or no background context; (2) Tendency to give "old" responses was higher with the same background than in other conditions. Both effects were observed only when meaningful backgrounds were utilized. These results indicate that the effect of background context associated with the targets is not always facilitative as the classical encoding specificity principle would predict, but can be considered as distractive when different context is presented. Also indicated was that the meaning of unchanged background context biases the judgments to be more gravitated to correctly and falsely recognizing target objects. It is arguable from these results that non-target semantic information of the scene contexts is memorized automatically and disturbs the retrieval of target objects.

(PS\_1.075)

**Differential outcomes and spatial recognition memory in five and seven-year-old children**

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Background: It has been demonstrated that the differential outcomes procedure (DOP) facilitates both conditional discrimination learning and delayed face recognition in humans. In the present study, we extend this procedure to five and seven-year-old children who were asked to remember spatial locations. Method: Two computerized spatial working memory tasks were used. In the differential outcomes condition each location was paired with its own outcome. In the non-differential condition outcomes were randomly arranged. Results: Five-year-old children

showed a significantly better performance when differential outcomes were arranged. By contrast, the overall performance of children aged seven was similar in both conditions, differential and non-differential, suggesting that the task used was very easy for them to perform. Conclusions: These results showed, to our knowledge for the first time, that the DOP can enhance spatial recognition memory performance in children. This finding, along with those of Hochhalter, Sweeney, Bakke, Holub, and Overmier (2000) and López-Crespo, Plaza, Fuentes, and Estévez (2009) suggests that this procedure can be a technique to improve memory performance in children and in people with memory impairments. This research was supported by grants CSD2008-00048 and PSI2009-09261 from Spanish Ministerio de Ciencia e Innovación.

#### · Working Memory ·

##### (PS\_1.076)

#### **Does high work-related stress impair working memory capacity?**

KALAKOSKI, V., AKILA, R., VUORI, M. & PUTTONEN, S. *Finnish Institute of Occupational Health. Helsinki, Finland.* The ability to perform complex cognitive tasks requires working memory (WM). In work assignments there are several factors that may impair WM functioning. We studied whether long-term exposure to high psychosocial stress, i.e. a combination of high job demands and low job decision latitude, is related to impaired WM capacity. As a part of a large research project, the WM capacity of 99 nurses (n = 43 in High Work Stress Group and n = 56 in Low Work Stress Group) was measured. Visuo-spatial WM span was estimated with a computer-based Symmetry span test consisting of storage of a set of locations, and processing of symmetry information (Kane et al. 2004). Verbal WM span was assessed with an operation span task consisting of word lists to be remembered and arithmetic operation tasks (Turner & Engle, 1989). The High Work Stress group showed a somewhat smaller WM capacity than the Low Work Stress group, suggesting that high work load impairs working memory functioning. We discuss the interaction of workload with other factors, e.g. age, and whether the observed lower performance level in WM tasks is explainable by other cognitive functions, such as inefficiency of visual search or short-term memory encoding.

##### (PS\_1.077)

#### **Phonological errors in working memory and speech production**

SCHWEPPE, J.<sup>1</sup>, GRICE, M.<sup>2</sup> & RUMMER, R.<sup>1</sup>. <sup>1</sup>*Cognitive Psychology, University of Erfurt, Germany,* <sup>2</sup>*Phonetics, University of Cologne, Germany.*

We test the assumption that verbal working memory and speech production are closely related by having a closer look at how phonological features influence errors in serial recall and in a tongue twister task. In serial list recall, syllables with onset consonants that are acoustically similar (sharing the MANNER feature, e.g. pa-ta) were more frequently confused than syllables with dissimilar consonants, with both auditory and visual input and written and oral output. Articulatorily similar items (with consonants sharing the PLACE feature, e.g. da-za) led to more errors than dissimilar items only with

oral recall, that is, only when the task involved overt articulation. For the tongue twister task (paced reading aloud of syllables with incompatible onset and rhyme patterns, e.g. pam-tos-tam-pos), the error pattern resembled that of oral serial recall. The recall data suggest a greater role for input than for output similarity. A comparison between the recall and the tongue twister data indicates that verbal working memory and speech production are similar in that they are similarly influenced by both internal features (acoustic similarity affects serial recall and paced reading in the absence of acoustic input) and by motor codes (articulatory similarity affects those tasks that require overt articulation).

##### (PS\_1.078)

#### **Developmental interplay between attentional refreshing and articulatory rehearsal in working memory**

OFTINGER, A. & CAMOS, V. *Département of psychology, University of Fribourg, Fribourg, Switzerland.*

Past research in adults shows two mechanisms of maintenance of verbal information in working memory, articulatory rehearsal and attentional refreshing. Rehearsal in Baddeley's model is already in use at 7 years of age (Tam, Jarrold, Baddeley, & Sabatos-DeVito, 2010). At that age, children also use attentional refreshing mechanism described in time-based resource-sharing (TBRS) model (Barrouillet, & Camos, 2010). The present study evaluated the interplay between these two mechanisms and its changes from 7 to 9. In a complex span task, children have to maintain letters, while they performed a concurrent task. The opportunity for attentional refreshing was manipulated by varying the attentional demand of the concurrent task. This task was performed either silently or aloud, the latter involving an additional articulatory suppression. As expected, recall performance increased with age. The articulatory suppression had a detrimental effect on recall, but it did not varied across the age groups. Finally, increasing the attention demand of the concurrent task reduced recall, but this effect did not interact with age, or with articulatory suppression. To conclude, the efficiency of the articulatory rehearsal or the attentional refreshing did not improve from 7 to 9, contrary to previous results.

##### (PS\_1.079)

#### **Working memory capacity in French-German bilinguals**

PERRIARD, B. & CAMOS, V. *Department of Psychology, University of Fribourg, Fribourg, Switzerland.*

It was suggested that bilinguals have advantage on complex non-verbal tasks, because of the superiority of their executive functions (Bialystok et al., 2010). More especially, Bialystok et al. (2004) have shown that bilinguals gave faster answers on trials in a Simon task and concluded that bilinguals had better inhibitory capacity. However, in a replication with children when language and socio-economic status (SES) are controlled, difference between bilinguals and monolinguals disappears (Morton & Harper, 2007). The aim of the present study is to reassess the difference between bilinguals and monolinguals adults while controlling other variables as Morton and Harper did. We then contrasted in a Simon task two groups of young adults with equivalent mean age, French proficiency, SES, and working memory capacity. Contrary to previous findings, our two groups showed no difference in the Simon task. Thus, it could be suggested

that previous observed difference relied on impact of other variables like SES. It remains possible that the better inhibitory capacity between monolinguals and bilinguals depends also on the distance between the two languages mastered by the bilinguals. Indeed we contrasted two European languages whereas Bialystok compared Asian population speaking English.

#### (PS\_1.080)

##### **Effect of dynamic and static visual noise on the recognition task of color shades**

SANT'ANNA PEREIRA, M. & GALERA, C. *Department of Psychobiology. University of Sao Paulo. Ribeirao Preto. Brazil.*

Working memory is involved in an important range of everyday tasks such as learning, reading, comprehension, argumentation, decision making and reasoning. This short term system allows us to perform the storage and manipulation of information simultaneously, while a particular cognitive task is performed. This study aimed to investigate the effects of dynamic visual noise (DVN) and static visual noise (SVN) on visual working memory. The task was to recognize colors and shades. Thus, one color was presented on the center of the screen and after a short interval of time, it was showed a second color. The participants had to judge whether the two showed colors were the same or different. During the interval, the participants stood staring at the screen that could be white (control) or filled by the visual noise (static or dynamic). The partial results showed that participants performance was impaired by the presence of noise. However, there was no difference between the DVN and SVN conditions, suggesting that the noise affected the visual memory task performance, regardless of its nature.

#### (PS\_1.081)

##### **Spatial and non-spatial contributions to visual short term memory**

BARRETT, D. *School of Psychology, College of Medicine and Biological Sciences, University of Leicester, Leicester, UK.*

Recent neuroimaging evidence suggests visual short term memory (VSTM) is subserved by separate spatial and non-spatial components. This study uses a change detection task to investigate whether and how these components combine. Observers were presented with memory and probe arrays separated by an ISI of 1500 ms. Memory arrays contained three or four uniquely oriented Gabor patches. Probe arrays contained two Gabor patches randomly selected from the memory array; one identical and one that had changed (target). Targets could change their orientation, location or a combination of both and change in each dimension was manipulated using five equally spaced step sizes. Observers reported the identity of the target on each trial and the probability of a correct response was compared across conditions. The results revealed a linear relationship between step size and target detection in all three conditions. Detection thresholds ( $P = .75$ ) for orientation targets were smaller than those for location targets. Detection thresholds for combined and orientation targets were equivalent. These findings support independent spatial and non-spatial components in VSTM. When target-change

occurs across both components, performance appears to be based upon a winner-takes-all competition between spatial and non-spatial information.

#### · Semantic Memory ·

#### (PS\_1.082)

##### **Function and manipulation tool knowledge coded in lateral anterior temporal lobe and inferior parietal lobule: Evidence from an rTMS study**

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A remarkable cognitive ability in humans is the competency to use a wide variety of different tools. Two cortical regions, the anterior temporal lobes (ATL) and left inferior parietal lobule (IPL), have been proposed to make differential contributions to two kinds of knowledge about tools: function vs. manipulation. We used repetitive transcranial magnetic stimulation (rTMS) and two semantic decision tasks to assess the role of these regions in healthy participants. Participants made semantic decisions about the function (what for) or manipulation (how) of tools used in daily life. The stimulation of ATL resulted in longer responses for the "function" judgments, whilst stimulation of IPL yielded longer responses for the "manipulation" judgments. In line with the neuropsychological literature, these results indicate ATL and IPL disproportionately contribute different aspects of the representation of tools, supporting the "hub-and-spoke" theory of semantic memory.

#### (PS\_1.083)

##### **Individual differences in strength of category-based relations vs. event-based relations**

MIRMAN, D. & GRAZIANO, K. M. *Moss Rehabilitation Research Institute, Philadelphia, USA.*

Knowledge about word and object meanings can be organized around categories, such as fruits or mammals, which are defined by shared features, or around events such as eating breakfast or taking a dog for a walk. An eye-tracking study showed that both kinds of knowledge are automatically activated during comprehension of a single spoken word, even when the listener is not required to perform any active task. The results further revealed that an individual's relative activation of category-based relations compared to event-based relations predicts that individual's tendency to favor category or event relations when asked to choose between them in a similarity judgment task. These results argue that individuals differ in the relative strengths of their category-based and event-based semantic knowledge and suggest that meaning information is organized in two parallel, complementary semantic systems.

## (PS\_1.084)

**Possible cerebellar contributions to semantic fluency**

KENT, J.<sup>1</sup>, MATTHEWS, S.<sup>1</sup>, BOLBECKER, A.<sup>1,2</sup>, RASS, O.<sup>1</sup>, KLAUNIG, M.<sup>2</sup>, JONES, M.<sup>1</sup>, O'DONNELL, B.<sup>1,2,3</sup> & HETRICK, W.<sup>1,2,3</sup>. <sup>1</sup>*Department of Psychological and Brain Sciences, Indiana University, Bloomington, IN, USA*, <sup>2</sup>*Larue D. Carter Memorial Hospital, Indianapolis, IN, USA*, <sup>3</sup>*Department of Psychiatry, Indiana University School of Medicine, Indianapolis, IN, USA*.

Although the role of the cerebellum in motor coordination has long been appreciated, only recently has its role in cognitive processes been explored. Theoretical models of psychopathology identify the cerebellum as a critical node in a coordinative network regulating cognition. We tested the hypothesis that performance on a cerebellar-dependent associative learning task (delay eyeblink conditioning) would be correlated with semantic fluency performance in healthy individuals (n=10) but not in schizophrenic (n=8) and bipolar (n=11) participants, where cerebellar anomalies have been reported. Subjects completed delay eyeblink conditioning (EBC) and a semantic fluency task. During EBC, an airpuff that elicits an unconditioned blink response is repeatedly paired with a tone. Subjects develop a conditioned blink response (CR) to the tone that precedes the airpuff. In the semantic fluency task, subjects name exemplars from the "animal" category for two minutes. In healthy participants, but not in schizophrenia or bipolar participants, the number of items generated on the semantic fluency task correlated with CR timing ( $r(9) = -0.71$ ,  $p = 0.02$ ). This relationship between performances on a cerebellar-mediated task (delay EBC) and semantic fluency in healthy participants supports the hypothesis that the cerebellum is involved in the coordination of cognitive processes in individuals with intact cerebella.

## (PS\_1.085)

**Playing patty-cake interferes with comprehending the names of objects that are interacted with manually**

YEE, E.<sup>1,2</sup>, CHRYSIKOU, E.<sup>2</sup>, HOFFMAN, E.<sup>2</sup> & THOMPSON-SCHILL, S.<sup>2</sup>. <sup>1</sup>*Basque Center on Cognition Brain & Language*, <sup>2</sup>*University of Pennsylvania*.

How do we know the meaning of words? Sensorimotor-based theories of semantic memory claim that semantic information about an object is distributed over the neural substrates that are invoked when we perceive and interact with it. Hence, occupying a neural substrate that is an important part of an object's representation (e.g., with a concurrent secondary task) should interfere with accessing that representation. In the current work, participants made concreteness judgments about (heard) names of objects while either simultaneously performing a patty-cake-like task on a table, mentally rotating objects, or performing no concurrent task. Objects varied in the extent to which one interacts with them manually (e.g., tiger=low manual interaction, pencil=high manual interaction). We found that performing a concurrent task increased errors for all objects. Critically, however, during the patty-cake task, errors were greatest for objects rated as high in manual interaction. (In contrast, the concurrent mental rotation task did not disproportionately increase errors for manual objects.) These findings suggest that engaging brain regions underlying manual interaction (with an incompat-

ible manual task) interferes with comprehending the names of that are manually experienced. Hence, these regions appear to be part of (rather than peripheral to) the representation of frequently manipulated objects.

## • Speech Perception •

## (PS\_1.086)

**Is phonological knowledge on linguistic restrictions universal? A French-Japanese cross-linguistic approach**

MAÏONCHI-PINO, N.<sup>1</sup>, TAKAHASHI, K.<sup>1</sup>, YOKOYAMA, S.<sup>1</sup>, ECALLE, J.<sup>2</sup>, MAGNAN, A.<sup>2</sup> & KAWASHIMA, R.<sup>1</sup>. <sup>1</sup>*Institute of Development, Aging and Cancer - Smart Ageing International Research Center - Functional Brain Imaging - Tohoku University - Japan*, <sup>2</sup>*Laboratory of Cognitive Mechanism Studies - Institute of Psychology - Lyon University - France*.

We present results from a cross-linguistic comparison between native French- and Japanese-speaking adults which aimed at examining whether phonological knowledge on linguistic restrictions in speech perception is universal. We used two syllable counting tasks within pseudowords. In Experiment 1, we manipulated onset cluster sonority profiles to compare 15 French adults to 15 Japanese adults. Our results evidence that listeners from both languages systematically misperceive universal phonotactically-illegal (marked) onsets as phonotactically-legal ones (unmarked; /rpal/ misperceived as /rəpal/). Phonological repairs decreased as onset phonotactic legality increased (/rpal/ > /klal/) in both languages. In Experiment 2, we manipulated intervocalic cluster sonority profiles within syllable boundaries to compare 15 French listeners to 15 Japanese listeners. Of interest is that we highlight a reversed pattern following the universal markedness within syllable boundaries. French and Japanese adults misperceive intervocalic clusters disrespecting optimal syllable contact (/afmal/ misperceived as /afəmal/). Here, phonological repairs decreased as intervocalic clusters came to respect the optimal syllable contact (/aklal/ > /arpal/). Ours is a significant contribution demonstrating that listeners exhibit universal phonological knowledge on phonotactic restrictions both in languages that have (French) or do not have (Japanese) clusters. In both experiments native acoustic-phonetic properties have no straightforward influence on phonological repairs.

## (PS\_1.087)

**Phonological variation affects lexicalization of newly learnt words**

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Upon hearing two variable forms for the concept of "20", twenty (citation form) vs. twenny (nasal-flap form), do listeners form independent phonological representations for each word, associated with the same concept? Using the novel word-learning paradigm showing that newly-learned non-words (e.g., lantobe) are lexicalized after a night of sleep and compete with similar words (e.g., lantern; Gaskell & Dumay, 2003), we test predictions

made by a multiple-variants storage account of phonological variation. Specifically, English native speakers learned novel-words (e.g., *advantape*) that were either non-variable (all items were presented in the citation form only) or variable (all items were presented in both the citation and nasal-flap forms). One day after the learning phase, training on non-variable stimuli inhibited the recognition of words with shared overlap (e.g., *advantage*; replicating Gaskell & Dumay, 2003), but training on variable stimuli did not inhibit the recognition of these words. Because each novel-word received the same amount of exposure in both conditions, our results suggest that the nasal-flap and citation forms associated with the new lexical entries were not stored and not as one unique citation form. Rather, surface forms of novel-words seemed to be stored independently, each receiving not enough exposure for subsequent inhibition effect.

(PS\_1.088)

**Cheese and socks on audio-visual pizzas: Modality dependence of N400 effects**

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<sup>1</sup>University of Muenster, <sup>2</sup>Otto Creutzfeldt Center for Cognitive and Behavioral Neuroscience.

This event-related potential (ERP) study examines the influence of presentation modality on semantic integration, measured by the N400. Highly constraining sentences were presented audio-visually except for the final word, a noun that was either a highly predictable or an anomalous continuation. This noun was either presented audio-visually (speech and the speakers mouth), auditorily only or visually only. The time course and strength of the context effect (predictable vs. anomalous) differed depending on the modality of presentation. A context effect was present between 200 and 350ms for the audio-visual and the auditory-only conditions, but not for the visual-only condition. The N400 time window (350 to 600ms post-onset) discriminated between predictable and anomalous continuations in all three presentation modalities. The 600 to 800ms time window revealed a context effect for auditory-only and visual-only conditions, but no longer for the audio-visual modality. In contrast to what might be extrapolated from earlier studies on phonological processing, the context effect was stronger in the auditory-only than the audio-visual condition. Our results thus show a modality dependence of the context effect, and, most interestingly, a modulation of the ERPs by context even when the critical word could only be identified by lip reading.

(PS\_1.089)

**Temporal changes in conversational interactions induced by the presence of a simultaneous conversation**

VILLEGAS, J.<sup>1</sup>, AUBANEL, V.<sup>1</sup> & COOKE, M.<sup>1,2</sup>. <sup>1</sup>*Ikerbasque (Basque Science Foundation), Spain*, <sup>2</sup>*Language and Speech Laboratory, Universidad del Pais Vasco, Spain*.

This study aims to better understand the changes in foreground conversations induced by background conversations, particularly modifications in the temporal domain including overlaps between foreground and background speech. Understanding the strategies that humans adopt to orally communicate with a peer in the presence of competing dialogs could give some useful insights for developing improved human-computer interfaces, delivering aural information more effectively,

etc. In comparison to the acoustic effects of a background dialog in a conversation, our knowledge on background conversation interactional effects is rather limited. In experiments involving simultaneous conversations, we have found intensity and fundamental frequency increments, speech rate decrements, and other changes associated with the Lombard effect in speech produced in the presence of competing talkers. Interactional effects such as greater number of interruptions and dysfluencies, and less accurate turn taking were also seen. Unlike previous studies, we observed no reduction in overlap between foreground and background speech. We hypothesise that this unexpected result could be explained by visual cues used by the subjects during the conversation, methodological differences (i.e., as opposed to free conversations, previous reports focused on task-oriented experiments), stimuli differences (a single competing talker instead of a spontaneous talking pair).

(PS\_1.090)

**Semantic priming at the cocktail party: behavioral and EEG studies**

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Our studies addressed the issue of auditory masked semantic priming using cocktail party situations. Three behavioral studies showed that semantic relatedness between a multi-talker babble and a target elicited semantic priming. This effect however only appeared when the number of background voices sharing semantic features with the target was higher than the number of voices which did not. In an EEG study, we investigated to what extent the babble is semantically processed by testing the hypothesis that brain indexes of babble semantic processing could be observed even when no priming effect emerged behaviorally. Participants repeated target words embedded in multi-talker babble in which the ratio of semantically related/unrelated voices was 1/2 (no behavioral priming effect) or 2/1. Importantly, within one of the related voices, a semantically unrelated word (deviant) could be inserted. Our prediction was that semantic processing of the babble should be reflected by larger N400 effect for deviants than for non-deviants. Results showed a larger N400 for both unrelated targets and deviants compared to related targets and non-deviants respectively. There was no effect of the number of related voices. Overall these findings suggest that semantic features can be processed in low-intelligibility listening conditions, however intelligibility is necessary.

• Language Acquisition/Cognitive Development •

(PS\_1.091)

**Effects of computer-assisted comprehension training in French less skilled comprehenders in second grade**

POTOCKI, A., ECALLE, J. & MAGNAN, A. *Laboratoire EMC, Université Lumière Lyon 2*.

This study examines the effects of a computer-assisted learning (CAL) program designed to foster comprehension skills in comparison with a CAL program designed to foster decoding skills. In a randomized control trial

design, two separate groups of less skilled comprehenders in second grade were constituted. The first group (N = 41) was trained using a software fostering several aspects of comprehension skills (literal comprehension, coherence inferencing and knowledge-based inferencing). The control group (N = 20) was trained with a software focused on grapho-syllabic process. The two groups were matched on a range of measures (age, non verbal intelligence, reading comprehension, listening comprehension, vocabulary, memory and comprehension monitoring) and trained intensively over a short period (10 h over a period of 5 weeks). A classical pre-test/training/post-test design was used. The results showed that the experimental group trained with the comprehension software outperformed the control group in reading comprehension, comprehension monitoring and vocabulary.

#### (PS\_1.092)

##### **Developmental differences in the access of information in working memory**

LENDINEZ RODRÍGUEZ, C., PELEGRINA LÓPEZ, S., LECHUGA GARCÍA, M. T. & MARTÍN PUGA, M. E. *University of Jaen*.

Our main aim was to investigate possible developmental differences in accessing information in WM using two different numerical updating memory tasks in which object switching was manipulated. These tasks were administered to children (8 and 11 year old), adolescents (14 year old) and younger adults (mean age=22 year). As expected, with a numerical comparison updating task, log-transformed response times decreased and recall performance increased as a function of age group. Most importantly, the time needed for object switching was longer in children than in younger adults. The second task was an updating counting task in which object switching and memory demand were manipulated. Results showed that switching cost was longer in the higher memory load condition. Moreover, previous results obtained with the comparison updating task were replicated, since switching cost decreased as a function of age group. Altogether, these results show age related trends in accessing information in WM. Their implications for understanding the development of WM in children are discussed.

#### (PS\_1.093)

##### **Effects of computer-assisted training with syllabic units on reading in french poor readers in grade 2**

KLEINSZ, N., ECALLE, J. & MAGNAN, A. *Laboratoire d'Etude des Mécanismes Cognitifs (EMC), Université Lyon 2, Lyon, France*.

Numerous studies have shown that the syllable is a pertinent unit in the learning-to-read process in French. Here, we predict that grapho-syllabic training will have a positive effect on poor readers in Grade 2. The purpose was to reinforce the use of grapho-phonological relations by training children to manipulate both the spoken and orthographic syllabic unit in a word. We used a pre-test/training/post-test design comparing two groups: experimental and control. Experimental group heard a syllable, saw it on the screen and then heard a word. They had to indicate in which position (initial, median, final) the syllable appeared in the word. A program designed to foster comprehension skills was used in the control group. All children were trained intensively over a

short period (10h during 5 weeks). Numerous tasks were proposed before and after the training (including silent word reading, word and pseudoword reading aloud, phonological skills and vocabulary) in order to obtain detailed profiles of poor readers who benefit from the grapho-syllabic training as opposed to those who do not benefit.

#### (PS\_1.094)

##### **Are infants' communicative vocalizations more speech-like than private ones?**

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Before language, infants engage in pre-speech vocalizations both in social settings and in private ones. This preliminary study focused on the differences in form characterising these types of vocalizations. To that end, the articulatory quality, number of segments, the rhythmic pattern, and F0 values of communicative and non-communicative vocalizations uttered by Spanish infants were compared. In line with classical studies on crib speech and language play, it was hypothesised that the forms of private vocalizations would be closer to the model language, than the forms of social vocalizations. The argument put forward is that in non-communicative settings all cognitive resources can be allotted to the infant's vocal production. Videos of 7 Spanish infants aged 16 to 23 months recorded both familiar interactive situations and non-social situations. Recordings were coded following Oller's infraphonological model, inter-judge agreement procedures were used, and the resulting data were analyzed statistically. The results did not support the hypothesis: the forms of communicative vocalizations were more advanced than those of private ones. This is discussed as probably expressing the effect of pragmatic variables. The most advanced forms were produced under the need of being understood, communicative vocalizations possibly drawing on more cognitive resources than private vocalizations.

#### (PS\_1.095)

##### **Neural correlates (revel individual differences in processing of case marking cues in the developing brain**

KNOLL, L. J., BRAUER, J. & FRIEDERICI, A. D. *Max Planck Institute for Human Cognitive and Brain Sciences. Leipzig, Germany*.

We used functional neuroimaging to investigate the acquisition of case marking information for argument interpretation. Short sentences with manipulated word order (subject-initial or object-initial) were presented acoustically to children aged 5 to 6 years. The fMRI results showed increased activation within the posterior superior temporal gyrus (pSTG) and the temporoparietal junction in object-initial sentences compared to subject-initial sentences. Post-hoc analysis revealed different activation patterns at the single subject level. A subgroup of the children showed increased bilateral activation within the inferior frontal gyrus (BA 47), dorsolateral prefrontal cortex (BA 46), premotor cortex (BA 6), and pSTG in object-initial sentences compared to sentences with subject-initial construction. The other subgroup

showed the effect in the reverse contrast; an increased activation within the right dorsolateral prefrontal cortex and bilateral within the premotor cortex. The neural distinctions between the subgroups are mirrored in significant performance differences in a grammar test (TROG-D). Our data suggests a broad heterogeneity within the tested children related to sentence processing. Different strategies seemed to be employed when it comes to use case marking information for sentences processing. The use of the particular strategy is not dependent on age within this age-group but rather on the children's individual grammatical knowledge.

(PS\_1.096)

**Does multimodal letter representation enhance the acquisition of alphabetic principle with 5-year-old children?**

LABAT, H., ECALLE, J. & MAGNAN, A. *Laboratory of study cognitive mechanisms, EA 3082, University Lyon (2), Bron, France.*

This study investigated the effect of five trainings on the acquisition of alphabetic principle with 5-year-old children. Children were evaluated before and after training in letter-sound knowledge, in sound-to-letter correspondences task and in reading. Children were assigned in five matching training groups which differed on the number and the nature of letter exploration. Phonological exercises were the same for each group. The three trainings on letter knowledge involved two sensory explorations: Auditory and visual, haptic or graphomotor groups. The other two trainings on letter knowledge involved three sensory explorations: Auditory-visual-haptic group or auditory-visual-graphomotor group. In all tasks, trained and untrained letters scores improved between pre and post-tests. Moreover, in the sound-to-letter correspondences and reading tasks, scores of three-modes groups increased more than scores of two-modes groups. Results were interpreted as supporting the influence of multimodal letter representation (Longcamp, et al., 2010) on knowledge development in grounded cognition area (Barsalou, 2008). References Barsalou, L.W. (2008). Grounded cognition. *Annual Review of Psychology*, 59, 617-645. Longcamp, M., Lagarrigue, A., & Velay, J.-L. (2010). Contribution de la motricité graphique à la reconnaissance visuelle des lettres [Contribution of writing movements to visual recognition of letters]. *Psychologie Française*, 55, 181-194.

• Language Comprehension •

(PS\_1.097)

**Sinking about speech: Acoustic similarity versus linguistic experience in prelexical processing**

BIEN, H.<sup>1</sup>, HANULIKOVA, A.<sup>2</sup>, WEBER, A.<sup>3</sup> & ZWITSERLOOD, P.<sup>1,4</sup>. <sup>1</sup>*Institute for Psychology. University of Muenster. Muenster. Germany,* <sup>2</sup>*Basque Center on Cognition, Brain and Language. Donostia-San Sebastián. Spain,* <sup>3</sup>*Max Planck Institute for Psycholinguistics. Nijmegen. The Netherlands,* <sup>4</sup>*Otto Creutzfeldt Center for Cognitive and Behavioral Neuroscience. Muenster. Germany.* Speech sounds of a second language are often hard to pronounce, and speakers approximate the correct pronunciation by using a close relative from their native language. Using an identity Mismatch Negativity (iMMN)

design, we examined whether processing of such mispronounced segments is driven by acoustic similarity with the standard pronunciation or by one's experience. Specifically, we compared the English standard pronunciation of the interdental fricative in the pseudoword 'thond' to deviant pronunciations 'tond' and 'sond', typical of either German (who frequently substitute 'th' with /s/), or Dutch second-language learners (who frequently substitute 'th' with /t/). Acoustically, /s/ is always more similar to 'th' than /t/. ERP-data from Dutch and German listeners were analyzed subtracting the responses to the exact same stimuli presented as deviant and standard across conditions. In Dutch and German participants, both substitutions for 'thond' elicited a significant iMMN and consecutive P2. For Dutch listeners, the effects of 'sond' and 'tond' were equally large in both the iMMN and P2. For Germans, 'sond' elicited a smaller P2, while the iMMNs were of the same size. The iMMN results suggest that acoustic distance influences prelexical processing of 'th'-substitutions in non-native listeners, whereas linguistic experience may have an impact downstream (P2).

(PS\_1.098)

**Is wordlikeness judgment a good predictor of pseudoword processing in the lexical decision task?**

ROBERT, C.<sup>1</sup>, ZAGAR, D.<sup>2</sup> & MATHEY, S.<sup>1</sup>. <sup>1</sup>*Université Victor Segalen Bordeaux 2,* <sup>2</sup>*Université de Bourgogne.*

Readers can generally recognize that a sequence of letters is a real word and have intuitions about how typical it looks as a word. In fact, previous research has reported that pseudoword processing was influenced by orthographic neighbourhood and by the frequency with which a letter sequence occurs in one given language. Other studies have found that wordlikeness ratings of pseudowords varied as a function of lexical neighbourhood and bigram frequency. Even though there is evidence that the similarity with words influences pseudoword processing, it is yet unclear what makes a sequence of letters more or less typical, more or less wordlike. The aim of the present study was to disentangle the role of wordlikeness judgments from various objective lexical variables (e.g., orthographic neighbourhood, bigram frequency, syllable frequency) on pseudoword lexical-decisions. Twenty-two participants performed a lexical decision task on 200 pseudowords. Then, they were asked to rate on a seven-point scale the degree to which each pseudoword looks like a real word. Results indicated that wordlikeness judgment was the strongest significant predictor of lexical decision latencies and errors, which suggests that a subjective variable of wordlikeness is a good predictor of pseudoword processing in the lexical decision task.

(PS\_1.099)

**Action goal selects affordances evoked by understanding nouns of tools**

MARINO, B. F.<sup>1</sup>, BORGHI, A. M.<sup>2, 3</sup> & RIGGIO, L.<sup>1</sup>. <sup>1</sup>*Dipartimento di Neuroscienze, Università di Parma, Parma, Italy,* <sup>2</sup>*Dipartimento di Psicologia, Università di Bologna, Bologna, Italy,* <sup>3</sup>*Istituto di Scienze e Tecnologie della Cognizione, CNR, Roma, Italy.*

Recent behavioural and brain imaging studies have shown that understanding nouns of graspable man-made objects triggers the activation of motor programs for



hand movements associated with both object prehension and object use (i.e. structural and functional affordances). Here, we investigated whether functional and structural affordances evoked by those nouns can be selected in accordance with the goal of the action sequence expressed by the sentences in which the nouns are embedded. To this end, 34 participants were presented with sentences obtained by combining the noun of familiar tools with a verb pair expressing different action goals (i.e. grasping-to-move, grasping-to-use, looking-to-grasp and looking-to-stare). Participants decided whether the tool mentioned in the sentence was the same as that displayed in a following picture. We found that accessing the meaning of a tool noun activates a set of motor programs for hand movements in accordance with the specific action goal expressed by the verb pair. Specifically, functional affordances are activated only by the grasping goal related to tool use. This pattern of result is in keeping with embodied theories on language and with the idea of a chained activation of the motor system during action sentence understanding.

#### (PS\_1.100)

##### **Lexical processing of homonyms: the role of frequency dominance and grammatical class**

MANCUSO, A. & LAUDANNA, A. *Department of Communication Sciences. University of Salerno. Salerno, Italy.*

The present study investigates the role played by frequency dominance and grammatical class information in lexical processing of homonyms in Italian. By using a naming task, we evaluated different degrees of semantic priming on homonyms, depending on whether they were preceded by primes biasing toward dominant vs. subordinate meaning. We selected 90 homonymic words: 18 had a higher frequency as nouns (e.g., abito, dress/I live); 18 had a higher frequency as verbs (e.g., accetta, he/she accepts/hatchet); 18 had two balanced nominal meanings, (e.g., credenza, cupboard/belief); 18 had two unbalanced nominal meanings (e.g., campione; champion/sample); 18 had two balanced nominal/verbal meanings (e.g., boccia, bowl/he-she rejects). The critical stimuli were preceded by semantically related vs. unrelated primes. The results showed a significant priming effect when the prime was biased toward the dominant meaning of unbalanced words or toward one of the two meanings of balanced words, while no priming effect was found when the subordinate meaning was activated. The results are interpreted as evidence that both the dominance relationship between multiple meanings and the grammatical class ambiguity affect processing of homonymic words.

#### (PS\_1.101)

##### **Reading between the lines: Inference processes in the online comprehension of symbolic haikus**

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"a bitter rain - two silences beneath the one umbrella" Is the connotative meaning of texts readily available or is it gleaned at an extra cognitive cost? The eye-movements of 31 English native speakers (10 male; mean age, 21 years) were recorded while reading 24 haikus, 12 in the original/symbolic version, and 12 in a modified version where the most symbolic word (the keyword 'bitter' in

the example) was replaced by a more literal word ('loud') reducing the text's symbolic purport. The effects of keyword substitutions were measured globally, comparing total reading times for the two haiku types, and locally, examining the first pass gaze durations and dwell times on a word closely connected to the keyword, the referent 'silences', and on the last word, 'umbrella', to examine wrap-up processes. First pass duration showed no effects of the substitution. However, dwell time on referents and last-word regions, and total reading time were significantly longer for the original than for the altered haikus, suggesting that the connotative meaning of the texts was not available immediately but only through re-reading of the texts. The implications of these findings are discussed in relation to the literature on the processing of inferences in symbolic texts.

#### (PS\_1.102)

##### **Structural ambiguity resolution in nominal control construction: Eye-tracking studies with mono- and bilinguals**

KWON, N.<sup>1</sup> & STURT, P.<sup>2</sup>. <sup>1</sup>Nanyang Technological University, Singapore, <sup>2</sup>University of Edinburgh. Edinburgh, UK.

Bilinguals show a disadvantage in lexical access in production (Ivanova & Costa, 2008). Here we investigate whether they also show a disadvantage in the use of lexical information in parsing. Giver (refusal) and Recipient ("request") control nominals dictate that the empty pronominal PRO refers to "Roger" in (1) but cannot in (2) (Culicover & Jackendoff, 2006). If the parser uses such lexical information on-line, and actively searches for the antecedent for PRO, a reduced garden path effect is predicted in (2); "the teenagers" cannot be the antecedent for PRO in the object position of "stop" (Condition C violation) and will be correctly parsed as the main clause subject. In an eye-tracking experiment, monolinguals showed such a reduced garden path effect in (2) compared with (1), but early bilinguals (of English-Chinese; English-dominant; AOA of English before age 5) showed equal effects in (1) and (2). Thus, although early bilinguals may perform like monolinguals within the syntactic domain (Kotz et al., 2007), they make less use of lexical information in parsing. (1) Giver Control, Ambiguous/Disambiguated: After Roger\_i's refusal PRO\_i/\*k to stop/stop, the teenagers\_k felt... (2) Recipient Control, Ambiguous/Disambiguated: After Roger\_i's request PRO\_i/\*k to stop/stop, the teenagers\_k felt...

#### (PS\_1.103)

##### **Pro resolution in a discourse-oriented language: a self-paced reading time study in Korean**

KWON, N.<sup>1</sup> & STURT, P.<sup>2</sup>. <sup>1</sup>Linguistics. Nanyang Technological University. Singapore, <sup>2</sup>Psychology. University of Edinburgh. Edinburgh, UK.

This reading-time study investigated null pronoun (pro) resolution in Korean, a discourse-oriented language (Huang, 1984). We manipulated antecedents for pro; with or without a preceding discourse antecedent, and with matching or mismatching features on a following intra-sentential antecedent. Matching was manipulated using a reflexive, which requires its binder, pro, to be third person. An intra-sentential antecedent with mismatching features led to processing slow-down at the subsequent sentential positions only when there was no preceding discourse antecedent. In comparison to a

study in English where such mismatch effects were found regardless of presence of a preceding discourse antecedent (Liversedge & van Gompel, ms.), the results suggest that in Korean, when *pro* already refers to a discourse topic, the parser does not further form a dependency between *pro* and a potential intra-sentential antecedent. This is most compatible with the hypothesis that in discourse-oriented languages, discourse plays a more important role than morpho-syntactic cues in pronoun resolution, while in English, both are equally important. This suggests that individual languages might have different sensitivity to different cues in pronoun resolution. Moreover, *pro* interpretation is immediate even in languages without rich agreement, contra Mazuka (1991).

#### (PS\_1.104)

##### **Familial left handedness in right-handers changes neurological organization for language & cognition**

HANCOCK, R. & BEVER, T. *University of Arizona*.

Five decades of experimental, clinical and neuroimaging results demonstrate the cognitive and scientific importance of differentiating right-handed subjects with familial sinistrality (FS+) from those without (FS-). We present new fMRI and EEG evidence that lexical processing is faster and more bilaterally organized in FS+ subjects than in FS- subjects, while there is little difference in syntactic processing. P600 amplitudes are also mediated by familial sinistrality in a word probe task, suggestive of a sequential/lexical vs integrative/syntactic processing distinction. We suggest a neurocomputational model of dynamic instability in the corticostriatal loop as an explanation for this genetically-linked variability in language processing and other cognitive traits linked to personal and familial sinistrality. Preliminary data from non-linguistic behavioral and EEG studies support this model, revealing that FS+ subjects switch between bistable visual percepts (e.g. Necker cube perspectives) more rapidly than FS- subjects, and also show reduced alpha power suppression and make more commission errors in a go-nogo task, two measures thought to be linked to chemical dysregulation of the corticostriatal system.

#### • Sentence and Text Processing •

#### (PS\_1.105)

##### **Effect of narrative points of view on processing and accessing spatial text information**

FAHRAT, S. & TAPIERO, I. *Université Lumière Lyon 2*.

Previous experiments showed that some conditions like: memorization of a map before reading a text (Zwaan, Radvansky, Hilliard, & Curiel, 1998) or explicit instructions that elicit the reader to focus on spatial information, (Zwaan & Van Oostendorp, 1994) seemed necessary for the reader to take into account spatial dimension. In line with these experiments, we investigated how narrative perspectives (Cohn, 1978) might influence the accessibility and the processing of spatial information while reading a text. We contrasted three types of narrative points of view (internal, external and omniscient) and measured the effect of inconsistent spatial information on reading times according to the three narrative perspectives. We observed longer reading times for inconsistent information in the internal perspective compared to the two other. Our results confirmed that different

perspectives have an effect on accessibility of information. More specifically, that internal perspective allowed a more specific representation of spatial dimension.

#### (PS\_1.106)

##### **Emotional valence effects during the comprehension of causal and adversative sentences**

MORERA, Y.<sup>1</sup>, LEÓN, J. A.<sup>2</sup> & DE VEGA, M.<sup>1</sup>. <sup>1</sup>*Universidad de La Laguna*, <sup>2</sup>*Universidad Autónoma de Madrid*.

Connectives are text devices that signal the relation between adjacent sentences. In a double task paradigm, participants listened to first clause sentences in which a causal or an adversative connective was provided and an emotional positive or negative connotation was varied: a) Because/Although he was a very talent artist... b) Because/Although he was not a very talent artist... Then, an emotional icon was presented in the centre of the screen, which could be either a "happy" or a "sad" icon. After that, two words appeared on the screen and participants had to choose the most congruent with the sentence meaning (e.g., 1) He triumphed or 2) He failed). When there was no delay between the sentence and the emotional icon (Exp.1), a match effect with respect to the first clause meaning occurred (faster responses in a) sentences + happy-icon and in b) + sad-icon, compare to mismatched conditions: a) + sad-icon and b) + happy-icon). However, when the delay was 1000 ms (Exp.2), responses were faster when the emotional icon matched the second clause meaning (1) + happy-icon and 2) + sad-icon). The results are related with the role of connectives in activating emotional inferences.

#### (PS\_1.107)

##### **Recursion in grammar and in the parser**

LOBINA, D. & GARCIA-ALBEA, J. *Departament de Psicologia/CRAMC, Universitat Rovira i Virgili, Tarragona, Spain*.

Recursion is a property of the language faculty at various levels. First, it is at the core of its computational system. Secondly, it is a property of the generated structures, in the sense that all phrases appear to follow the same geometry: a [Specifier [Head-Complement(s)] configuration. Thus, a sentence is a combination of embedded phrases of this type and we here investigate if this results in a recursive application of the parser. As a metric, the memory load of assembling phrases in mono-clausal Subject-Verb-Object sentences was assessed by employing the click-detection paradigm -a technique sensitive to cognitive loads within and between clauses. 60 pairs of Spanish sentences, containing a longer phrase in either the Subject or Object position were employed, and three click positions (controlled for length) were determined. Results show that reaction times (RTs) are slower at the beginning of sentences, but there is a robust linear decrease in RTs between positions. An ANOVA analysis determines that both the sentence type and the click position factors are significant, but there is no interaction effect. Nevertheless, all within-sentence-type comparisons were significant, while only the second position -the S-HC frontier- proved to be significant across sentence-type, suggesting a recursive process.

## (PS\_1.108)

**Processing grammatical gender of role nouns: Further evidence from eye-movements**

IRMEN, L. & SCHUMANN, E. *Department of Psychology, University of Heidelberg.*

Two eye-tracking experiments investigated the effects of masculine vs. feminine grammatical gender of role nouns on establishing co-reference relations in German. Participants were presented with sentences of the basic structure My <kinship term> is a <role noun> <prepositional phrase> (e.g. My brother is a singer in a band). Role nouns were either masculine or feminine. Kinship terms were lexically male or female and thereby specified referent gender. Experiment 1 tested a fully crossed design including items with an incorrect combination of lexically male kinship term and feminine role noun (brother - [female] singer). Experiment 2 tested only correct items to control for possible effects of incorrect materials in Experiment 1. In early stages of processing, feminine role nouns, but not masculine ones, were fixated longer in case of a mismatch between grammatical and referential gender. In later stages of sentence wrap-up, sentences with masculine role nouns were fixated longer than those with feminine ones, irrespective of referential gender. Both experiments indicate that, for feminine role nouns, cues to referent gender are integrated immediately, whereas a late integration obtains for masculine forms. Our findings are discussed with regard to the different morphological and referential features of masculine and feminine gender in German.

· Language Production ·  
(PS\_1.109)

**Individual differences in picture naming speed: Contribution of executive control**

SHAO, Z.<sup>1</sup>, ROELOFS, A.<sup>2</sup> & MEYER, A.<sup>1, 3</sup>. <sup>1</sup>*Max Planck Institute for Psycholinguistics, Nijmegen, the Netherlands,* <sup>2</sup>*Radboud University Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, The Netherlands,* <sup>3</sup>*Department of Psychology, University of Birmingham, UK.*

Speakers clearly differ in how quickly they can retrieve words from the mental lexicon, but little is known about the sources of this variability. The present study investigated the relationship between speakers' executive control abilities and their speed of picture naming. In two experiments, adult speakers of British English named line drawings of objects and actions. Three main components of executive control - updating, shifting of attention, and inhibiting - were assessed using the operation-span, number-letter shifting, and stop-signal task, respectively (see Myake et al., 2000). Reaction times (RT) to action and object pictures were highly correlated. Ex-Gaussian analyses of the RT distributions showed that the speakers' updating scores correlated with the tau parameter of the RT distributions, i.e. predicted the proportions of slow responses in action and object naming. The inhibiting scores correlated with the mean RTs, whereas the scores obtained in the number-letter shifting task were uncorrelated to the RTs. These results indicate that the executive control abilities of updating and inhibiting contribute to the speed of naming objects and actions. Theories of word production may require modification to take account of these findings.

## (PS\_1.110)

**The Distractor Frequency effect: An overt naming ERP study**

NAVARRETE, E., SESSA, P., MULATTI, C. & DELL'ACQUA, R. *University of Padova.*

In the context of a color naming task, the Distractor Frequency effect refers to the phenomenon of longer latencies for low-frequency than for high-frequency distractor words (Burt, 2002). It remains unclear whether this effect has its locus at lexical or post-lexical stages. This would have important implications for models of spoken word production (Miozzo & Caramazza, 2003). Using the ERPs technique we explored the time-course of the Distractor Frequency effect in comparison to the Frequency effect in word reading and the Stroop effect. We monitored two time windows corresponding to two processing stages: 180-250 ms (lexical access), 300-500 ms (phonological encoding). In the reading task, occipito-parietal ERPs at 180-250 ms were modulated as a function of frequency with low-frequency words producing a negative shift relative to high-frequency words (replicating Cueto et al., 2009). In the color naming task, fronto-central ERPs at 300-500 ms were characterized by a negative shift for low-frequency distractors relative to high-frequency distractors. Replicating previous findings (Liotti et al., 2000), during this same later interval incongruent trials produced a negative shift relative to congruent trials. These results are discussed in relation to lexical and post-lexical accounts of the Distractor Frequency effect.

## (PS\_1.111)

**Phonological advance planning in sentence production: The case of the verb**

JESCHENIAK, J. D.<sup>1</sup>, OPPERMAN, F.<sup>1</sup>, SCHRIEFERS, H.<sup>2</sup>, KLAUS, J.<sup>1</sup> & BERWIG, M.<sup>1</sup>. <sup>1</sup>*University of Leipzig,* <sup>2</sup>*Radboud University, Nijmegen.*

In a set of three picture-word interference experiments we measured the phonological activation of verbs produced in isolation and in sentence contexts. Distractors that were phonologically related to the verb affected speech onset latencies in both verb production and sentence production, but in different ways. In verb production, there was substantial facilitation. In sentence production, the effect was attenuated and eventually turned into interference. These data show that the verb is phonologically activated before speech onset during sentence production. In addition, the modulation of the phonological effect as a function of utterance format provides further evidence for models of phonological encoding of complex utterances that assume a serial position coding in terms of a graded activation pattern (e.g., Dell, 1986; Jescheniak, Schriefers, & Hantsch, 2003).

## (PS\_1.112)

**The production of regular and sub-regular verbal forms in Italian**

AMORE, V. & LAUDANNA, A. *Department of Communication Sciences. University of Salerno. Salerno, Italy.*

The verbal morphology of Italian includes both idiosyncratic irregular phenomena and sub-regular patterns, shared by families of morpho-phonologically similar verbs. The experiment was aimed at verifying whether the production of regular and sub-regular verb forms is

influenced by phonological similarity to other existing verbs. For each regular verb, a morpho-phonologically similar sub-regular verb was selected (e.g., the regular verb *DEFINIRE* (to define), was matched with the sub-regular *PROVENIRE* (to come from)). A control list of regular verbal forms not similar to other sub-regular verbs (e.g. *COMPIERE* (to carry out)) was created. The results showed slower reaction times on sub-regular verbs than on regular ones, which, in turn, were slower than control verbs. We hypothesize that the predictability of inflectional patterns depends both on their regularity and on the internal consistency of verbs belonging to the same morpho-phonological family.

(PS\_1.113)

**Plural dominance effects in picture naming for language-impaired and unimpaired speakers: a comparison**  
BIEDERMANN, B.<sup>1</sup>, LORENZ, A.<sup>2</sup>, BEYERSMANN, L.<sup>1</sup>, SCHILLER, N.<sup>3</sup> & NICKELS, L.<sup>1</sup>. <sup>1</sup>*ARC Centre of Excellence in Cognition and its Disorders, Macquarie Centre for Cognitive Science, Macquarie University, Sydney, Australia,* <sup>2</sup>*Institute for Psychology, University of Münster, Germany,* <sup>3</sup>*Leiden Institute for Brain and Cognition, Leiden University, The Netherlands.*

This study looks at the effect of frequency on plural processing. Plural-dominant plural forms (e.g. 'ears', 'mice') are higher in frequency compared to their singular forms ('ear', 'mouse'), whereas singular-dominant plural forms (e.g. 'clocks') are lower in frequency compared to their singular forms. While plural dominance effects have been found in comprehension tasks (such as lexical decision) in healthy speakers, production tasks such as picture naming have been neglected to date as a tool of investigation. We explored the effect of plural dominance by comparing picture naming performance from brain-impaired with unimpaired speakers, and relating the outcome to current theories of morphological processing. Two Australian-English men with aphasia and 40 healthy, native English speakers named sets of pictures corresponding to plural-dominant and singular-dominant nouns, matched for frequency, name agreement, age of acquisition, etc. Both people with aphasia showed a significant plural advantage in naming accuracy for the plural-dominant plural stimuli compared to their singulars. In contrast, the healthy speakers exhibited only a trend for faster production times for plural-dominant plurals compared to their singulars. Additional analyses (mixed modeling) will be reported and the issue of controlling for recognition time in picture naming studies will be discussed.

(PS\_1.114)

**Grammatical and conceptual gender in the selection of independent gender features**

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The research on the selection of grammatical gender has been mostly concentrated on single words or words in agreement, often ignoring the impact of conceptual gender. The objective of the present study is to explore the mechanism of gender selection for gender-marked

elements that are not in agreement; and to verify whether the possible benefit of sharing gender is different for those entities that are also marked for conceptual gender. We elicited the production of sentences with direct and indirect Italian clitic objects (e.g., *gliela porta* 'to her it:FEM, [he/she] brings') in response to strings of visually presented words. We manipulated the gender of the direct and indirect object (masc vs. fem), and the animacy of the indirect object (animate, e.g., "to the sister" vs. inanimate, e.g., "to the shop"). Results showed a significant effect of gender congruency: gender-congruent trials were more accurate and faster than gender-incongruent trials. In addition, the effect of congruency tended to be larger for animate trials than for inanimate trials (RTs analysis only). These findings may suggest that (1) the gender selection mechanism is sensitive to all the values of internal verbal arguments; (2) conceptually motivated gender may "intrude" onto the selection mechanism.

· Bi/Multi-lingualism ·

(PS\_1.115)

**The effect of L1 syntax on the agreement of L2 possessive structures**

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Some studies have suggested an effect of L1 syntax on L2 agreement processing (Foucart & Frenck-Mestre, 2011; Tockowitz & MacWhinney, 2005). Previously, we showed that L1 syntactic rules affect the production of possessive structures (Foucart et al., 2010). Here we investigated whether such influence also occurs in comprehension. In a reading task involving possessives, we contrasted the performance of 18 English native speakers with that of two groups of 18 advanced late bilinguals with similar (Greek-English: possessives agree with the possessor) or different (Spanish-English: possessives agree with the possessee) agreement rules. In an eye-tracking experiment, participants read sentences in which the gender congruence of possessives and the gender matching between the possessor and the possessee were manipulated (e.g., *Yesterday the witch kissed her/his daughter/son and left quietly*). Preliminary results showed longer reading times for native speakers when the gender of the possessor and the adjective/pronoun conflicted. Additionally, there was a significant interaction between group and congruence for the native speakers and the Spanish-English bilinguals. In contrast, no interaction was found between the native speakers and the Greek-English bilinguals. These results suggest that L2 agreement may be affected by the L1 syntactic rules, at least in the case of possessive structures.

## (PS\_1.116)

**Is language-switching an instance of domain-general task switching? Evidence from Event Related Potentials**

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Although Bilingual language control is commonly considered to be subsidiary to the domain-general executive control functioning, there are few experimental studies that directly investigate whether this is the case. One way to do so is to compare participants' performances on a task that involves a switch between two languages with performances on a non-linguistic task that requires a switch between two task-sets. A differential pattern of switch costs between the tasks might be taken to reflect the recruitment of control processes specific to bilingual language control. We tested bilingual speakers while they performed a picture naming and a size decision task, both organised in three blocks (e.g., NameL1-NameL2-NameL1; or Bigger-Smaller-Bigger than a shoebox). The crucial comparison was between the first and the third block (in which participants had to return to the initial language or task set). In the linguistic task, returning to the initial language induced a cognitive cost (more positive ERP components and slower RTs) whereas, in the non-linguistic task, recovering a previously performed task produced a facilitation effect. The differential ERP and RT patterns between the two tasks suggest that bilingual language control should not be considered as an instance of domain-general executive control.

## (PS\_1.117)

**The role of lexical selection and speech production in language switching**

PHILIPP, A. M. & KOCH, I. *Department of Psychology, RWTH Aachen University, Aachen, Germany*.

When people switch between languages, language-switch costs occur. Empirically, language-switch costs are measured as the performance difference between switch trials, in which an object has to be named in a different language as the object in the previous trial, and repeat trials, in which the same language is relevant in two successive trials. In the present experiment, participants had to name digits in either German (L1) or English (L2). As an additional manipulation, a go/no-go paradigm was used. That is, 25% of all trials were no-go trials, in which no verbal response was requested. We observed substantial switch costs in go trials following go trials but not in go trials following no-go trials. Even when the no-go signal was presented 1500 ms after the digit and the language cue, so that participants were able to engage in lexical selection (i.e. select the correct word in the correct language), we observed no language-switch costs. This finding indicates that late, response-related processes, presumably phonological encoding, speech production, and/or articulation, play a crucial role for the occurrence of language-switch costs.

## (PS\_1.118)

**An ERPs Study of Code Switching effect in Chinese-English Bilinguals**

LIN, C. & TZENG, A. K. *The Department of Psychology in Chung Yuan Christian University*.

Two ERPs experiments were conducted to investigate code switching effect in Mandarin-English bilinguals. Stimuli were sentences presented in Mandarin (Experiment 1) or English (experiment 2). The last words in the sentences were the target. There were three types of targets: the expected words, synonyms (Lexical Switching, LS) and translations (Code Switching, CS). Participants were right-handed Mandarin-English bilinguals. In Experiment 1, N400 (400 - 500 ms) were significantly larger in CS condition than in Control and LS conditions. Experiment 2 showed the same effect in English. The comparison of CS between two experiments suggested that switching from L1 to L2 (experiment 1) elicited a larger N400 than from L2 to L1 (experiment 2). The comparison among three conditions showed only CS condition elicited a positivity before N400 (between 300 and 400 ms). We hypothesized this was a P300 due to the change of languages.

## (PS\_1.119)

**Effects of bilingualism in inhibitory control and context processing**

MORALES, J.<sup>1</sup>, BAJO, M. T.<sup>1</sup> & GÓMEZ-ARIZA, C. J.<sup>2</sup>. <sup>1</sup>*University of Granada*, <sup>2</sup>*University of Jaén*.

There is growing evidence showing that executive functioning benefits from bilingual experience, specifically on tasks engaging conflict resolution (e.g., Bialystok et al., 2004; Costa et al., 2008, 2009; Martin-Rhee & Bialystok, 2008). Nevertheless, there is no clear consensus regarding the nature of the mechanisms underlying this bilingual advantage. In our experiments, we explored bilinguals' performance in tasks involving different executive functions. We compared the inhibitory control and goal maintenance skills of young monolinguals and young early bilinguals in tasks which involve overriding competing responses, context processing, and continuous performance. Contrary to our predictions, we did not find higher inhibitory capacity for our bilinguals. However, our results showed that bilinguals made less mistakes prompted by misleading context information in a continuous performance task. These findings suggest that bilingual experience may lead to higher ability to focus on the goals of the task. Therefore, the better performance in conflict resolution tasks observed in previous studies might be mediated by goal maintenance and not strictly due to inhibitory control.

## (PS\_1.120)

**Stress assignment in bilingual adults reading Italian as a second language: The effect of vocabulary size**

BURANI, C.<sup>1</sup>, PRIMATIVO, S.<sup>1,2</sup>, ARDUINO, L. S.<sup>1,3</sup>, O'BRIEN, S.<sup>1</sup>, PAIZI, D.<sup>1</sup> & RINALDI, P.<sup>1</sup>. <sup>1</sup>*Institute for Cognitive Sciences and Technologies, ISTC-CNR, Rome, Italy*, <sup>2</sup>*University of Rome "La Sapienza", Italy*, <sup>3</sup>*LUMSA University, Rome, Italy*.

Italian has a transparent orthography, with regular grapheme-to-phoneme correspondences. However, stress assignment to three-syllable words is not governed by rule but requires lexical-lookup. Mainly, in Italian

there are two stress patterns and one is more frequent (dominant) than the other (non-dominant). Both word frequency and reader's lexical knowledge are expected to affect correct stress assignment. Two groups of English-Italian bilingual adults, matched for age, gender and education but differing for age of arrival and years spent in Italy, were matched to one group of Italian readers. The groups of bilinguals differed for vocabulary size, as evaluated by semantic fluency and lexical decision. All groups read aloud three-syllabic words differing for frequency (high and low) and stress pattern (dominant and non-dominant). Both naming latencies and pronunciation accuracy were affected by vocabulary size, with main differences on low-frequency words. In assigning stress, vocabulary size interacted with word frequency and stress dominance. Both groups of bilingual readers made more errors of stress assignment on low-frequency words with non-dominant stress, than native Italian readers. Bilingual readers with a smaller vocabulary made more stress assignment errors than bilinguals with a larger vocabulary. The results confirm the role of lexical knowledge in reading Italian aloud.

• Dyslexia •

(PS\_1.121)

**Common brain regions for behavioral predictors of reading (dis)ability**

FROST, S.<sup>1</sup>, LANDI, N.<sup>1, 2</sup>, PRESTON, J.<sup>1</sup>, MENCL, W. E.<sup>1</sup>, FULBRIGHT, R.<sup>2</sup> & PUGH, K. R.<sup>1, 2</sup>. <sup>1</sup>*Haskins Laboratories, <sup>2</sup>Yale University.*

Many studies have examined the specific neurobiological signatures of the major predictors of reading dis(ability), including phonological awareness (PA), print decoding, and rapid auditory processing. Rather than focus on their unique signatures, we explored the core common brain regions associated with these reading predictors in a large cohort of emergent readers ranging on a continuum from RD to superior readers. To accomplish this, we correlated behavioral indices of each skill with functional activation for speech and print and then performed a conjunction analysis to examine the intersection of the neurobiological correlates. The conjunction analysis revealed that individual differences in PA, print decoding, and rapid auditory processing were each positively correlated with print-related activation at canonical reading-related LH neo-cortical areas (including LH superior temporal and LH angular gyri) as well as with sub-cortical loci (specifically, posterior aspects of thalamus centered in and around pulvinar). We suggest that the correlation of each of these measures with common brain regions highlights both the importance of these regions for reading the need to more fully consider the role of sub-cortical sites and their interactions with neo-cortex in reading development.

(PS\_1.122)

**Involvement of ventral and dorsal pathways in visual word recognition in adults with developmental dyslexia: an ERP study**

MAHE, G., BONNEFOND, A. & DOIGNON-CAMUS, N. *CNRS, University of Strasbourg, Strasbourg, France.*

The efficiency of visual word recognition relies on fast and parallel processing of letters involving the ventral

visual pathway. However, words displayed in unfamiliar visual format require to be read serially under supervision of the dorsal visual pathway. The present ERP study investigated the involvement and the interactions of the ventral and dorsal visual pathways in adults with developmental dyslexia. Developmental dyslexia is a specific learning disability affecting reading acquisition. The involvement of the ventral visual system was assessed in a lexical decision task with stimuli (i.e., high and low frequency words, pseudowords or consonant strings) presented in a familiar visual format (i.e., horizontal). Same stimuli presented in an unfamiliar visual format (i.e., vertical) were used to investigate the involvement of the dorsal visual pathway. According to a visuo-spatial attention deficit hypothesis in developmental dyslexia, we expected an alteration of the dorsal pathway contribution in terms of impairment and/or delay when letter strings are presented in an unfamiliar visual format. Analysis of potential differences between dyslexics and normal readers could help us to understand the nature of their core deficit.

(PS\_1.123)

**Spoken word recognition in normative and reading-disabled children**

CAMEIRÃO, M. & VICENTE, S. *Faculty of Psychology and Education - University of Porto.*

The Lexical Restructuring Model (LRM; Metsala & Walley, 1998) suggests that, in young children, phonological representations are stored in the mental lexicon in a holistic fashion and, through childhood, they become increasingly segmental. The model proposes that reading-disabled (RD) children show a delay in this restructuring, which causes impairments in reading, phonological awareness and spoken word recognition tasks. We tested 17 RD children (M Age = 10.09), 17 age-matched controls (CA; M = 10.32) and 17 reading-age matched controls (RA; M = 7.72) in a gating task. The children should recognize 49 dysyllabic words, that contrasted in frequency, age-of-acquisition (AoA) and neighborhood density. The first gate of each word had 100 ms and subsequent gates increased in 50 ms. Overall, RD children needed more time than CA children to recognize words (456 vs. 429 ms), but didn't differ significantly from the RA group (456 vs. 461, respectively). There was a significant triple interaction between group, AoA and neighborhood density. RD children were impaired in recognizing early-acquired sparse words, but again didn't differ from the RA group. These results puzzle the question whether immature representations are cause or consequence of poor reading experience.

**POSTER SESSION 2**  
**Saturday Evening**

Author Present: 17:20-19:20

• **Consciousness** •

**(PS\_2.001)**

**Psychophysical measures of emotional consciousness: threshold-based approach**

SZCZEPANOWSKI, R. *Wroclaw Faculty of Psychology, Warsaw School of Social Sciences and Humanities, Wroclaw, Poland.*

The study justified the intuition that emotional consciousness could occur as an effect of interactions between discrete cognitive processes of availability and accessibility at a global threshold. The relationships between both cognitive processes were investigated by engaging the participants in backward masking tasks with subliminally presented emotional faces. Psychophysical measures of the interactions between both cognitive processes were taken with a threshold model by Krantz. In first experiment, the exclusivity relationship was examined which presumed that there is the threshold beyond which emotional stimulation is strong enough for the participant to gain access to consciousness, but no longer available. There was clear evidence that both cognitive processes were mutually exclusive when emotional target exposure increased. In the second experiment, the independence interaction was tested implicating that both cognitive processes act in concert in producing conscious performance, and therefore there are some proportions of emotional items that are consciously available and consciously accessed. As compare with the "exclusivity" condition, psychophysical measures indicated stronger evidence that emotional consciousness followed the independence interaction. Overall, the study showed that subjects' performance could be driven by cognitive processes of threshold-like nature, and their interactions could lead to plausible effects in producing conscious behavior during masking.

**(PS\_2.002)**

**Expertise effects on the access to consciousness**

VERMEIREN, A.<sup>1</sup>, BEYENS, U.<sup>1</sup>, FU, Q.<sup>2</sup> & CLEEREMANS, A.<sup>1</sup>.  
<sup>1</sup>Université Libre de Bruxelles, <sup>2</sup>Chinese Academy of Sciences.

Expertise in a certain domain can increase the visibility for stimuli from that domain. For example, car experts will recognize a car better when they see a flash of a car on the street. Here, we study whether expertise can influence not only the objective identification performance, but also the subjective feeling of having seen a stimulus. Chinese and European participants were asked to identify chinese and maya signs which were presented only for a short amount of time (16 ms). Furthermore, they were asked to rate their awareness of the stimuli. It was found that both identification and awareness were higher for the chinese signs than for the maya signs when testing Chinese participants, while the opposite was true for the European participants. This effect started already at very short SOA's (stimulus-onset-asynchrony) between the stimulus and the post-mask. This suggests that early on in the visual processing stream, feedback loops render

previous knowledge (expertise) available, allowing identification performance and subjective awareness of visual objects to increase more rapidly.

**(PS\_2.003)**

**Is consciousness graded or dichotomous?**

WINDEY, B.<sup>1</sup>, GEVERS, W.<sup>2</sup> & CLEEREMANS, A.<sup>1</sup>. <sup>1</sup>CO3. ULB. Brussels, Belgium, <sup>2</sup>Unescog. ULB. Brussels, Belgium.

This study aims to shed light on an ongoing debate in the visual awareness literature: is the transition from unconscious to conscious processing graded or dichotomous? The Recurrent Processing Hypothesis assumes a graded transition (longer presentation durations lead to gradually enhanced visibility). The Global Workspace Theory assumes an all-or-none transition (stimuli remain unconscious until the duration is sufficient to generate sudden clear experiences). Here we intend to unify the two theories and their supporting evidence, by taking the so far overlooked factor of the "level of processing" of stimuli into account. Participants performed a task on low-level stimuli (categorizing colored patches as red or blue) or on high-level stimuli (categorizing numbers as smaller or larger than 5). Presentation duration of the postmasked stimuli was varied parametrically. As expected, the psychophysical detection curve for the low-level stimuli showed a graded pattern, whereas the curve for the high-level stimuli showed a dichotomous pattern. In the next experiment we present the same stimuli (colored numbers) in both conditions, to match both conditions more closely. We hypothesize that for low-level stimuli, access to a more graded local workspace is sufficient to become conscious, whereas high-level stimuli require access to an all-or-none global workspace.

**(PS\_2.004)**

**Your unconscious knows your name**

POHL, C., PFISTER, R., KIESEL, A. & KUNDE, W. *University of Wuerzburg.*

The own name constitutes a unique part of conscious awareness, but it is also unique for the unconscious mind? To answer this question, we employed a subliminal priming experiment. Participants decided as fast as possible whether a name or a non-word was presented as target. Unbeknown to them, already before the target, a masked prime stimulus was briefly presented. The prime was either one of the targets, a non-word, the own name of the participant, or the name of a yoked participant. When one's own name was presented as prime, responding to a name target was substantially facilitated, whereas presenting the name of the other participant had the same effect as presenting a non-word prime. Thus, we show that - in contrast to any other name - one's own name has the power to bias a person's actions, even when the presence of the own name is unexpected and unconscious. The brain identifies and processes its name even in the absence of conscious awareness.

## (PS\_2.005)

**Modeling sensorimotor habits with neuro-robotics: a reappraisal of the habit concept in psychology**

BARANDIARAN, X. & DI PAOLO, E. *Department of Logic and Philosophy of Science, UPV-EHU University of the Basque Country, Donostia - San Sebastian, Spain.*

Recent trends in cognitive science have seriously undermined the notion of representation (symbolic or sub-symbolic) as a building block for theory construction and modeling in cognitive science (Stewart et al. 2011). The current lack of a clear theoretical building block for dynamical, embodied and situated cognitive approaches calls for a re-appraisal of the notion of habit as developed by early pragmatists (James, Pierce and Dewey) and continental psychologists and philosophers (Köhler, Goldstein, Merleau-Ponty). Whereas contemporary computational neuroscience and machine learning approaches (Daw et al. 2005) still sustain a behaviorist (S-R probabilistic association) conception of habit, we propose a richer notion by modeling habits as self-sustaining behavioural neurodynamic patterns where activity-dependent plasticity shows an extended temporal structure. We illustrate this point with some work on evolutionary robotics, implementing a combination of Hebbian and homeostatic plasticity (as recently supported by different neurobiological studies--Turriano 2000, 2007). In our robotic models, this mechanism is capable to generate sensorimotor development, reinforcement learning, spontaneous habit formation and re-habituating to sensorimotor disruptions (Di Paolo 2000, Barandiaran and Di Paolo 2010). We conclude that a richer notion of habit can significantly contribute to the foundations of cognitive science, opening up the possibility to model poorly understood psychological phenomena.

## · Attention ·

## (PS\_2.006)

**Trial-by-trial action control in infancy: evidence from the Simon effect**

IANI, C., STELLA, G. & RUBICHI, S. *University of Modena and Reggio Emilia.*

In the typical Simon task, responses to a non-spatial stimulus feature are faster and more accurate when stimulus and response spatially correspond (corresponding trials) than when they do not correspond (noncorresponding trials). Several studies have shown that the advantage for corresponding trials, known as the Simon effect, is null or inverted after a noncorresponding trial. These trial-by-trial modulations suggest the existence of executive control mechanisms that adapt our behavior to current goals protecting our performance from cognitive conflict. The aim of the present study was to assess whether these mechanisms, well consolidated in adults, are present in younger children. To this end we tested 17 first-grade and 17 second-grade children on a Simon task in which correspondence sequence was manipulated on a trial-by-trial basis. Both groups showed a regular Simon effect when the preceding trial was corresponding and a reduction of the effect when the preceding trial was noncorresponding. Crucially, this reduction was stronger for second-grade children who showed trial-to-trials modulations comparable to those observed in adults. These results provide insights into the development of cognitive control mechanisms.

## (PS\_2.007)

**Eye movement evidence for a link between insufficiency of convergence and ADHD**

AZNAR-CASANOVA, J., AMADOR, J. A., MORENO, M. & SOLE, M. *Universitat de Barcelona.*

As a result of literacy, prolonged visual efforts cause an excess of convergence during childhood. Several studies have found a high relationship between some binocular anomalies and attention and hyperactivity disorders. To date, it is not sure if convergence insufficiency (IC) is a result of the attention deficit hyperactivity disorder (ADHD). If the same problem that causes ADHD is also the cause of the failure of convergence. Alternatively, medication taken for ADHD children may be the cause of the failure of convergence. In order to verify a relationship between attention deficit and binocular vision we tested 12 children in an experiment using the paradigm of binocular and monocular rivalry and recorded vergence eye movements. Analysis of the variability of the angle of convergence to images that promote binocular and monocular rivalry revealed differences between normal children and children with ADHD. Thus, our data provide support to the link between ADHD and IC, i.e. visual focus and mental focus are narrowly linked.

## (PS\_2.008)

**A better understanding of inhibitory process in simple and dual tasks**

GÁLVEZ GARCÍA, G.<sup>1, 2, 3</sup>, ZWICK, G.<sup>1</sup>, PLAZA, B.<sup>1</sup> & MICHAEL, G. A.<sup>1</sup>. <sup>1</sup>Laboratory of Cognitive Mechanisms. University of Lyon 2, <sup>2</sup>French Institute of Science and Technology for Transport, Development and Networks (IFSTTAR), Lyon, France, <sup>3</sup>SOLEI company (Integral Ergonomics Solutions).

The cognitive inhibition has been deeply studied in the last decades. Nevertheless this term has been widely used without a good understanding of the process per se. The aim of this study was to study further the cognitive inhibition to ascertain if there is more than one inhibitory mechanism for different motor actions with different requirements. For this purpose we developed two experiments where the participants responded by reaching two circles previously signaled by arrows with two motor actions; normal reaching vs inverted reaching (supination of the palm) in experiment 1, and normal reaching or avoid to response (release action) in experiment 2. This design allowed the comparison of Simon or Congruence effect respect to different motor requirements. Finally, the participants performed these motor actions in three different conditions of dual task; detect one or three numbers in an auditory task or none. The results confirmed that attentional resources are limited and the inhibition was worst (bigger Simon or Congruence effect) in experiment 2 (normal reaching vs release) but not in experiment 1 (normal reaching vs inverted reaching). These results suggest a different inhibition mechanism for different motor actions when they have a big difference in motor requirements.



**(PS\_2.009)****Separating intertrial and intratrial interference during simultaneously executed saccades and manual responses**

PIECZYKOLAN, A. & HUESTEGGE, L. *RWTH Aachen University, Aachen, Germany.*

Multitasking usually causes performance deficits manifesting as increased response times and/or error rates. This has also been demonstrated for the simultaneous execution of saccades and manual responses. Studies so far concentrated on interference mechanisms caused by intratrial effects, whereas the role of interference between sequential trials in dual-task conditions remained largely unclear. In the present study subjects responded to a single auditory stimulus either with a saccade, a manual response or with both. The saccade was always spatially compatible to the stimulus while the manual response was not. In order to dissociate intertrial interference from intratrial interference we compared dual-task costs of pure blocks containing only stimuli on the same side (e.g. left) with mixed blocks containing stimuli on both sides (i.e. either left or right). Implications of the comparison across pure and mixed blocks for crossmodal selection mechanisms during multitasking will be discussed.

**(PS\_2.010)****On exceptions from the PRP effect: Comparing intentional and reflective eye blinks**

JANCZYK, M. & KUNDE, W. *Department of Psychology III, University of Würzburg, Würzburg, Germany.*

The psychological refractory period (PRP) paradigm is a well established tool to investigate the micro structure of dual-task performance within mental chronometry. Since its renaissance in the early 1990ies a vast amount of tasks has been reported to produce a PRP effect - ever since taken as an indicator for capacity limitations of the involved tasks. In fact, exceptions from the PRP effect have rarely (if ever) been reported and are controversial (extensive practice, ideomotor-compatible tasks, ...), questioning the usefulness of this paradigm to ascribe capacity limitations to a given task. At first glance, reflexes may constitute a potential class of fully automated behavior, thus not susceptible to the PRP effect. However, the intensity and latency of the eye blink component of the startle reflex can also be modulated by, for example, pre-pulses or emotional background content. In the first experiment, we show that a standard PRP effect can be obtained when participants are to blink intentionally as a response to an imperative stimulus. In a second experiment, we elicited the very same response with an air puff. Here, no signs of a PRP effect were obtained, reinforcing the claim that exceptions from the PRP effect indeed exist.

**(PS\_2.011)****Talking while looking: Interference between saccades and vocal responses**

HUESTEGGE, L. & KOCH, I. *RWTH Aachen University, Aachen, Germany.*

The simultaneous execution of two responses is known to cause interference. This was also demonstrated for saccades and manual responses, but potential interference between saccades and vocal responses remained

an open issue yet. In Experiment 1 of the present study, participants responded to lateralized auditory stimuli by saying "left"/"right" (vocal task), by executing a left/right saccade (saccade task), or both. Unlike saccades combined with manual responses, here responses do not involve shared physical characteristics (e.g., left/right movements), but only shared conceptual attributes (i.e., both involve the cognitive concepts of left/right). Results indicated that both vocal responses and saccades exhibited dual-response costs, indicating that shared physical characteristics of both responses are not necessary to produce dual-response costs. In Experiment 2, we additionally introduced a condition without shared conceptual attributes across responses (i.e., vocal responses "yellow" vs. "green"). This condition led to increased dual-response costs, indicating that participants in Experiment 1 benefit from shared abstract response characteristics via response-code priming.

**(PS\_2.012)****Temperamental basis of the effectiveness of selective and divided attention**

STOLARSKI, M., LEDZIŃSKA, M. & ZDRAL, B. *University of Warsaw, Faculty of Psychology.*

The role of temperamental variables in the dynamics and effectiveness of attention processes has rarely been investigated so far and, within the borderline area between personality and intelligence, remains an unresolved issue. The paper reports a series of studies illustrating the role of temperamental traits distinguished in the Regulatory Theory of Temperament (Strelau, 2008). In Study 1 we investigated the temperamental correlates of the intensity of intrusive thoughts. The aim of Study 2 was to illustrate the temperamental basis of the strength of experience of data overload (also labeled infostress), which earlier proved to be related to selective attention. Finally, in study 3 we experimentally investigated the role of temperament in selective and divided attention, measured with computer attention task DIVA (Nęcka, 1994). The obtained data provide evidence for the role of temperamental traits, particularly Emotional Reactivity and Perseveration, in attention processes and illustrate two of the possible mechanisms of this relationship: intrusive thoughts and infostress experience.

**(PS\_2.013)****The relationship between visual attention and visual short term memory for objects**

PILLING, M. & GELLATLY, A. *Oxford Brookes University.*

We explore the relationship between attention and object representation in visual short-term memory (VSTM). We specifically look at the conditions in which attention leads to an updating of the VSTM store. Displays consist of various coloured shapes on a neutral background. Attention is drawn towards display objects in cue sequences in which objects briefly increase in luminance or are surrounded by an outline square. One item (either previously cued or uncued) is then covered and participants required to report its colour. Previous research shows that observers show above-chance accuracy only in reporting about the most recently cued objects in the sequence, suggesting VSTM representations of earlier attended objects have been overwritten. We vary the task-relevance of the intervening cued items in the sequence. Similar reporting accuracy is found for the

covered object even when the intervening items in the cued sequence are task-irrelevant. Reporting accuracy remains unimproved even when empty locations are cued in the intervening sequence. The data overall suggests that we have limited, if any, control over the consolidation of attended information into VSTM. Cueing any spatial location, filled or unfilled, task-relevant or otherwise, seems to automatically update VSTM and overwrite previously attended information held in this store.

**(PS\_2.014)**

**Gaze and head orientation reduce attentional blink (AB) for subsequent visual events**

COMPARETTI, C. M.<sup>1,2</sup>, PICHON, S.<sup>2</sup>, RICCIARDELLI, P.<sup>1</sup> & VUILLEUMIER, P.<sup>2</sup>. <sup>1</sup>*Department of Psychology, University of Milano-Bicocca - Italy*, <sup>2</sup>*Laboratory for Behavioral Neurology and Imaging of Cognition, Medical School, University of Geneva - Switzerland*.

Others' gaze direction and body position are powerful social cues indicating the presence of relevant information in the environment. We investigated how the processing of gaze direction (averted, directed) and head position (deviated, frontal) diminishes AB for subsequent visual events. AB refers to the reduced detection of a stimulus-T2 during a brief time-window (~250ms) following the detection of another first target stimulus-T1. Subjects had to report the gender of a face(T1) with different gaze and head orientation, and then categorize an indoor or outdoor scene(T2). Behavioral data showed that, outside the AB refractory-period, faces with congruent gaze and head position facilitated the identification of T2\_scenes. During the AB-period, recognition for T2\_scenes was diminished, except after T1\_faces with direct gaze and frontal head. Comparison of trials where T1\_faces or T2\_scenes were correctly detected showed increased activity in FFA and PPA respectively. Activity in bilateral IPS decreased during AB in parallel to the decrease in T2 performance. Outside AB-period the interaction between head and gaze showed activity within ACC; face network activity increased for gaze contact but drastically diminished during AB. These results show that body and gaze position modulate the AB effect and influence the observer's attention for subsequent visual stimuli.

• Perception and action •

**(PS\_2.015)**

**Demystifying the social simon effect**

DOLK, T.<sup>1</sup>, HOMMEL, B.<sup>2</sup>, PRINZ, W.<sup>1</sup> & LIEPELT, R.<sup>1,3</sup>. <sup>1</sup>*Department of Psychology, Max-Planck-Institute for Human Cognitive and Brain Sciences. Leipzig, Germany*, <sup>2</sup>*Cognitive Psychology Unit, and Leiden Institute for Brain and Cognition. Leiden University. Leiden, The Netherlands*, <sup>3</sup>*Department of Psychology, Junior Group "Neurocognition of Joint Action". Westfälische Wilhelms-University Münster. Münster, Germany*.

The social Simon effect (SSE) has been considered as an index of action co-representation. However, recent findings challenge this view by suggesting that the SSE may result from salient events that provide a reference for spatially coding one's own action. The aim of the present study was to further clarify the role of action co-representation in the SSE. If referential response coding

of an individual's own action is induced by any salient event, it should not matter whether this event is social in nature or not. We manipulated the saliency and nature of reference-providing events, ranging from non-human "social" events (Experiment 1), over non-social animated events (Experiment 2) to non-animated events (Experiment 3) in an auditory go-nogo Simon task. We found reliable SSEs under solo conditions in all three experiments. We conclude that the SSE occurs whenever agents code their own action as left or right in reference to another salient event, suggesting that the effect does not necessarily require a social co-representation of another person's action.

**(PS\_2.016)**

**Spatial compatibility relationships with simple lever tools**

MÜSSELER, J. & SKOTTKE, E. *RWTH Aachen University, Germany*.

With regard to the ideomotor principle, the anticipations of action effects fulfill a generative function in motor control. When using a lever tool, subjects have to deal with two, not necessarily concordant effects of their actions: The body-related proximal effects, like tactile sensations from the moving hand, and/or representations of more external distal effects, like the moving effect points of a lever. As in tool use the intentional goal is usually directed to the distal effects, they should be predominant. Various studies tried to determine the spatial compatibility relationships between stimulus (S; at which the effects point of the lever have to aim at), respond hand (R) and effect point of the lever (E). However, in none of these studies a tool was used allowing to vary orthogonally compatible and incompatible SR, SE or RE relationships. The present study examine a tool, which fulfill these requirements.

**(PS\_2.017)**

**Implicit transfer of learning and action effects**

FERRARO, L.<sup>1</sup>, RUBICHI, S.<sup>1</sup>, NICOLETTI, R.<sup>2</sup>, IANI, C.<sup>1</sup> & GALLESE, V.<sup>3</sup>. <sup>1</sup>*University of Modena and Reggio Emilia*, <sup>2</sup>*University of Bologna*, <sup>3</sup>*University of Parma*.

Ideomotor theories predict that learning effects should be present when action effects are observed. The transfer of learning effect consists in the modulation (i.e., elimination or reversal) of the Simon effect (that is, the tendency to react toward stimulus location) when participants practice with incompatible S-R mappings before performing the Simon task. In line with ideomotor theories, in Experiment 1 we showed that the transfer of learning effect is related to observed action effects and not to real performance. Indeed, participants observed the practice task performed by the computer and then transferred to the Simon task. The Simon effect was eliminated after a spatially incompatible practice (and not after a spatially compatible practice). The transfer of learning strictly depends on the possibility to emit a manual response: no modulation occurred when a transparent screen separated participants from the response device (Experiment 2). In addition, no transfer of learning was found when during practice a standard response device was absent (Experiment 3). On the whole, results indicated that the observation of action effects activates motor representations similarly to what occurs when the action is actually performed.

**(PS\_2.018)****About the role of distractors when performing pre-determined movements with distorted visual feedback**

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Changes in perspective challenges information processing, as the actor is often not able to handle successfully the discrepancies between the tactile/proprioceptive feedback and the visual feedback on a projection screen. In this context the present experiments will show, how visibility and motor activity of an irrelevant effector distracts from performing one-hand movements. Participants responded to visual stimuli with a pre-determined response hand while the other, non-responding hand was either kept within view or outside the viewing angle. The non-responding hand was passive (Ex.1) or active (Ex.2). Stimuli and hand(s) were covered, but presented in front of them on a display with a non-egocentric perspective that either retained or reversed left-right relations. In Ex.1 we found a remarkable decrease of performance when visual feedback reversed left-right relations. This is in accordance with previous findings by Sutter and Müsseler (2010). However, even if the present task was simpler and the responding hand was pre-determined spatial transformation effects were in effect, and this was independent from seeing the non-responding hand or not. In contrast, when the non-responding hand was also active spatial transformation effects were cancelled out. It seems as if with increasing task complexity visual monitoring becomes more important.

**(PS\_2.019)****Cognitive determinants of efficiency of pilot's behavior in condition of visual illusion**

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This study examined efficiency of pilots' behavior in conditions of spatial disorientation. It has been assumed that visual illusions tends to produce spatial disorientation. Spatial disorientation was analyzed in context of dependent vs independent style of perception, efficiency of attention and working memory, total air time, age and type of the aircraft. 66 pilots participated in the experiment (air-raid 1017.6 hours +/- 797.6; age 32.25; +/- 6.64). Efficiency of execution of flight profile has been defined on simulator HYPERION based on indicators of course (variability of course, asymmetry of course). Cognitive processes were researched by means of computer tasks: DIVA, SWATT, MMATT; field dependence - EFT. It appears that visual illusion influence the efficiency of pilot's behavior. The research shows that weak inhibition mechanisms and higher susceptibility to interference (selective attention), lower efficiency of working memory (low efficiency in updating, low accuracy trade-off) influence the spatial disorientation. The total air time, age and the type of the aircraft did not have an impact on the spatial disorientation.

**· Face and object recognition ·****(PS\_2.020)****Perceiving faces with different kinds of glasses: Distinctiveness, beauty and intelligence**

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Faces are very important objects in our visual environment. The eye region - with its importance for a person's identity, gaze direction, and emotional expression - plays a crucial role in many face-related tasks. Functionally, the eyes are the entry points for visual information processing. However, over a lifetime they lose their effectiveness. This is often corrected by means of eyeglasses. Therefore, beyond physiognomic changes over time, such accessories influence facial appearance in everyday face perception. In a series of experiments, we studied perception and appreciation of faces with and without glasses. We found some data in accordance with the stereotype that glasses make wearers look more intelligent but less attractive. Comparing glasses with and without rims the difference in the amount of area in the face covered by rims affects face perception, recognition, distinctiveness, and the assignment of stereotypes. Moreover, when we measured eye movements, glasses on the face generally directed gaze to the eye regions. Thus, glasses affect how we perceive faces, and in accordance with the old stereotype, they can decrease attractiveness but increase perceived intelligence and trustworthiness. These effects depend on the kind of glasses, probably due to amount they conceal areas of the eye region.

**(PS\_2.021)****Categorical perception of face is mediated by the compression effect**

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Categorical perception (better discrimination for the cross-category stimuli relative to the within-category) is observed in face recognition (e.g., Beale & Keil, 1995). There are two possible mechanisms: The one is an expansion effect, in which the discrimination for the cross-category stimuli is intensified. The other is a compression effect, in which the discrimination for the within-category stimuli is attenuated. We examined which mechanism underlies the categorical perception of face by successive 3 experiments. Eleven participants learned to classify 17 successive morphed faces into two categories, and then they rated how each stimulus represented its category. Finally, they performed the face discrimination task. Another 11 participants performed only the discrimination task without learning and rating task, as a control. The results for the rating task revealed the boundary and the prototypes of the two categories. The results for the discrimination task showed that the accuracy for the cross-category discrimination was higher than the within-category discrimination in the category learner group. Such a categorical perception was not obtained in the control group. The accuracy for within-category discrimination, moreover, was lower in the category learner group than the control group, suggesting that the categorical perception of face is mediated the compression effect.

## (PS\_2.022)

**Inversion effect of “old” vs “new” faces, face-like objects, and objects in a healthy student sample**

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Processing of social stimuli seems impaired in conditions such as autism and schizophrenia. In autism, a bias for local information has been described, while apophenia might explain faulty interpretations in schizophrenia. To test such impaired social processing, the use of face stimuli has been popular. Based on previous findings, we suggest that such processing biases should be established with face-like stimuli lying between faces and objects stimuli. To assess face-like stimuli processing, we here evaluated in 48 healthy participants whether configural processing performance for face-like stimuli would lie between the one for faces and objects in a recognition task with inversion. After a first encoding block, participants made old-new judgments on upright or inverted “old” and “new” stimuli, randomly intermixed in a second block. Accuracy and reaction time analyses yielded the commonly observed face inversion effect. Despite no inversion effect for face-like stimuli, overall performance was lying between the ones for faces and objects. Also, reaction times were comparable for inverted faces and both inverted and upright face-like stimuli. These results indicate that face-like stimuli might be a promising stimulus type to assess local and configural processing biases, in particular when autistic and schizophrenic pathological or personality dimensions are considered.

## (PS\_2.023)

**Effect of motor and tactile interference in haptic recognition**

FERNANDES, A. & ALBUQUERQUE, P. *School of Psychology, University of Minho.*

This study analyzes the effect of motor and tactile interference at encoding in an immediate incidental haptic recognition memory task. Participants haptically explored a set of 50 objects, for three seconds each, with one of their hands, and then had to perform a haptic recognition task with 25 presented and 25 non-presented objects. Participants touched the stimuli inside a wooden box, preventing visual contact during the whole experiment. Study phase occurred in single or dual task conditions. Dual task conditions entailed a motor (performing a motor sequence with one hand) or tactile task (evaluating paper sample pairs with one hand). Results show that tactile interference at encoding significantly impaired haptic recognition. Motor interference, on the other hand, had no effect in haptic recognition. Data suggests a haptic specificity in memory that is related to particular tactile cognitive processing and not limited to exploration movements encoding.

## (PS\_2.024)

**Perceptual completion facilitates object-based feature binding for two features from the same dimension**

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Previous research suggests that binding between features from different dimensions supports the view that representations in visual short-term memory (VSTM) can be object-based. An alternative account to object-based storage is independent feature-based modules. To test for this previous research used bi-coloured objects in a VSTM task and observed object-based binding. These results have not successfully been replicated. To further explore the possibility of object-based within-dimension feature binding in VSTM, two change detection experiments are reported. These involved memory for either two pairs of coloured squares abutting one another (forming single bi-coloured objects) or two pairs of coloured squares separated by a small gap. Using these stimuli the first experiment saw no object-based benefit for bi-coloured objects. The second experiment used the same stimuli with the exception that all displays were partially covered by an occluding surface with holes through which surface colours could be seen. Same-object benefits were observed when perceptual completion was possible, demonstrating object-based feature binding for features from the same dimension. The role of perceptual completion as an object-based mechanism is discussed, as is the nature of object-based representations in VSTM.

## • Emotions •

## (PS\_2.025)

**High/low avoidance-motivated negative affect and efficiency of cognitive inhibition**

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The aim of presented study was to examine whether high/low avoidance-motivated negative affect influences cognitive inhibition. Despite the fact that inhibition is one of the key aspects of cognitive control only few studies investigated its connections with emotions. Amongst all, some studies revealed that positive mood can lead to increase in the inhibitory costs in Stroop task, while negative affect may reduce Stroop interference. What is more, it has been shown that affective influences on the attentional breadth can be changed depending on the type of approach/avoidance motivation of given affect. Here we focus on negative affect, to which not much attention was paid in previous studies. We hypothesize that approach/avoidance motivation modulates influence of negative emotions not only on attention but on inhibition processes as well. To manipulate affect and type of motivation IAPS (International affective picture system) pictures were presented. The low/high avoidance-evoking pictures were chosen on the basis of pilot study. Subjects were assigned to one of the three groups in which: (1) high avoidance-motivated negative affect; (2) low avoidance-motivated negative affect; (3) neutral affect were evoked. Stop signal and go/no-go tasks were used to

measure efficiency of inhibition processes. Data is being processed.

#### (PS\_2.026)

##### **When words become negative: using a learning paradigm to explore the effect of emotions on lexical access**

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This research explores how words' emotional attributes affect linguistic processing and whether their acquisition requires consolidation. French-speakers were repeatedly exposed to associations between written made up words (e.g., 'évrade') and pictures with either an emotionally negative or a neutral content (e.g., 'a growling pitbull' vs. 'a spoon'). The ability of the novel orthographic forms to activate their emotional attributes was then tested immediately and retested after a week. A stroop-like colour identification task showed facilitation for negative compared to neutral words at test (13 ms), but interference at retest (16 ms). In line with the idea that what had consolidated has to do with more than just arousing power of the stimuli, an old/new recognition task administered only at retest revealed an interaction between participants' general level of anxiety and emotional content: whereas more anxious participants took longer to recognize negative than neutral words, less anxious participants showed the reverse pattern. Altogether, these results indicate that words' emotional attributes need consolidation before they can be activated by the written input; given the fully rotated nature of our design, they also show that negative stimuli freeze participants under attentional tasks that do not focus on word identity.

#### (PS\_2.027)

##### **Searching for affective bases of intuition. The influence of affective stimuli on "feeling of warmth" ratings**

MARTA, S. & NĘCKA, E. *Jagiellonian University*.

The aim of this study was to explore the relationship between emotions and intuition. Intuition can be described as a feeling, knowledge or belief about own's cognitive states, that is, a kind of metacognition that produces hunches, guesses and feelings. Several studies suggest that intuitive judgements are accurate and that they might be based on simple affective processes. A positive or negative affect can be the effect of progress monitoring and serve as a subtle cue about "being right". In this experiment we examined the role of externally and subliminally implemented affect on intuitive feelings about approaching the solution of difficult problems ("feeling of warmth"). 130 students of Jagiellonian University were asked to solve two problems and give their feeling of warmth ratings every 15 s. They were also presented subliminally pictures of faces expressing emotions (negative, positive and neutral). The results suggest that it is possible to bias people's intuitive feelings by external affective stimuli. That means that subtle affective changes might be the core of intuitive feelings.

#### (PS\_2.028)

##### **Comparing different paradigms for exploring affective priming**

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In affective priming a presentation of positively or negatively valenced stimuli facilitates the reaction to subsequent stimuli if they are congruent in valence with the first one as compared to the situation when they are not. Numerous paradigms have been developed to measure this effect, and the question remains - do they all measure the same thing? In this study we wanted to explore how different setups of the affective priming paradigm relate to one another and to the several external criteria. Three versions of the design were used: Classical evaluative decision task (EDT), response window technique (RWT) and continuous presentation (CP). In EDT participants react to target words preceded by valenced primes and evaluate them as positive or negative. In RWT, participants are forced to react very fast (usually within 700ms), and the dependent variable is not reaction time like in the EDT, but the items correct. CP is similar like EDT, but the primes and targets are not explicitly distinct, and every stimulus acts as a target for a preceding one and a prime for subsequent one. These methods are compared to one another and evaluated regarding criteria like susceptibility to current mood and implicit affect.

#### (PS\_2.029)

##### **Pupillary responses to emotional words**

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The pupillary response of the human eye has been shown to be sensitive to both task load and emotional content. The present study investigated the interplay of both factors in the processing of single words that varied in emotional valence and arousal. To this aim, two tasks of varying cognitive load, uninstructed reading and a lexical decision task, were employed; followed by an unannounced recognition memory task. In contrast to previous findings for pictures and sounds, high-arousing words elicited smaller pupillary responses than low-arousing words. This effect occurred independently of task load, which increased pupil diameter. Furthermore, high-arousing words elicited faster response latencies in the lexical decision task and better incidental memory performance. These results indicate that the influence of arousal in word processing does not mandatorily activate the autonomic nervous system, but rather works on a cognitive level, facilitating word processing.

#### (PS\_2.030)

##### **Preferential access to emotional cues is mediated by threshold: An evidence from attentional blink paradigm**

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There is commonsense view that awareness of perceptual information requires not only strong representation of

the contents of awareness, but also access to that information. Recent studies suggest that a function relating the perceptual activation strength to conscious access may contain thresholds contrary to the continuous quality of perceptual representation. The main goal of this study was to show that the threshold model was able to account for participants' performance under attentional blink (AB) paradigm with emotional targets. An analysis of receiver operating characteristics (ROC) was used to distinguish between two models of perception by inspecting two different ROC's shapes. The results showed that observer's performance was better described by the linear ROC predicted by the threshold theory than by the ROC's curvilinear ROC shape provided by the signal-detection theory. This pattern of conscious threshold access to emotional content was consistent among all lag conditions. Moreover, there was no differences in the ROCs between the all-T1-trials condition and the correct-T1-trials condition, providing evidence that emotional representation of stimuli leads to attenuation of the blink effect. Overall, the findings support the notion that conscious access to emotional content operates in the "all-or-none" manner as predicted by the threshold approach.

#### (PS\_2.031)

##### **Perception of gesture dynamics from bodily expressions of emotion**

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Gestures serve many cognitive-linguistic functions, but the affective facets of gestural communication have, in contrast to those of vocal and facial expression, not yet been explored. We investigated the perception of spatiotemporal qualities of emotional arm gestures. We examined how the emotion dimensions arousal, valence, and potency, affected the judgment of 6 spatiotemporal characteristics of gestural arm movement that were found to be related to emotion in previous research (amount of movement, movement speed, force, fluency, size, and height/vertical position). The emotional expressions were taken from the Geneva Multimodal Emotional Portrayals. First, we tested the recognition of these emotion dimensions from bodily expressions and found that the rating of the perceived dimension was most strongly influenced by the corresponding encoded dimension in the predicted direction. Valence, potency and arousal are thus relevant dimensions in the perception of bodily expression of emotion. Second, the gesture ratings revealed that arousal and potency are strong determinants of the perception of gestural dynamics, whereas the differences between positive or negative emotions were less pronounced. In sum, this study identifies perceptual cues in gestural arm movement that are relevant in communicating major emotion dimensions. Gesture thus forms an important part of multimodal emotion communication.

#### • Executive control •

#### (PS\_2.032)

##### **Gender differences in inhibitory control induced by erotic pictures**

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The executive control of voluntary action involves not only choosing from a range of possible actions but also the inhibition of responses as circumstances demand. Think of driving toward a crossroads (the light is amber), do you brake or continue to accelerate? A rapid decision which may have severe consequences is required. A recent study has shown that emotional stimuli can effectively alter inhibitory control. However, whether gender may play an important role on modulating the effects of emotional stimuli in inhibitory control is unclear. The present study employed the stop signal paradigm with presentation of erotic pictures to investigate how gender differences modulate the effects of emotion on inhibitory control. Twenty-eight subjects participated in the study and the pattern of results demonstrated that only males' inhibitory control was deteriorated by the erotic pictures by increasing their stop signal reaction times. In contrast, the erotic pictures did not affect females' performance on the task. To our knowledge, this is the first study to demonstrate how erotic pictures affect inhibitory control and to examine the differences of the effects between genders. This study highlights the specificity of the effects of emotional stimuli in the modulation of inhibitory control.

#### (PS\_2.033)

##### **A new method to dissociate cognitive control mechanisms**

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In the study of cognitive control, a debated question is whether our system counts with several control mechanisms or with a single general one. In an attempt to answer it, previous studies dissociated two well known effects related to cognitive control, conflict adaptation and proportion congruent effects, based on their ease to generalize across conflict types (Funes et al. 2010b; Torres-Quesada et al., under review). In the present experiment, we tried to dissociate both mechanisms in a more direct manner, by testing whether proportion congruent effects can still be present under conditions where conflict adaptation effects are prevented. We presented two types of conflict (Simon and Spatial Stroop) and a proportion congruent manipulation only affecting one conflict type. Our results showed that both proportion congruent and conflict adaptation effects were conflict type specific. Nevertheless, proportion congruent effects were present even in the conflict type alternation condition, that is, on the condition where conflict adaptation effects were prevented. In conclusion, we can say that proportion congruent and conflict

adaptation effects can be measured independently of each other, even if both might have similar consequences on performance (both can be conflict type specific).

#### (PS\_2.034)

##### **Voluntary task switching versus explicit task-cuing procedure in the Prader-Willi Syndrome**

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Task-switching paradigms are widely used to study executive control. However, standard paradigms may not require active control to switch tasks. We examined voluntary task switching by having subjects choose which task to perform on a series of bivalent stimuli. Instructions were to perform the two tasks equally often and in a random order. The response-to stimulus interval (RSI) was either 100 or 1,000 ms, manipulated between blocks. The aim of this study was to compare this task with the explicit task-cuing procedure on a population presented as having some executive deficit: participants with Prader-Willi Syndrome (SPW). The results showed that the SPW have no deficit on the standard paradigm (except a cognitive slowing) but have performed less well on the voluntary task. The results are interpreted in terms of a selective deficit of the switching processes, more precisely as an impairment of the top-down processes and a maintenance of the bottom-up processes.

#### (PS\_2.035)

##### **Influence of motivational states on conflict control and error processing**

NIGBUR, R. & STÜRMER, B. *Humboldt-Universität zu Berlin*.

It is still open whether improvements in cognitive control and performance monitoring are induced by positive or negative emotional states. Here, we investigated effects of appetitive and aversive motivation on the control of cognitive conflicts and error processing. We combined a Simon response conflict task in two different blocks with monetary gains and losses that were related to behavioral performance - so either the 25 % fastest responses were rewarded (reward block) or the 25 % slowest responses were penalized (punishment block). Feedback-related potential amplitudes confirmed appropriate processing of the feedback signal. To quantify selective inhibitory control of response conflict we analyzed block differences in performance via reaction time distributions. Enhanced online inhibitory control was observed in the reward but not in the punishment block. To assess error-related block differences we analyzed the error-related negativity (ERN) and post-error-slowing (PES) which mirrors a shift of response threshold. ERN amplitude as well as PES were enhanced in the reward block compared to the punishment block. Our error-related results suggest that the recent reinforcement history determines current expectancy and modulates online performance monitoring. Furthermore, our results indicate that cognitive control is more flexible in positive contexts as compared to negative contexts.

#### (PS\_2.036)

##### **Formation and maintenance of task models in a goal-neglect task: Influence of instructions and task experiences**

HONMA, R., SHIOZAKI, M., UTSUMI, K., GOTO, T. & SAITO, S. *Kyoto University*.

A mental model created by participants after receiving experimental instructions is referred to as a task model. It has been established that the complexity of the task model, rather than the complexity of the task itself, affects performance of the task. In this study, we examined whether different instructions for a task would generate different task models and whether the experiences during the task would modify these task models during the experimental session. Our goal-neglect task consisted of a combination of decisions about living/non-living phenomena and a target-detection task. Results indicated that two different instructions led to differential rates of goal neglect (i.e., missing targets) in the target-detection task, but that the response times for the living/non-living and the target-detection tasks did not differ as a function of different instructions. This effect was observed throughout the experimental session, suggesting that participants formed task models on the basis of verbal instructions only, irrespective of task experience, and maintained these models throughout the experimental session.

#### (PS\_2.037)

##### **Cognitive functions among khat users**

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Catha Edulis is a plant grown in the countries around the Red sea and Eastern Africa. Its leaves are chewed by local people for their stimulant properties. Khat leaves contain alkaloids called cathine and cathinone. These active ingredients are similar in pharmacological activity and structure to amphetamines. We investigated whether khat users show detrimental performance in updating of Working Memory, Inhibitory control and Mental Flexibility as measured by N-back task, Stop Signal task and Global-Local task respectively. We found khat users showed longer SSRTs in the Stop-Signal task than khat-free participants reflecting general slowing of inhibitory processes and indicating lower levels of inhibitory efficiency. Similarly, regular users showed a significant increase in the error rates of the N-back task, suggesting that long-term regular khat use is associated with impairments in WM updating. So this result shows an impairment in monitoring of information. This deficit in monitoring could be decisive to adapt and update the cognitive system in response to changing environments. Finally, Khat users had increased switching costs in the Global-local task, suggesting that recreational use is associated with impaired cognitive flexibility.

## (PS\_2.038)

**Response conflict as a negative learning signal**

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Recent cognitive control theories proposed that conflict is a learning signal driving behavioural adaptations. Its nature has remained unclear, however. Verguts and Notebaert (2009) proposed that conflict is an arousal signal; Botvinick (2007) conceptualized conflict as inherently aversive; and recent data suggest that conflict may act as a positive signal (Braem, Verguts, & Notebaert, in press). Here, we focus on the valence dimension of conflict. We used a preference judgement paradigm to investigate whether response conflict is associated with a positive or negative valence. Participants had to choose whether they preferred a trial from one of two categories (low- or high conflict category). Results showed a higher preference for the low-conflict category, indicating conflict avoidance. This was elaborated in a second study, using an approach-avoidance paradigm. Participants were instructed to move a manikin towards (approach) or away from (avoidance) Stroop stimuli based on the colour of the word. They were significantly faster on compatible trials (approach congruent stimuli; avoid incongruent stimuli) than on incompatible trials (approach incongruent stimuli; avoid congruent stimuli). Together, these findings suggest that response conflict is a negative learning signal resulting in avoidance behaviour.

## (PS\_2.039)

**Does inter-stimulus interval impact the strength of the stroop effect?**

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In the Stroop task, an interference effect between reading a word naming a color and its printed color is a robust phenomenon. Here we tested whether within-task variations in the interstimulus interval (ISI) may impact on this interference. Twelve healthy young adults performed a modified version of the Stroop task, where they responded by pressing buttons to the color of a color-word stimuli when the two sources of information were congruent (e.g., "red" printed in red) or incongruent (e.g., "red" printed in blue). Control stimuli, i.e. neutral words matched with each color were interspersed to annihilate undesirable effects. Within the task, ISI was pseudo-randomly manipulated so that stimuli within each category were displayed after 1000, 1500 or 3000 msec. A repeated measures ANOVA with interval and condition as within-subject factors was computed on mean reaction times for correct responses. Results disclosed higher RTs for incongruent than congruent stimuli ( $p < 0.01$ ), and than control items ( $p < 0.01$ ). The main effect of the interval ( $p > 0.05$ ) and the interaction between interval and category ( $p > 0.05$ ) were non-significant. These

results indicate that interference effects in the Stroop task are not influenced by ISI variations within this time range.

## · Human and implicit learning ·

## (PS\_2.040)

**Simultaneous online tracking of adjacent and non-adjacent dependencies in statistical learning**

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When children learn their native language, they have to deal with a confusing array of dependencies between various elements in an utterance. Some of these dependencies may be adjacent to one another whereas others can be separated by considerable intervening material. In this study, we investigate whether both types of dependencies can be learned together, similarly to the task facing young children. Statistical learning of adjacent dependencies (probability = .17) and non-adjacent dependencies (probability = 1.0) was assessed in two experiments using a modified serial-reaction-time task. The results showed (i) increasing online sensitivity to both dependency types during training, (ii) better non-adjacency than adjacency learning, and (iii) non-adjacency learning being highly correlated with adjacency learning, suggesting that adjacency and non-adjacency learning can occur in parallel and might be subserved by a common statistical learning mechanism. An overnight break between two training sessions helped the online learning performance of slower learners to approach that of faster learners, but the same amount of training without such a break (a 15-min interval) did not, suggesting that memory consolidation may play a role in statistical learning of complex statistical patterns, especially for slower learners.

## (PS\_2.041)

**The omission of an expected cue has functional properties of a contextual change**

PÉREZ CUBILLAS, C. & VADILLO, M. A. *Universidad de Deusto*.

Information-retrieval effects, such as renewal, reinstatement or spontaneous recovery are well-studied phenomena in the literature on human and non-human learning. These effects consist of the retrieval of first learned information after an interference treatment (e.g., X+ trials followed by X- trials). Within this framework, context change (either physical, associative or temporal) is considered responsible for the retrieval of the first- or the second-learned association. But what is a context change? The context is usually defined as set of constant, nonsalient and nonpredictive stimuli. We conducted three experiments showing that the absence of an expected cue can have similar effects as a context switch. In these experiments, a cue received an overshadowed treatment (AX+) in a first phase. After that, in a second phase, these cues were paired with a different consequence (AX-). In the test phase, only one of the cues (X) was presented. This variation in the presentation of the cue lead participants to partially retrieve the first-learned association, showing an intermediate level of responding



to cue X. None of the theories that are usually invoked in the literature to account for information retrieval can explain this data satisfactorily.

#### (PS\_2.042)

##### **Changing explicit and implicit attitudes towards homeless with evaluative conditioning**

SIEMIENIUK, A., SWEKLEJ, J. & BALAS, R. *Warsaw School of Social Sciences and Humanities.*

The aim of the study was to examine whether different types of odors could (un)consciously influence people's attitudes towards homeless via evaluative conditioning (EC). The results of pre-test showed that the majority of people have a negative attitude to the target group. The explicit (questionnaire and direct scale) and implicit (priming task) attitude to homeless was measured. We checked if participants' attitudes changed as a result of conditioning phase in which subtle odorants (different on affective congruence in explicit and implicit evaluation) were paired with affective pictures of homeless people. It was hypothesized that the affectively congruent odor would be able to increase both implicit and explicit attitudes towards homeless, but explicitly neutral and implicitly positive odor could increase the latent attitude toward homeless. In contrast, odor perceived as explicitly positive and implicitly as a neutral could increase explicit attitude. The results indicate successful conditioning of attitudes on implicit and explicit levels of measurement. Moreover, the EC effects were more pronounced when a lemon scent was used as unconditioned stimulus. This effect might be due to a common association of a lemon scent with cleanness and freshness.

#### (PS\_2.043)

##### **Implicit contextual learning with multiple cues**

VAN ASSELEN, M., RODRIGUES, A. & CASTELO-BRANCO, M. *IBILI, Faculty of Medicine, University of Coimbra.*

Implicit contextual cueing is a learning mechanism in which visual information from our environment is memorized in order to facilitate visual search. In the current study we investigate how different types of contextual information presented simultaneously can facilitate visual search. It is known that both spatial and object cues can facilitate visual search, but it remains unclear how two different types of cues presented together can do so. Therefore, we tested 20 healthy young adults with a contextual cueing task including object identity and spatial configuration as cues. We found that when both cues are used, the contextual cueing effect is much larger than when only a single cue is used. Furthermore, a larger effect was found for spatial cues than for object cues. Finally, eye movement data that was recorded during the contextual cueing task confirm previous studies showing that spatial based contextual cueing is associated with a reduction in the number of fixations that are made (Peterson & Kramer, 2001; Tseng and Li, 2004), whereas object based cueing is associated with shorter fixation durations (Van Asselen, 2010).

#### (PS\_2.044)

##### **Automatic sequence learning in young children: the effects of reading and arithmetic fluency**

DE VRIES, M., REED, H., GEMMINK, M. & JOLLES, J. *VU University Amsterdam.*

Many daily routines, such as reading, walking, and riding a bike, are performed effortlessly and without paying much attention to it, in other words, these skills have become automatic. Some children have difficulties arriving at the level of automaticity when learning new skills at school, resulting in, for instance, problems in reading and arithmetic fluency. This may be caused by a rather domain-general deficit in the procedural memory system (e.g., Nicolson & Fawcett, 2010), involved in the acquisition of cognitive and motor skills and mediated by frontal-striatal-cerebellar regions (Packard & Knowlton, 2002; Ullman, 2004). A typical test of automatized sequence learning is the so-called serial reaction time task (SRTT; Nissen & Bullemer, 1987). In our study, 28 Dutch children in Grade 2 and 3 participated in an adapted version of SRTT. We hypothesized that children with low scores on reading and arithmetic fluency would show a significantly smaller effect of automatized sequence learning. The results showed that reading fluency did not affect serial reaction time performance. However, as expected, children with low scores on the arithmetic fluency test performed significantly worse on the serial reaction time task. The implications of the results are discussed.

#### (PS\_2.045)

##### **Influence of sad mood on visual statistical learning**

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It is well established that mood influences many cognitive processes, such as learning and executive functions. Although statistical learning is assumed to be part of our daily life, as mood does, the influence of mood on statistical learning has never been investigated before. In the present study, a sad vs. neutral mood was induced to the participants through the listening of stories while they were exposed to a stream of visual shapes made up of the repeated presentation of four triplets, namely sequences of three shapes presented in a fixed order. Given that the inter-stimulus interval was constant within and across triplets, the only cues available for triplet segmentation were the transitional probabilities between shapes. Both direct and indirect measures of learning revealed that participants learned the statistical regularities between shapes. Interestingly, although they performed similarly in the sad and neutral mood conditions, sad participants were more confident in their responses. Moreover, the combined analysis of objective and subjective measures of consciousness revealed that while "neutral" participants' performance relied on both explicit and implicit knowledge of the regularities, sad participants' performance most probably relied exclusively on extensive explicit knowledge.

## · Memory ·

## (PS\_2.046)

**Effects of sleep deprivation on memory consolidation and resistance to interference**

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The aim of this study was to test post-learning consolidation and protection against interference processes in healthy volunteers ( $n = 9$ ) in a within-subjects sleep deprivation (SD) paradigm. After learning a list of unrelated word pairs (A) subjects sleep or stay awake a whole night. Two days later, a novel list of word pairs (B) was learned just before delayed recall of the list A. List B was composed of 50% word pairs in which the initial word of the pair was also presented in list A, hence creating interference. Results indicate an interference effect in the sleep but not in the SD condition ( $p=0.004$ ). Recall of word pairs subjected to interference in list B was lower than recall of word pairs not subjected to interference. Our findings may be in line with the reconsolidation theory in that after a night of sleep the reactivation of consolidated memory traces puts them back in a labile form, hence again sensitive to interference. By contrast, in the SD condition, subjects would create a dual trace (AB and AC) allowing them to fend off the negative impact of interference: the second list does not modify the first but the two lists coexist.

## (PS\_2.047)

**Synergistic memory: the consequences of actions enter as an input into memory judgments**

BROUILLET, D.<sup>1</sup>, MILHAU, A.<sup>1</sup>, HEURLEY, L.<sup>1</sup>, FERRIER, L.<sup>1</sup>, ROLLAND-THIERS, E.<sup>1</sup> & BROUILLET, T.<sup>1, 2</sup>. <sup>1</sup>*EPSYLON Montpellier 3 France*, <sup>2</sup>*LPCS NICE Sophia Antipolis France*. Traditionally, action has been considered as an output from the organism, whose consequences are not integrated in key models of cognition. Yet, living beings are able to learn and adapt in their environments, because they are reflective systems which change their internal state depending on behavior. Furthermore, memory's function is to guide pattern of possible actions in current context. Therefore, the planned actions should take into account their consequences based on prior experiences. According to the synergistic theory, we suggest that the consequences of action enter as an input into memory judgments. Two experiments showed that after a learning task, a secondary task associating color to the consequence of the responses produced (correct vs incorrect) has an impact on the recognition task, when words were presented in those colors. The results showed that the rate of recognition, such as rates of false recognition and response times were influenced by past associations of color and answers in the secondary task. These results support the idea that memory is a dynamic system. The judgment of memory is not the product of the activation of stored knowledge, but it emerges from the interacting parts of the temporal aspects of the embodied activity.

## (PS\_2.048)

**Influence of sensory interference during encoding on memory retrieval**

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Objective. Replicate classical sensory interference effect in memory (Lehman & Murray, 2005) and explain those effects regarding Act-In model (Versace et al, 2009), which argues that knowledge are sensory-based. Specifically in this model, sensory components of memory traces are activated and progressively integrated during retrieval. In this frame, a sensory interference during encoding may selectively interfere with the activation of sensory components of the memory trace. Instead, a bimodal congruent stimulus presented during encoding should facilitate memory retrieval compared to unimodal condition. Method. First, participants had to complete a categorization task (living vs. non-living). Items could be presented either audio-visually (i.e., a visual picture presented with a semantically congruent sound or with a white noise) or only visually. In the second part of the experiment, participants completed a recognition task of visual items, which supposed to implicate familiarity and recollection processes. Results. In multimodal condition, items are globally better recognized than other ones. Instead, sensory interference (i.e., white-noise interference) selectively disrupts familiarity process compared to unimodal condition. Discussion. Retrieval from memory seems to be influenced by sensory manipulation during encoding. These results can be discussed related to activation mechanism in Act-In modelization.

## (PS\_2.049)

**Prospective memory in children: The role of episodic future thinking and social importance**

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The primary goal of this study was to explore the relationship among retrospective memory, episodic future thinking (EFT), and prospective memory (PM) in pre-school, first, and second grade children. The PM task involved a pro-social intention. One hundred twenty children (67 boys and 53 girls) took part in the experiment. Participants were from four age groups: 4-year-olds, 5-year-olds, 6-year-olds, and 7-year-olds. Participants were administered a recognition memory task, a task to test the ability to pre-experience future events, and an event-based PM task. The degree of social importance of the to-be-performed action was manipulated. For each age group ( $N=30$ ), half of the participants were assigned to the high importance, whereas the other half to the low importance condition. Data were submitted to correlational analyses, ANOVAs and logistic regression analyses. Results showed that performance on the different tasks improves with age. More interestingly, results of the regression analysis showed that, independently of retrospective memory abilities, age, EFT abilities, and social importance of the to-be-performed action were significant predictors of PM performance. These novel findings suggest that the development of EFT abilities is at

the root of PM functioning and that the latter is modulated by social relevance of future actions.

#### (PS\_2.050)

##### **Telescoping effect in dating public events**

CUBELLI, R., SELLARO, R. & FIORINO, L. *University of Trento.*

In dating tasks, public and personal events, whose dates are unknown, tend to be judged as more recent than they really are. It has been proposed that such effect, called "telescoping effect", might be due to various factors, including how accessible an event is or how far it is in time. The present study aimed at investigating some factors that can influence the subjective time of an event: participants' age, degree of knowledge and temporal distance. To this end, two age-groups of participants (i.e., youngsters and adults) were asked to date 30 public target events and to rate the amount of information they knew about each event. The results showed that remote events were dated as more recent than their actual dates and recent events were estimated as more distant in time. The telescoping effect was larger for remote high-knowledge events, i.e. participants produced more errors in dating known events than in dating other events. Further, youngsters were more accurate than adults. Results can be accounted for by assuming that since the most known events are recalled more frequently, participants tend to remember the last retrieval episode, thus judging the event as closer in time.

#### (PS\_2.051)

##### **Spacing retrieval practice and long term inhibition in memory**

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Retrieval Induced Forgetting (RIF) shows that selective retrieval of memories can impair later retention of related contents that compete for access during memory retrieval (Anderson, Bjork, & Bjork, 1994). According to previous experiment with the retrieval practice paradigm, inhibition of related contents disappeared when a delay of 24 hours is introduced between Retrieval practice (RP) and the final memory test (MacLeod & Macrae, 1999). In three experiments we further explored this finding using specific-cue-independent final test and introducing the idea of spacing retrieval in RP paradigm. Spacing promote long lasting effects of practice (Bjork, 1975), hence we wanted to explore if spaced retrieval practice modulated temporal effects of retrieval inhibition. In Experiment 1 and 2, we assessed temporal effects of RIF and replicated MacLeod & Macrae results but with specific-cue-independent final tests. In Experiment 3, we applied a spacing practice schedule to the RP paradigm. Result supported our hypothesis.

#### (PS\_2.052)

##### **False memories in a short-term memory task: The effects of backward associative strength and item identifiability**

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Can STM tasks produce false memories? Our major objective was to understand whether false memories produced with DRM paradigm on LTM tasks can be extended to STM ones. In order to accomplish this aim we applied the

Sternberg paradigm using associative lists and manipulating memory set size, probe type and backward associative strength of the words presented (0.6 and 1.2). Results showed: (1) an increase of errors and RT with the increment of set size; (2) errors decrease in high BAS condition; (3) finally, false alarms are higher and RT are slower when the probe is a critical lure. In a second study, we intended to determine whether the theme identifiability is associated with accuracy of probe detection. We found that item identifiability is higher with a higher BAS lists and no set size effect was found. Also, RTs are slower for lists with higher identifiability. We can conclude that STM paradigms can produce false memories, and theme identifiability is crucial to that memory distortion.

#### (PS\_2.053)

##### **An inquiry in to students' knowledge about monitoring strategies**

TODOROV, I., LARSSON SUNDQVIST, M. & JÖNSSON, F. *Department of Psychology, Stockholm University, Stockholm, Sweden.*

Properly tuned metacognitive knowledge is important for setting up realistic learning goals. One of the more robust findings in metacognitive science, the delayed JOL effect, pertains to the fact that delaying judgments of learning (JOL) leads to more accurate monitoring than immediate JOLs. We investigated students' (n=60) knowledge about metacognitive strategies with regard to the delayed JOL effect. There was a significant effect on monitoring accuracy from delaying JOLs, yet the participants showed poor explicit knowledge of it, and neither did their choice of strategy improve with task experience. A manipulation of the JOL question, focusing it on either prediction of memory performance or current learning, failed to elicit significant change in strategy choice. The students' predictions about their performance did not differ as a function of the altered phrasing of the JOL question. For a substantial sub-group of the participants (n=20) that kept consequently choosing the same strategy throughout the whole experiment there was a significant effect of phrasing of the JOL question. These results demonstrate the important role of correct assessment during ongoing learning, and that even experienced learners, such as, university undergraduates are seemingly unaware of which strategies lead to optimized monitoring.

#### (PS\_2.054)

##### **Familiarity can aid prospective memory performance in older adults - but at what cost?**

ENTWISTLE, R. & RUSTED, J. *Department of Psychology, University of Sussex, Brighton, U.K.*

In everyday life older adults are able to compensate for age-related declines in cognitive processing resources by using pre-established knowledge structures. We investigated whether familiarity could facilitate prospective memory (PM) performance in older adults. Participants (37 older, 40 younger) were randomly assigned to sort a familiar or unfamiliar deck of cards. The number of correctly identified PM cues, reaction times to PM cues and reaction times to sort the cards were recorded. For PM accuracy, older adults performed worse than younger adults in the unfamiliar condition but performed equally as well as them in the familiar condition. Paradoxically, the cost to ongoing performance was only observed in the familiar card condition for both groups. We conclude

that activation of the familiar cards improves PM performance but interferes with peoples' ability to perform the ongoing task and does not release resources as expected.

#### (PS\_2.055)

##### **One lump or two? How aging affects error-monitoring in a tea-making task**

BALOUCH, S. & RUSTED, J. *School of Psychology. University of Sussex. Brighton, UK.*

According to the resource theory errors occur in everyday activities when cognitive resources are limited by brain damage, distraction or old age. This predicts failures in error-monitoring (ability to detect and correct errors) when resources are limited. We investigated differences in errors and error-monitoring between cognitively healthy young and older adults in a tea-making task (TT) under conditions that limited cognitive resources. Participants completed the TT in the standard condition (SC) and a dual-task distractor condition (DC). Errors and error-monitoring were comprehensively coded. Older adults made significantly more errors than young adults. The DC significantly reduced verbal checks compared to the SC in both groups, producing more microslips for young adults, but not for older adults. We conclude older adults may benefit from training that employs the effective checking strategies used by young adults, and future studies will explore this approach.

#### • Working memory •

#### (PS\_2.056)

##### **Working memory involvement during learning with text and pictures: A dual-task approach**

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The theoretical framework for multimedia learning (i.e., learning with text and pictures) is the Cognitive Theory of Multimedia Learning (CTML). Based on Baddeley's working memory model, CTML states that information selected from text is processed in the phonological loop, whereas information selected from pictures is processed in the visuospatial sketchpad. We investigated this distinction empirically using a dual-task paradigm. Students learned from text and pictures while performing a secondary task that loaded either the phonological loop (i.e., articulatory suppression) or the visuospatial sketchpad (i.e., foot tapping). The preliminary results show that the phonological loop is involved during learning from text: performance on free recall, recall questions, and transfer questions concerning information in the text was impaired by articulatory suppression. The visuospatial sketchpad was also, although less strongly, involved during learning from pictures: performance on recall questions concerning information in the picture was impaired by foot tapping. Thus, these results corroborate the assumptions of CTML that working memory is involved in multimedia learning. They demonstrate that the distinction between phonological loop and visuospatial sketchpad also seems to be relevant when processing complex learning materials.

#### (PS\_2.057)

##### **Are true and false memories similarly influenced by cognitive load in a working memory task?**

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The Time-Based Resource-Sharing model was designed to account for the relationships between working memory functions that are processing and storage. It has been shown that storage capacity is a function of the cognitive load (CL) involved by processing. Adapting to a complex span task the DRM paradigm known to provoke false memories, we wonder whether true and false memories are similarly influenced by CL. Participants studied lists of 6 words, all associated with a non-presented critical item. Between each word, they performed intervening activities varying in cognitive load (high or low) and nature (articulatory suppression or attentional capture). For one group, lists were semantically related (bed, rest, pillow, ... for Sleep), for another, phonologically related (rat, fat, hat, ... for Cat). Immediate serial recall followed each list presentation and delayed recognition ended the experiment. While high CL leads to more forgetting of true memories, with articulatory suppression more deleterious at immediate recall and attentional capture at delayed recognition, false memories remain uninfluenced by these factors. Our results suggest that false memories do not appear to rely on working memory mechanisms, but probably rather on long-term memory processes.

#### (PS\_2.058)

##### **Processing and storage in working memory: The effect of memory load on processing performance**

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Working memory (WM) is usually defined as a system devoted to the simultaneous processing and storage of information. Up till now, this dual functioning of WM has mainly been studied by assessing the effect of processing demands on recall performance in dual-task situations combining processing and storage. Doing so, it has been shown that recall performance is a direct, linear function of the cognitive load involved in concurrent processing, both in verbal and in visuo-spatial working memory (e.g., Barrouillet et al., 2004, 2007; Vergauwe et al., 2009, 2010). In the present study, we examined the relationship between processing and storage in WM by assessing the effect of memory load on processing performance. Using a pre-load method, verbal storage (series of letters) was combined with verbal processing (parity judgment) in Experiment 1, and visuo-spatial storage (series of locations) was combined with visuo-spatial processing (fit judgment) in Experiment 2. In line with the time-based dual functioning of WM as proposed by the Time-Based Resource-Sharing model, processing performance decreased as a direct, linear function of concurrent memory load in both experiments.

## (PS\_2.059)

**Working memory and the development of emergent writing skills**

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The present study investigated the relative contribution of working memory to the acquisition of emergent writing skills at letter, word and sentence level in typically developing children aged 4-5 years. There are bi-directional processing advantages to reading and writing and the two literacy domains are taught in parallel. Of particular interest was the role of visual short-term and working memory in the interplay between reading and writing development. It is essential that the orthographic configuration of the correct grapheme correspondence to represent the speech based code is identified. Therefore, it was predicted at the earliest stages of formal instruction that there would be a greater reliance on visual short-term and working memory to support the visual discrimination skills required to encode this information from reading in order to perform writing tasks. To test this hypothesis the children were assessed on the visual and phonological domain specific storage and processing components of working memory. Measures of nonverbal cognitive ability, orthographic awareness and the children's ability to write letters, words and sentences, independently, were examined. The findings are discussed in relation to current theoretical conceptualisations of the cognitive underpinnings related to individual differences in the developmental efficacy of early writing skills.

## (PS\_2.060)

**Syntactic and semantic influences on verbal short-term memory**

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Although semantic influences on verbal short-term memory (STM) performance are well-established, substantially less research has studied the influence of syntactic representation. In the present study, syntactic and semantic factors were manipulated in order to explore how both interact to influence verbal STM. Subjects performed immediate, serial recall on lists of six Dutch words composed of three sets of adjective-noun pairs, where the nouns were either common ('de') or neuter ('het') gender. The grammaticality of the word pairs was manipulated through the morphological agreement between the adjectives and nouns (either legal or illegal), and the semantics by creating more or less meaningful word pairs (e.g., big bucket vs. grateful bucket). Syntactic and semantic factors were fully crossed within-subjects and within-items yielding a 2 (Grammatical) X 2 (Meaningful) X 2 (Noun Gender) design. Results on serial order memory accuracy revealed that both grammaticality and meaningfulness improved performance, and that the factors interacted, such that the beneficial effects of grammaticality were only present for lists of meaningful items. The present results thus demonstrate that while something as simple as morphological agreement (a long-term, syntactic constraint) can improve verbal STM performance, it

only seem to do so in the presence stronger semantic constraints.

## (PS\_2.061)

**Partial report techniques and the characteristics of iconic memory**

COLTHEART, V. *Macquarie Centre for Cognitive Science Macquarie University*.

Brief unmasked (50-100 ms) visual displays of alphanumeric characters are retained in a short-lived form of visual memory referred to as iconic memory. Although only 3-4 items can be reported from such displays when full report is attempted, the use of partial report cues presented after display offset has shown that many more items are briefly available in memory and can be selected for report even when the cue is delayed by 50 ms or more (Sperling, 1960; Averbach & Coriell, 1961). However a different technique has been used more recently to measure memory from a brief visual display. The display is shown again with one or more missing items. The task is to report the missing items from the initial display. Using this technique, the results are not consistent with the traditional picture of iconic memory. Several experiments contrasted report from brief letter displays interrogated by missing letters and other cues. The implications of results obtained with different partial report techniques for an understanding of properties of iconic memory are considered.

## · Episodic and Semantic Memory ·

## (PS\_2.062)

**Semantic representations of retrieved event information**

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The semantic content is central in autobiographical memories. In the present study we investigated the retrieval of event information by addressing the semantic representation of events. For the purpose of the present study we adopted Latent Semantic Analysis. In the experiment participants were presented with unimodal (i.e., one modality) or multimodal (i.e., three modalities in conjunction) retrieval cues and asked to retrieve autobiographical events. The events were verbally described and transcribed to text. The Latent Semantic Analysis indicated that the semantic representation (i.e., the meaning) of visually evoked memories were most similar to the multimodally evoked memories, whereas auditorily and olfactorily evoked memories were less similar to the multimodally evoked events. We conclude that retrieval using multimodal retrieval cues is dominated by visual information.

## (PS\_2.063)

**Words prime actions: How semantics affect facilitation and interference of motor programming**

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Recent studies have shown strong links between perception, motor programming, and the processing of meaning. In particular, studies within the embodied cognition approach demonstrated that action and sentence comprehension seem to be associated. However, it is still matter of debate how and when this interaction happens. In this study we tested how actions can be primed by words with different levels of abstractness. Ninety participants performed the simple action of moving a joystick upward or downward accordingly to the presentation of an imperative stimulus. Actions could be primed by task-irrelevant words belonging to four different categories with different levels of abstractness: the first category of words has a direct motor meaning (e.g. "to push up"/"to push down") while the remaining three show progressively higher levels of abstractness in their relationship with the "upward" and the "downward" directions (e.g. from the fourth category: "joy"/"sadness"). The delay between prime and imperative stimulus was systematically varied. Action-word semantic matching effects have been found in reaction times to the imperative stimulus. Such effects are also modulated by timing presentation and level of abstractness of the prime. Results are discussed according to recent theories of action representation.

## (PS\_2.064)

**Memory for performed and to-be-performed action phrases: comparative analyses of memory accuracy and accessibility**

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Motoric encoding leads to better memory performance than verbal encoding of action phrases (the enactment effect, c.f. Nilsson, 2000). Also action phrases that are encoded for later enactive (in comparison to verbal) recall show reliably better memory accessibility (e.g., shorter recognition/lexical decision response latencies). This is referred to as the intention-superiority effect (Goschke & Kuhl, 1993; Marsh, Hicks & Bink, 1998) or the intended enactment effect (Freeman & Ellis, 2003). The current study explores comparatively both effects as a function of list length (18, 30, 60, or 90 items), in what order the retrieval tasks are presented (recall, recognition vs. recognition, recall), subjective item ratings (familiarity and motor activity) as well as individual differences (in action orientation, Kuhl & Beckmann, 1994). Similar effects of intended and realized enactment were found for memory accuracy and accessibility. These effects were moderated by the nature of the action phrase and action orientation: State-oriented individuals and highly motoric action phrases showed a pronounced (intended) enactment effect. The results are discussed in terms of the action- and intention-superiority account and the results support a common explanation for both effects.

## · Numerical cognition ·

## (PS\_2.065)

**Magnitude representation and spatial-numerical associations in 6 to 8 year-old children**

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We examined the integration of magnitude and spatial information with symbolic number notation in 6, 7 and 8 year-old children. Study 1 used event-related brain potentials to determine the speed of access to magnitude information from Arabic digits in a situation when number meaning was not relevant. All age groups accessed magnitude information with similar speed. This suggests that access to basic magnitude information was mature very early during schooling. Study 2 took a step further and examined not only automatic access to magnitude but also automatic access to spatial information from symbolic digits within the same sample of children. Previous research has separately investigated the development of these components. However, developmental trajectories of symbolic number knowledge cannot be fully understood when considering components in isolation. The numerical Stroop paradigm demonstrated automatic access to magnitude from Year 1. Additionally, a parity judgment task where number meaning was again, irrelevant, showed that the onset of the Spatial-Numerical Association of Response Codes (SNARC) effect occurs from 8 years of age (Year 2 of school). These findings uncover the developmental timeline of the integration of magnitude and spatial information during the early learning of Arabic digits in normally developing children.

## (PS\_2.066)

**Numerosity, area surface, duration magnitude processing: No evidence for a shared mechanism in children**

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Numerosity, area surface, and duration are fundamental information along which living species perceive and represent the world. Whether these dimensions are subtended by a common system of quantities is still open. Here we found no evidence for such a link in children aged from 4 to 7 years. Kindergartners and first grade children were presented with two successive sets of wagons one to the left and one to the right of the screen. Depending on the task, they had to judge either the numerosity (selecting the train with the more numerous wagons), the area surface (selecting the longest train), or the duration (selecting the train which "drives" for the longest time) by pressing the corresponding left or right button on a two-key pad. The ratio between the two members of each pair was manipulated for the relevant dimension. Participants successively performed the different ratios until accuracy felt below 70 percents. Performance on numerosity judgment was not correlated with performance on the two other judgments. The

analysis of the highest ratio obtained by each child and the Weber fraction computed across all ratios indicated a finer representation for numerosity than area surface and duration in both kindergartners and first grade children.

**(PS\_2.067)**

**Reverse SNARC in left-to-right readers**

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The aim of presented study was to assess the extent to which the SNARC effect (Spatial-Numerical Association of Response Codes) may be accounted for by activating left-to-right scanning and numerical sequences. We hypothesized that reading of task instructions (activating left-to-right scanning) and processing of Arabic numbers (e.g. parity judgment or magnitude classification) within the task activate culturally determined left-to-right mapping. We examine whether SNARC occurs when Arabic number stimuli are excluded and direction of eye movements is being manipulated. In Experiment 1, left-to-right reading participants were orally instructed to determine the color of elements in a set by pressing left or right button. Sets (with equated total surface of elements) varied in numerosity. Reverse SNARC was observed - responses to small sets were facilitated on right hand side and to large on left hand side. In Experiment 2, apart from oral instruction, a ball moving from left to right was presented (thus evoking eye movements similar to those while reading), and no SNARC was found. These results suggest that reading-related left-to-right scanning may inhibit before-existing reverse SNARC. In Experiment 3, we investigate the pattern of the SNARC effect while right-to-left eye movements are evoked. The data are being analyzed.

**(PS\_2.068)**

**The influence of spatial attention on exact and approximate arithmetic**

SEYLL, L. & CONTENT, A. *LCLD, Université libre de Bruxelles, Brussels, Belgium*.

In two experiments, we assessed the intervention of visuo-spatial attention during the resolution of two forms of mental addition: exact calculation (e.g.,  $56 + 23 = 79$ ) and approximate calculation (e.g.,  $56 + 23$  is about 80). Participants had to memorize the left or right position of a cue before responding verbally to two-digits addition problems. The allocation of attention to one side of the visual field influenced the resolution of approximate additions but not the resolution of exact additions. This influence resulted in the facilitation of addition problems with a larger second operand (between 30 and 49) following the presentation of a right cue and conversely the facilitation of addition problems with a smaller second operand (between 10 and 29) following the presentation of a left cue. These findings can be interpreted as being the consequence of dynamic shifts on a spatially organized mental representation of numbers in the case of approximate addition. Conversely, exact mental arithmetic would rather entail language and complex calculation strategies involving working memory, which might hide or erase the influence of visuo-spatial attention.

**(PS\_2.069)**

**Spatial coding of object size: evidence for a stimulus size-response position correspondence effect**

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Left-to-right readers tend to react faster to small numbers when a left response is required and to larger numbers when a right response is required. This effect (i.e., the SNARC effect) is attributed to the automatic activation of spatial representations of number magnitudes, which interact with response-position codes. In particular, the SNARC effect suggests that numbers are spatially represented on a mental number line, which is oriented from left to right. The present study aimed at investigating whether the typical size of objects, as with number magnitude, is automatically represented, even if it is irrelevant to the task, and whether this representation is spatial in nature. Participants were asked to classify a centrally-presented picture as belonging to either the category of living or non-living entities, by pressing a left- or right-side key. Left responses were faster when the picture depicted a small object (e.g. an ant), whereas right responses were faster in the case of large objects (e.g. an elephant). These results indicate that the information about object typical size is automatically activated and suggest that this information is spatially coded: small objects are represented on the left and large objects on the right.

**(PS\_2.070)**

**Comparability of the numerical distance effect between tasks**

SMETS, K., GEBUIS, T. & REYNVOET, B. *University of Leuven*.

Non-symbolic quantities are represented with overlap between numerically close quantities. This overlap underlies the so-called 'distance effect', which is assumed to be a measure of numeric processing and is suggested to relate to mathematical performance. Adult participants are usually tested with comparison or same-different tasks. Recently, some doubt has been casted on whether these tasks are comparable and whether the distance effects derived from the tasks all originate at the same level. In the current study, comparison and same-different tasks were contrasted on a behavioral and a neural level. Careful precautions were taken to ensure that participants were not able to rely on visual cues which are associated with number while doing the task. On a behavioral level (i.e., reaction times), the correlation between the comparison distance effect and the same-different distance effect did not reach significance. The neural results obtained with electroencephalography were in the same line as the behavioral data. This seems to indicate a different origin for both distance effects which suggests that comparison and same-different tasks may not be entirely comparable.

## • Spatial cognition •

## (PS\_2.071)

**Spatial representation and grasping: the role of distance and sensory feedback**

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In the presence of vision, aimed motor acts can trigger remapping into peripersonal space. However, it is yet unclear how the space is coded and remapped depending on the availability of visual feedback and on the target position within the subject's peripersonal space, and which cerebral areas subserve such processes. We used fMRI in right-handed volunteers to examine neural activity during reach-to-grasp movements with and without visual feedback and at different distances of the target (near vs far reachable space). Brain response in the superior parietal lobules (SPL), in the dorsal premotor cortex (dPM) and in the anterior part of the inferior parietal lobule (IPL) was significantly higher during visually-guided grasping towards the far targets compared to the closer ones. Moreover, IPL exhibited the opposite pattern when grasping in the absence of visual feedback. We argue that in the presence of visual feedback, a visuo-motor circuit (dPM-SPL) intervenes to remap space, possibly to support online control of movement. Conversely, IPL seems to be involved in coding/remapping peripersonal space.

## (PS\_2.072)

**Spatial reasoning about remote environments encoded through narratives**

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In two experiments we investigated how spatial information described in narratives is organized in memory. Participants read short stories describing themselves at remote settings (e.g., an opera house) and were asked to memorize the locations of objects in them. Subsequently, they physically rotated to the left or right to match a change of orientation described in the narrative and then pointed towards memorized objects from imagined perspectives. Performance was faster and more accurate when participants pointed to objects from the imagined perspective that was aligned with the initial orientation described in the narrative than any other orientation. This finding suggests that (1) participants maintained spatial information in memory from a preferred direction that was determined by the initial orientation introduced in the narrative, and (2) they did not update this initial spatial memory when physically rotating. Therefore, spatial updating in environments encoded through language vs. through perceptual experience may differ.

## (PS\_2.073)

**Developmental trajectories of mental rotation abilities across adolescence**

CONSON, M., MAZZARELLA, E. & TROJANO, L. *Dept. of Psychology, Second University of Naples, Italy*.

Developmental studies on mental rotation have focused their attention on childhood or early adolescence, but did

not compare different adolescent stages. In the present paper we present a cross-sectional study to clarify the effect of adolescence-related brain maturation processes on different imagery abilities. To this aim, three groups of adolescents with typical development were required to mentally rotate letters, objects and hands. Results showed that 11-12 year-old participants were slower and less accurate than both 14-15 and 17-18 year-old individuals in all the three tasks. Moreover, the effect of body anatomical constraints on mental rotation of hands emerged in 14-15 year-old participants, and fully matured in 17-18 year-old participants. These findings demonstrate that brain developmental changes in the age range between early and middle adolescence are crucial for increasing general efficiency of mental imagery abilities. Visuospatial imagery is fully effective by middle adolescence, whereas only late adolescent automatically activate motor, body-related, information to mentally simulate actions.

## (PS\_2.074)

**Multisensory processing during spatial navigation**

VAN DER HAM, I., VAN DER KUIL, M. & DELOGU, F. *Experimental Psychology, Helmholtz Institute, Utrecht University, the Netherlands*.

Finding your way is undoubtedly a necessity in everyday life. Although numerous studies have addressed navigation ability based on performance in purely visual tasks, hardly any have focused on the contribution of auditory sensory processing. In this study we have specifically examined how both visual and auditory cues are used to navigate through virtual environments. The main goal was to assess to what extent auditory information, in isolation and in combination with visual information, contributes to navigation ability. Virtual, interactive, three-dimensional mazes were used, consisting of rooms that were only discernable by visual cues, auditory cues, or a combination of visual and auditory cues. After memorizing the environment with one set of cues, participants were placed at a random room in the maze with the same set of cues and were instructed to find their way to the exit. Results indicate that visual cues lead to better navigation performance, compared to auditory cues. Notably, performance did not improve when combining visual and auditory cues, compared to visual cues in isolation. These findings indicate that auditory information can be used to navigate through a virtual environment, but they do not contribute to performance when visual information is also available.

## (PS\_2.075)

**Both perceptual and personal factors drive visuospatial planning in the TSP**

BASSO, D. *Faculty of Education, Free University of Bozen-Bolzano*.

Visuospatial planning is a particular kind of planning, studied using the Traveling Salesperson Problem (TSP). In this 2D task, perceptual data are expected to heavily influence the choice of the trajectory in order to visit all the locations using the shortest path. However, personal traits such as egocentrism and allocentrism were not considered yet into computational models that tried to explain human performance. In this study, 30 trials (representing an open version of the TSP) were administered to 60 healthy participants, which were required to



connect 5 up to 10 points within a 2D square by finding the shortest path. Each trial was built placing the dots according to a mathematical function except for one dot, which was far away from the other ones. Results showed that the external dots were included into the figures by using either a horizontal or a vertical heuristic (as described in Basso, 2005). This performance was mainly dependent on their ego-allothetic score, while the real shortest path was partially relevant for the choice of allothetic people only. These results may not be explained by purely syntactic models (such as crossing-avoidance or pyramid approaches) but could be interpreted within the 4-stages planning model.

#### (PS\_2.076)

##### **So far so good: affective content in reaching distance perception**

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Substantial growth of interest about the interactions between perceptual and motor systems has provided extensive evidence of the multimodality of the peripersonal neural system. Such multimodality has been proposed to underlie basic action planning mechanisms. Surprisingly, little attention has been devoted to the role of affective attributes of objects in reaching distance perception and action. We present a real scenario experiment in which we manipulated both physical and psychological attributes of stimuli (e.g. desirability, familiarity) in order to test their influence on distance perception. Using a proximity judgment task participants were asked to indicate when an object was near enough to reach. Participant's estimations measured in centimetres showed a tendency to perceive undesirable objects (e.g., "used condom") as closer than desirable or familiar objects (e.g., 50€ note, own mobile phone). Individual differences taken with the Revised Eysenck Personality Questionnaire (EPQ-R) showed a significant correlation between extraversion and the estimation of reaching distances. These results are contrasted with a computer-based experiment in which digital objects (controlled for arousal and affect) were presented on a horizontal display surface. Together, our data highlight the relevance of emotional attributes and individual differences in the representation of objects and motor actions within peripersonal space.

#### (PS\_2.077)

##### **Similarity and number of alternatives in the random-dot motion paradigm**

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The popular random-dot motion (RDM) task has recently been applied to multiple-choice perceptual decision-making. In this task, participants have to decide on a direction of motion of a cloud of moving dots. The response alternatives typically surround the stimulus in a

circular way. However, this means that changes in the number of alternatives on an RDM display lead to changes in the angular distance between the response alternatives, complicating the study of multiple-choice effects with this paradigm. To disentangle the effects of angular distance and number of alternatives we analyzed behavior in the RDM task using a neurally-inspired optimal observer model. The model applies Bayesian principles to give an account of how changes in the stimulus influence the decision-making process. In addition to an analysis of optimal behavior, we applied a Linear Ballistic Accumulator (LBA, Brown & Heathcote, 2008) model to verify the predictions of the optimal model. The results show that (a) there is a natural interaction in the RDM task between angular distance and the number of alternatives, (b) the number of alternatives is encoded by the "response caution" parameter, and (c) behavior in the RDM task is near optimal when handling multiple choices.

#### • Social cognition •

#### (PS\_2.078)

##### **When task sharing eliminates the Simon effect**

SELLARO, R.<sup>1</sup>, TRECCANI, B.<sup>1</sup>, RUBICHI, S.<sup>2</sup> & CUBELLI, R.<sup>1</sup>. <sup>1</sup>University of Trento, <sup>2</sup>University of Modena & Reggio Emilia.

The joint Simon effect refers to the finding that, when two participants, sitting close to each other, respond each to one of the two possible values of a lateralized stimulus (i.e., they perform two complementary Go/NoGo tasks), responses are faster when the position of the stimulus corresponds to the position of the response, that is, to the position of the responding participant. The present study aimed at investigating the social (i.e., task sharing) and spatial (i.e., response position coding) factors underlying this effect. Participants performed a Go/NoGo task first individually, then either imaging themselves responding to the NoGo stimuli or co-operating with another person acting in another room. The Simon effect occurred only when participants spatially coded both alternative responses within their own task representation. Conversely, the belief of co-acting with another individual who performed the complementary task (i.e., the co-actor was thought to respond to the actor's NoGo stimuli), without knowing the co-actor's position, induced the implementation of a division-of-labor mechanism, which led participants to ignore the alternative response (i.e., the co-actor's response), thus eliminating the Simon effect.

#### (PS\_2.079)

##### **Genuineness of smiles modulate attentional control**

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The present study attempt to investigate the role of emotions in category formation. The context specific proportion congruency effect was used as an experimental procedure to assess implicit generation of categories. Our goal was to examine whether genuineness of a smile might be used as a contextual cue to control attention. In particular, genuineness of smile faces served as a general context that was associated with a specific proportion of congruent/incongruent flanker trials (PC or PI trials).

Thus, spontaneous smiles faces were associated with high (or low) PI trials, while posed smile faces were associated with low (or high) PI trials. Furthermore, we also created consistent and inconsistent category members within each of these two general contexts. More specifically, three faces of one group were associated with high (or low) PI trials (consistent faces), whereas a fourth face of the same group would be associated with low (or high) PI trials (inconsistent face), and vice versa for the other group. Participants showed more control for those faces that were associated with the group associated to high PI. Importantly, this effect appears even in the face inconsistent with its status as spontaneous smiling face, who was associated with high PC trials.

#### (PS\_2.080)

##### **A response-discrimination account of implicit attitude measures**

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Process analyses have put forward the idea that affective stimulus-response compatibility (SRC) is involved in several implicit attitude measures (e.g., affective priming, Implicit Association Test). However, it is unclear whether affective SRC develops through repeated pairing with categorical information or through an intentional specification of the response-meaning (or both). In a series of experiments, originally neutral key responses are massively paired with evaluative categories in evaluation trials, whereas an intentionally specified response-meaning is only occasionally highlighted. Results consistently show that intentional response-coding is more effective for a specification of the response-meaning than a repeated pairing with evaluative categories. A response-discrimination account of implicit attitude measures is discussed.

#### (PS\_2.081)

##### **Cognitive and social aspects of adaptation to a communication partner**

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Communication is a socially highly relevant form of joint action. Adaptation of interlocutors to each other's verbal behavior, e.g. by using identical lexical expressions or syntactic structures, is a well-studied phenomenon. Such adaptation can be found on various linguistic levels and may contribute to communicative success. But to what extent do situational aspects, cognitive capacities, social skills etc. influence adaptation on these different linguistic levels? We present a series of experiments, using the confederate scripting technique with children and adults, investigating the potential influence of cognitive factors (e.g. working memory) and social factors (e.g. interlocutor's native language) on the strength of linguistic adaptation. Results showed that participants adapted to their interlocutor's lexical terms, even if these were unconventional (e.g. saying telephone for a cell phone), and did so to a greater extent if their conversational partner was a non-native speaker. General language capabilities had no

effect on adaptation at the syntactic level, while lower working memory capacity decreased adaptation strength. The results suggest that social-strategic and cognitive factors influence the amount of adaptation that may contribute to successful communication. In addition, top-down factors may influence adaptation behavior more strongly than general language capabilities.

#### (PS\_2.082)

##### **How cognitive mechanisms contribute to group processes: The shared fluency theory of social cohesiveness**

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Processing fluency is the ease with which a cognitive process can be executed. It has been shown that fluency is affectively positive, and statements that can be processed fluently are more likely to be judged as true. The goal of the talk is to reveal how group processes may emerge from these simple cognitive mechanisms by presenting a shared fluency theory of social cohesiveness, defined as mutual liking and shared liking among interacting individuals. The core of the theory consists of two inter-related recursive loops: one from behavioral coordination via interpersonal fluency to mutual liking and back to behavioral coordination; the other from shared exposure via shared object fluency and shared liking back to shared exposure. I then present evidence for each step of the theory. The shared fluency theory explains a diverse set of phenomena and provides new insights into topics such as cultural rituals, Confucian virtue ethics, military drill, culturally shared aesthetic tastes, and place attachment.

#### (PS\_2.083)

##### **Normal adults' attachment and theory of mind: An exploratory study**

HÜNEFELDT, T., ORTU, F. & OLIVETTI BELARDINELLI, M. *University of Rome "La Sapienza".*

While there has been extensive research on the relationship between attachment and theory-of-mind (ToM) in developmental as well as in clinical perspective, hardly anything is known about this relationship in normal adults. Considering the current models of attachment and ToM, we hypothesized that the two dimensions of adult attachment, avoidance and anxiety, are differently related to ToM. In particular, we expected a positive correlation of anxiety, but a negative correlation of avoidance with ToM concerning other persons' mental states. In order to test this hypothesis, we used the "Reading the Eyes in the Mind Test" as a measure of ToM and the "Relationship Questionnaire", the "Experiences in Close Relationships" questionnaire and the "Inventory of Parent and Peer Attachment" as measures of attachment. A preliminary research indicated that the relationship between adults' attachment and their ability to recognize other people's emotions is mediated by variables concerning the affective quality of these emotions. In particular, we found that anxiety but not avoidance was positively correlated with the recognition of negative emotions, while neither anxiety nor avoidance were correlated with the recognition of neutral or positive emotions. These preliminary findings basically support our hypothesis but emphasize the role of mediating variables.

## (PS\_2.084)

**Interaction between inhibition of return and the Simon effect in social contexts**

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It has been shown that inhibition of return (IOR) amplifies the Simon effect. In the present study we tested whether IOR may also modulate the social Simon effect, recently observed by distributing the standard Simon task between two individuals. To this end, 24 pairs of participants performed a joint shape discrimination task in which each participant had to respond to only one of two possible shapes presented to the right or to the left of fixation. Participants' responses were assessed in relation to shape and location of the current and previous trials (IOR paradigm). Responses to successive trials were given by the same participant when the shape was repeated and by different participants when the shape changed. Results showed that the repetition of stimulus location determined a large inhibitory effect when the shape was not repeated, and a small facilitatory effect when the shape was repeated. In addition, we found a social Simon effect that was modulated by repeating stimulus location and by the gender of participants' pairs. In particular, IOR reduced the social Simon effect rather than amplifying it, in contrast to the standard Simon effect.

## (PS\_2.085)

**Can you feel me: A different sensitivity to interaction dynamics in High Functioning Autism?**

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In a Perceptual Crossing paradigm, two blindfolded participants interact by moving their mouse cursor in a one-dimensional space on a PC. In this space they encounter a fixed and a moving object, and an object representing the other's cursor. At each encounter participants receive a tactile stimulation, and they have to click the mouse whenever they think a stimulation is due to an encounter with the other. Thus, only when they meet, both simultaneously are stimulated. Previous research showed that healthy volunteers show a dissociation between task performance and awareness, in that their interaction dynamics distinguish between the moving object and the other's cursor, which however is not reflected in the proportion of clicks (they are unable to tell the difference explicitly between moving object and the other). We tested dyads consisting of one healthy control with one person with High Functioning Autism. HFA persons can exhibit three types of behaviors: (a) less exploration; (b) less marked (implicit) distinction in interaction dynamics between the moving object and the other; (c) increase in click-based (explicit) distinction between moving object and the other. We observed (b), suggesting problems with implicit interaction feedback.

## · Orthographic processing ·

## (PS\_2.086)

**Is the activation of homographic stems affected by phonological recoding?**

BRACCO, G. & LAUDANNA, A. *Department of Communication Sciences. University of Salerno. Italy.*

A debated issue in Psycholinguistics is whether or not a pre-lexical conversion of written words into a phonological code is needed to achieve lexical access: we addressed this issue in Italian, a language with a fairly transparent orthography. Three priming experiments using different prime durations (150 ms, 250 ms, 350 ms) were carried out to observe the putative time course of phonological code activation in the recognition of Italian words, by comparing homographic to homographic but non homophonic stems. In each experiment 48 verbal forms were used as targets in three priming conditions: A) prime/target containing homographic and homophonic stems (e.g., sparato/sparito, shooted/disappeared); B) prime/target containing homographic but not homophonic stems (e.g., pregi (/predʒi)/prega (/preg/), virtues/he/she prays); C) prime/target sharing the initial orthographic pattern (e.g., tornio/tornavo, lathe/ I returned). In the control condition an unrelated prime was used for each target. Experimental and control lists were all matched for the degree of orthographic overlap between primes and targets. The results show that the effect of homographic stem is still robust until prime duration of 250 ms, whereas inhibitory orthographic priming requires a 350-ms prime presentation, when priming is also modulated by phonological information.

## (PS\_2.087)

**Top-down modulation of the crowding effect in reading**

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The reading rate depends on the number of letters we take in at each fixation (visual span). This span seems limited by crowding: beyond some eccentricity the reader's critical spacing exceeds the spacing of the text and the letters crowd each other, spoiling recognition. We used the progressive demasking task, a degraded stimulus presentation procedure, to study the crowding effect during reading of isolated words. Stimuli were familiar words or pronounceable non-words, and spacing between letters was manipulated. We used standard letter and decreased letter spacing (1,03 x letter length). Our results show that the identification of decreased spaced strings was slower than normally spaced strings (crowding effect). More importantly, decreasing the lateral distance between letters impaired non-word more than word identification, thereby revealing a top-down modulation of the crowding effect. Lexical, whole-word representations would convey top-down signals that interactively help to extract spatial details in the reduced spacing condition. This feedback mechanism is not available for unfamiliar letter strings. Since sub-lexical information and phonological decoding are crucial for reading development, increased crowding could be an important factor underlying reading difficulties in dyslexic children.

## (PS\_2.088)

**Written language processing in Hearing and Deaf readers**

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A number of studies indicate that covert word recognition is mediated by phonological activation. We investigated visual word recognition in hearing and deaf readers to test for an effect of auditory deprivation in processing written language. Deaf readers have more difficulties in forming phonological representations of words and letters, which might affect the functioning of brain areas typically associated with phonological processing and their interaction with other brain regions. In this behavioral study, a lexical decision task comparing response to Italian 5 letters words and consonant strings was performed by three groups of adults: Hearing participants; Deaf Signers with Italian Sign Language as primary language; Deaf Non-Signer, which use spoken language and lip reading for communicate. Overall, Deaf readers were faster than Hearing participants in performing the task. Deaf Signers were slower than Deaf Non-Signers in processing consonant strings, whereas no difference emerged for words. Significant Lexicality by Group interaction indicates that the Lexicality effect was restricted to Deaf Signer, which responded faster to words than consonant strings. Results will be discussed within classical models of visual word recognition and taking into account effects of early training intervention on deaf participants' written language processes.

## (PS\_2.089)

**The development of sub-lexical spelling mechanisms in a shallow orthographic system (Spanish)**

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Word spelling involves, besides grapheme to phoneme translation rules, two purely orthographic processes, one based on whole-lexical representations and another one exploiting sub-lexical regularities. Data collected in English and French, two opaque orthographic systems, show that young children do use sub-lexical regularities. The present study examines the acquisition of lexical and sub-lexical abilities in Spanish, a transparent system. To examine these question Spanish-speaking participants were asked to spell high and low frequency words containing sequences like “va, ve, vi...” in which phoneme-grapheme translation rules are useless. Spelling would therefore reflect both word frequency and sub-lexical regularity effects (i.e. “vi” is more frequent than “bi” at word beginning while “va” is less frequent than “ba”). The results show strong lexical and sub-lexical effects from first grade onwards. In a second experiment the nature of units stored in orthographic memory was examined. The results were compatible with the notion that this information was purely orthographic and it didn't take into account the syllabic structure of words. Results are discussed in the context of specific features of orthographic learning in transparent systems and on the role of implicit mechanisms involved in learning to read and spell.

## · Language acquisition/cognitive development ·

## (PS\_2.090)

**One-week life of a new word. Fast ERP signatures in learning new words**

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In the present study we investigated the processes underlying word learning in adults and their neural correlates using event-related potentials (ERP). Two ERP experiments were conducted in which Spanish participants were exposed to Hungarian words in two ERP-sessions (one week apart). The amount of exposition of the new-words was carefully controlled: (i) two presentations (1st day and 2nd day), (ii) three presentations (two during 1st day and one during the 2nd day) and (iii) multiple presentations during the first day. Using this design and introducing several control conditions (legal pseudowords and Spanish words) we evaluated the ERP modulations depending on the amount of exposition to the new-words and were able to track the different ERP changes associated to same-day repetition vs. one-week repetition. Interestingly, we observed the modulation of two components which has been previously associated to fast word learning: the P2 and the N4. The evolution of the P2 and N4 depended on the number of presentations and the intra-day or between-day presentations. These results might be discussed considering how learners could be able to extract regularities of the new language in a fast and flexible way and in which degree memory consolidation processes influenced the present P2/N4 modulations.

## (PS\_2.091)

**Frequency and imageability effects in children's processing of inflected forms**

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Language requires both storage and composition. However, exactly what is memorized and what is assembled remains controversial. Inflectional morphology and particularly examination of regular and irregular past tense forms have been a fertile terrain for investigating this issue. Recent work showed that in adults the storage vs. composition of past tense forms is influenced by factors such as frequency and imageability, with frequency being the most important. The aim of the present study was to examine how such factors might affect storage vs. composition in children. Fifty-three normally developing children with ages ranging from 8 to 12 were tested on a past tense production task which involved 32 regular forms (e.g., fail-failed) and 32 irregular forms (e.g., hold-held). Results indicate that children generally resemble adults, however, in children imageability seems to play a more important role. Details of the analysis and results are presented, along with discussion and implications.

## (PS\_2.092)

**Early -20 to 27 months- formation of syntactic processing**

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A detailed investigation on syntactic-seeming changes in the speech of a Spanish child (20 - 27 months) was carried out. It was hypothesised the process would be gradual, and show local dependencies, rather than reflect underlying abstract syntactic rules. All the child's productions during 7 months were coded, and analyzed with CLAN (CHILDES Database instrument) to identify such changes. The syntactic structure of the mother's input was similarly analysed. The data were tested statistically for the significance of differences found. Unexpected results show that along with the two-word constructions, the child produced elliptical forms, increasingly so over time. Linguistic experience seems partly responsible for this, as analysis of input to the child found a constant number of elliptical constructions. Input and output, nevertheless, did not match perfectly. There were interesting differences in the syntactic structure of the elliptical forms of child and mother, probably reflecting the bias introduced by the child's own learning system. Finally, the child's elliptical forms were only situational at the beginning becoming gradually more general. The findings support the hypothesis and provide unforeseen insight into the role of syntactic fragments of input and output in the formation of the syntactic processing system.

## (PS\_2.093)

**It's raining cats and 'binus'! - lexico-semantic integration of newly learned object names as measured in two classic naming paradigms**

GEUKES, S. & ZWITSERLOOD, P. *Institute of Psychology, Westphalian Wilhelm-University. Muenster, Germany.*

The picture-word interference (PWI) and blocked naming (BN) paradigms have been frequently applied in mono- and bilingual settings to index lexical and semantic relationships between native and second language words, and their respective concepts. They allow to distinguish subtle differences in the processing of languages learned earlier and later in life. However, due to the historic focus on mid- to long-term bilinguals, relatively little is known so far about semantic integration of newly learned words immediately after learning. In our study, we therefore looked at short-term lexico-semantic effects of word-to-concept learning, using an artificial vocabulary. Over a few days, participants learned a set of pseudowords as names for common objects by means of a statistical learning procedure. These newly learned names, along with corresponding native language names, were used in PWI and BN tasks. Semantic inhibition effects were found for both native and novel object names, indicating that the novel names were rapidly integrated with conceptual memory after few exposures. These results conflict with models of bilingual representation that predict conceptual integration of novel words only for advanced stages of learning.

## (PS\_2.094)

**Setting the alarm takes longer than you think: the role of consolidation in acquiring words' emotional attributes**

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This study examines how words' emotional attributes affect linguistic processing and whether their acquisition requires consolidation. Participants were exposed to two sets of associations between made-up words (e.g., 'knirck'), both spoken and written, and pictures with either an emotionally negative or a neutral content (e.g., 'a dead sheep' vs. 'a pizza'). One set of associations was learnt one week before the test, giving them more time/sleep to consolidate; the other set was learnt either 6hrs or immediately before the test. The novel words' ability to evoke their emotional attributes was assessed using both a Stroop-like colour identification task (which did not work) and an auditory analog, i.e., pause detection. Picture-word association showed poorer memory for negative than neutral words and similar forgetting in both conditions. In striking contrast, pause detection revealed no emotionality effect for words learnt either 6hrs or immediately before the test (-4 and -3 ms), but robust interference (+30 ms) for seven-day old negative compared to neutral words. These findings indicate that it takes words' emotional attributes between 6hrs and seven days to be fully operational. Given our rotated design, they also demonstrate that alarming words produce a cost in attentional tasks orthogonal to word processing.

## (PS\_2.095)

**Electrophysiological auditory responses and language development in infants with periventricular leukomalacia**

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This study presents evidence suggesting that electrophysiological responses to language-related auditory stimuli recorded at 46 weeks postconceptional age (PCA) are associated with language development, particularly in infants with periventricular leukomalacia (PVL). In order to investigate this hypothesis, electrophysiological responses to a set of auditory stimuli consisting of series of syllables and tones were recorded from a population of infants with PVL at 46 weeks PCA. A communicative development inventory (i.e., parent report) was applied to this population during a follow-up study performed at 14 months of age. The results of this later test were analyzed with a statistical clustering procedure, which resulted in two well-defined groups identified as the high-score (HS) and low-score (LS) groups. The event-induced power of the EEG data recorded at 46 weeks postconceptional age (PCA) was analyzed using a dimensionality reduction approach, resulting in a new set of descriptive variables. The LS and HS groups formed well-separated

clusters in the space spanned by these descriptive variables, which can therefore be used to predict whether a new subject will belong to either of these groups. A predictive classification rate of 80% was obtained by using a linear classifier that was trained with a leave-one-out cross-validation technique.

(PS\_2.096)

**Basic auditory processing predicts rule learning in early infancy**

MUELLER, J., FRIEDERICI, A. D. & MÄNNEL, C. *Max Planck Institute for Human Cognitive and Brain Science.*

The ability to discover remote dependencies between speech units is a basic requirement for language acquisition. We applied event-related potentials in a passive oddball paradigm to test whether this capacity is influenced by the development of auditory perception. Standard stimuli consisted of three-syllabic spoken sequences that followed two different AXB rules for which A syllables predicted B syllables with variable X syllables. Interspersed among standards were pitch deviants and rule deviants, i.e. violations of the final B element according to the AXB rules. Infants were grouped according to the polarity of their mismatch responses to the pitch deviant as an index for the maturational status of the auditory cortex. Only those infants who showed a negativity for the pitch deviants showed a mismatch response to the rule deviants. In an adult control group no rule deviance effects were found. We conclude that the ability to extract remote dependencies is present in early infancy and critically depends on the maturational status of basic auditory mechanisms. Interestingly, it seems to be absent in its automatic form in adulthood. Future research is needed to test the impact of the observed early interindividual differences in perceptual functions on later stages of language acquisition.

• Language comprehension •

(PS\_2.097)

**Phonetic and Acoustic discrimination in premature babies with Periventricular Leukomalacia: an ERP study**

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Periventricular leukomalacia (PVL) is a frequent pathology in premature newborns that has been associated with cognitive disorders. We assessed phonetic and acoustic discrimination using auditory event-related potentials (ERPs) in 17 premature infants with periventricular leukomalacia, 10 healthy premature infants and 14 healthy at term infants (46 weeks PCA) during sleep, listening phonetic and acoustic changes. For the phonetic change, we introduced a phonetic deviant (a change in the place of articulation in the consonant) within a stream of CV syllables. For the acoustic change, we introduced an acoustic deviant (frequency change) in a stream of harmonic tones. The obligatory components for the standard stimulus in both conditions (phonetic and acoustic) were smaller in amplitude in the PVL group than in the term and premature groups. In response to the deviant syllable, the PVL group and premature group didn't show that response in the ERP's whereas the term infants did. These results may suggest an abnormal cortical auditory processing of speech and acoustic stimulus in the PVL group.

(PS\_2.098)

**The role of working memory in understanding temporal order statements**

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Research on the comprehension of temporal order statements such as biclausal Bevor/Nachdem ('Before'/'After') sentences is sparse and sometimes conflicting. Solidifying its base is important for examining both event structure and event ordering in cognition (e.g., with non-linguistic stimuli, Zacks, et al., 2007; Raisig et al. 2010) and language comprehension. Analyses of event-related brain potentials (ERPs) suggest event order cues (e.g., bevor vs. nachdem) are processed immediately, although Bevor sentences cue greater working memory demands to which HWM (but not LWM) readers are immediately sensitive (Münte et al., 1998). We revisited Münte et al.'s findings using eye tracking, allowing sentence (re-)reading (unlike ERPs with rapid serial presentation). Longer reading time is interpreted as indexing greater working memory demands. First-pass time analyses revealed temporal cue effects (elevated times for before than after). As in Münte et al., temporal cue effects appeared shortly after HWM (but not LWM) participants read Bevor versus Nachdem. Surprisingly, both HWM and LWM readers showed longer re-reading (second pass) post-conjunction in Bevor versus Nachdem sentences. Thus, on the second (but not first) sentence reading, both HWM and LWM readers were influenced by increased working memory demands, suggesting these two groups differ only initially in event order comprehension.

(PS\_2.099)

**Spatial and temporal dynamics of lexico-semantic processing in American Sign Language**

LEONARD, M., FERJAN RAMIREZ, N., TORRES, C., HATRAK, M., MAYBERRY, R. & HALGREN, E. *University of California, San Diego.*

It has been demonstrated that written and auditory words evoke lexico-semantic neural activity in a mostly left hemisphere fronto-temporal network between ~200-500 ms, suggesting that the brain areas that process meaning are modality-independent. Is the same true when one's first language is acquired in a visuo-motor modality, as is the case in congenitally deaf individuals who learn sign language? Using a multimodal imaging approach that combines the temporal resolution of magnetoencephalography (MEG) and the spatial resolution of MRI, we examined a group of native deaf signers of American Sign Language (ASL). We presented signs that were either matched or mismatched with a picture of an object, and localized the activity that occurs ~400 ms after the onset of the sign videos to a similar left fronto-temporal network as speech. Our results agree with previous research using hemodynamic and lesion methods, but add a crucial temporal component, which demonstrates that the similar neural substrate for sign and speech are driven by a similar temporal dynamics.

## (PS\_2.100)

**Activating gender stereotypes in Italian during on-line language processing**

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Research suggests that information about stereotypical gender associated with certain occupations and characteristics is incorporated into speakers' representations, rendering such information difficult to suppress during language processing. The aim of the present study was to investigate the activation of gender stereotypes in Italian. Participants were primed with a noun or an adjective that belonged to one of the following categories: (1) masculine stereotypical gender unmarked (conducente "driver"); (2) feminine stereotypical gender unmarked (insegnante "teacher"); (3) masculine biological without stereotypical gender bias (pensionato "pensioner"); (4) feminine biological without stereotypical gender bias (passeggera "passenger"); (5) stereotypically neutral gender unmarked (conoscente "acquaintance"). The prime was followed by a target, which was a personal pronoun lui ("he") or lei ("she"). Participants were required to decide as quickly as possible whether the pronoun was masculine or feminine. The results showed faster RTs in congruent conditions, both biological (pensionato - lui, passeggera - lei) and, crucially, stereotypical (conducente - lui, insegnante - lei), compared to incongruent conditions (pensionato - lei, passeggera - lui; and conducente - lei, insegnante - lui). Although the effect was stronger for biological gender manipulations than stereotypical ones, our results provide further support for a stereotypical gender priming effect in language.

## (PS\_2.101)

**Neuronal correlates of prelexical and lexical processes in visual word recognition. An individual differences research with ERPs measures**

URRUTIA, M., DOMÍNGUEZ, A., HERNÁNDEZ-CABRERA, J. A., LEÓN, I. & DE VEGA, M. *University of La Laguna.*

Many studies establish the cause of reading disabilities at a phonological level. The goal of this research was to use ERPs to investigate this hypothesis at a lexical and prelexical level. Three groups of participants, differing at their lexical and discourse abilities, completed a lexical decision experiment. The groups were the following: 1) high lexical and discourse performance (HL-HD) 2) high lexical performance but a low discourse competence (HL-LD) and 3) low lexical decoders but high discourse competent participants (LL-HD). Lexicality, syllable frequency and imaginability were manipulated variables. The results show that syllable frequency allows discriminating between groups of readers more clearly than the other variables. At the P200 component the words composed of high frequency syllables produce more positive amplitudes than those of low syllable frequency at frontal sites. At the N400 component the inverse pattern was found for high syllable frequency. In this case, a significant effect was found only for the participants of group 1. The lexicality interacts with syllable frequency in groups 1 and 2. However, any significant effect was found in the imaginability between groups. In conclusion, phonological processes are more sensitive to individual differences in visual word recognition.

## (PS\_2.102)

**The role of the declensional class in recognition of Italian written nouns**

DE MARTINO, M. & LAUDANNA, A. *University of Salerno.*

Lexical processing of nouns is affected by information about their grammatical gender. Nevertheless, it is still unclear whether the effect of gender depends on orthographic-phonological (the surface form), or on morphological factors (the activation of the inflectional paradigm). This problem is crucial for Italian nouns, since their inflectional ending simultaneously incorporates information about Gender (G), Number and Declensional Class (DC). In a lexical decision task with the priming paradigm we exploited experimental conditions where the surface forms of prime and target were kept under control and the mismatch of information about their G and DC was manipulated. The aim was to investigate the specific role of DC. Reaction times were slower when prime and target did not share G and DC. The simple mismatch of G induced a higher number of errors. Results are compatible with two explanations: i) the pre-activation of grammatical information (G and DC) inhibits the lexical processing of nouns with incongruent grammatical information; ii) a hierarchical relation holds between G and DC, where G is superordinate to DC. In this last case, effects of DC should be observed in presence of G effects, but effects of G would not imply DC effects.

## (PS\_2.103)

**Comprehension in individuals with probable Alzheimer type dementia: Can embodiment make it better?**

DE SCALZI, M., OAKHILL, J. & RUSTED, J. *University of Sussex.*

It has been shown that the process of understanding a verb activates a spatial representation that is extended along a horizontal or vertical axis. This study aimed to find out whether there were differences in how young, old and probable Alzheimer Type Dementia (pDA) individuals represent verbs, and in how their understanding verbs may interact with directional cues. When tested on forced choice and implicit comprehension tasks, no significant group differences were found, indicating that the spatial content of language is preserved in pDAs, despite their generalised impairment in comprehension. Directional cues incongruent to the direction implied in the action verb were responded faster by all three groups. This reverse compatibility effect was in line with findings from embodied studies testing young adults. Exploring this intact perceptual component of language comprehension may identify conditions under which comprehension in pDAs is facilitated, translating reverse compatibility effects into real life or clinical applications.

## (PS\_2.104)

**Detection of frequency-modulated sweep direction by speakers of Mandarin Chinese: an MEG study**

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The contour of frequency-modulated (FM) sweeps is a critical acoustic component of speech and other conspecific communication signals. Evidence from human psychophysics has shown that tonal-language speakers performed better in FM sweep direction identification, suggesting that experience in a tone-language

environment sharpens perception of FM contours. The current magnetoencephalographic (MEG) study investigates the sensitivity to the contour of FM sweeps, indexed by auditory-evoked magnetic fields, in human auditory cortex. In an auditory mismatch negativity (MMN) paradigm, speakers of Mandarin Chinese determined the direction of successive presentations of FM sweeps in a random-block design. Stimuli were linear rising and falling FM sweep in the frequency range of 600-900Hz presented at durations of 10, 20, 40, 80, 160, and 320ms. The results revealed significant MMN, peaking in the time window of 150-200ms after the stimulus onset, which was associated with both upward and downward FM sweeps. As the duration of the sweep increases, the MMN peak amplitude increases for upward but not for downward sweeps. These results suggest that the auditory evoked-field pattern is dependent on the rate and direction of frequency-modulated sweeps, and their implications for speech encoding and lexical distinction in tonal-language processing will be discussed.

#### (PS\_2.105)

##### **Valence differences in early emotional word processing. A simultaneous EEG-MEG study**

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The 'early posterior negativity' (EPN; 200-300 ms) reflects prioritized processing of emotional stimuli. It was recently discovered, that the EPN also appears in response to emotional words (Kissler et al., 2007). The question if the EPN in words is triggered by valence properties or by arousal hasn't been settled yet. The present study aimed at investigating this topic by means of an extended combination of methods. Simultaneous EEG-MEG measurements were conducted while participants silently read continuously presented streams of neutral, positive and negative nouns. Data were analyzed using L2 minimum norm solutions based on individual head models and cortical constraints. For the time window of 200-300ms we found enhanced activation for emotional words in left occipito-temporal regions replicating the results of Kissler et al. (2007). Furthermore our results displayed activation in the cingulate cortex, consistent with fMRI studies on emotional word processing (Maddock et al., 2003). With regard to the valence of stimuli, we found more right dorsolateral prefrontal activity for negative words and more left inferior prefrontal activity for positive words. This supports early hemispheric specialization for valence differences of emotional stimuli (e.g. Davidson, 2001). Methodologically, this study emphasizes the benefit of combined neurophysiological measures.

#### (PS\_2.106)

##### **Coactivation of dialects during auditory word processing in bidialectal speakers of High and Konstanz German**

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Analogous to studies on bilingual language representation, the present study addresses the possibility of parallel lexical activation of dialect variations in speakers of two language dialects. Native speakers of German who speak High German (HG) and a dialect of Konstanz (KG)

and those who speak only HG were tested on an inter-modal priming task embedded in a lexical decision task. Each trial consisted of a dialect-neutral picture prime followed by an auditory target word in HG. Pictures were paired with a target that could be phonologically primed by an HD label and one that could be primed with a KD label. For example, the HG label of Mast /mast/ could prime HG words with /s/ such as Masse /masə/. The KG label of Mast /maʃt/ could prime HG words with /ʃ/ such as Masche /maʃə/. We asked whether bidialectal participants would coactivate both HG and KG dialects in a monodialectal HG experimental environment. If the picture prime coactivates both dialects during language processing, we predicted bidialectal participants to show priming for both HG and KG conditions. Preliminary priming effects are interpreted in light of present models of lexical processing.

#### · Sentence and text processing ·

#### (PS\_2.107)

##### **Eye tracking evidence for pronoun resolution in students with intellectual disability**

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This study investigates how students with intellectual disability and low reading comprehension levels process and resolve anaphoric pronouns. The influence of the order of mention of the antecedent and its syntactic function in the resolution of ambiguous pronouns in Spanish texts were tested by means of the analyses of readers' eye movements. Eighteen participants with intellectual disability read 32 counterbalanced mini-stories of two sentences in a self-paced reading task. The first sentence contained 2 proper names. The second sentence began with a subject pronoun (the anaphor) referring to either the subject or the object of the first sentence. The arguments immediately following the pronoun disambiguated it. The study followed a 2 (antecedent position: first mentioned name vs. second mentioned name) x 2 (antecedent function: subject vs. object) within-participant design. For several pre-defined areas of interests (object and subject of the first sentence and disambiguation area in the second sentence), the number of regressions, gaze durations, first fixation, regression path and total fixations were calculated. The congruence of the preliminary analysis of these measures with the use of a less costly general cognitive strategy for pronoun referent assignment (first mentioned account) versus a grammatical analysis (subject preference account) is discussed.

#### (PS\_2.108)

##### **Can cognates modulate language switching costs in sentence context?**

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Switching between languages in production or recognition is associated with a measurable cost. Yet, numerous



studies have shown that bilinguals access lexical representations from both languages in parallel. This is especially clear for cognates, which are translation equivalents with form-overlap, such as the Dutch-English word FILM. Cognates co-activate representations in two languages and therefore provide an interesting test ground for language switching. According to Clyne's (2003) trigger hypothesis, cognates may facilitate codeswitching in the speech of habitual codeswitchers. This is corroborated by recent evidence that noun cognates reduce switch costs in reading. We examined the trigger hypothesis using an unexplored word class, verb cognates, and studied how verb cognates affect language switching in sentences. In a shadowing task, Dutch-English bilinguals were presented with sentences that could start in L1 Dutch or in L2 English; the verb prior to the switch was manipulated for cognate status. Although switching from L1 to L2 showed no effect of the cognate, latencies of slow shadowers indicated that switching from L2 to L1 was easier when the switch was preceded by a cognate verb rather than a noncognate control verb, suggesting that verb cognates can to some extent modulate switch costs in sentence context.

#### (PS\_2.109)

##### **Stereotypical and grammatical gender cues in pronoun resolution: Evidence from German**

ESAULOVA, Y., REALI, C. & IRMEN, L. *Department of Cognitive and Theoretical Psychology. University of Heidelberg. Heidelberg, Germany.*

In this eye-tracking study we investigated the processing of grammatical and stereotypical gender cues in pronoun resolution. Materials contained a gender typical role name (e.g., electrician, beautician) in masculine or feminine grammatical gender as an antecedent in the first clause and a pronoun (he or she) as an anaphor in the second. In both early and late measures, masculine pronouns were fixated longer after an incongruent feminine as compared to a masculine antecedent. No reliable effect of antecedent gender was found for feminine pronouns. Typicality did not affect pronoun resolution but role name processing. Fixation times were shorter when the typicality and grammatical gender of the role name were congruent as compared to the incongruent case. This effect was reliable in early stages of processing for typically male role names. Results show that pronoun resolution is mainly guided by grammatical features, such as grammatical gender, whereas role name processing also comprises conceptual information from semantic memory, such as gender typicality. However, masculine and feminine grammatical gender constrain pronoun resolution to a different extent.

#### (PS\_2.110)

##### **Emotional content of words in sentences modulates syntactic processing**

FERNÁNDEZ HERNÁNDEZ, A.<sup>1</sup>, MARTÍN-LOECHES, M.<sup>1, 2</sup>, CASADO MARTÍNEZ, P.<sup>1, 2</sup>, JIMÉNEZ-ORTEGA, L.<sup>1, 2</sup> & FONDEVILA, S.<sup>1</sup>. <sup>1</sup>*Center for Human Evolution and Behavior, UCM-ISCIII, Madrid, Spain,* <sup>2</sup>*Psychobiology Department, Complutense University of Madrid, Madrid, Spain.*

In the present study we investigate the influence of the emotional valence of words in the syntactic and semantic processing of a sentence by means of event-related brain potentials (ERP). Whereas the possibility is open that

emotional content may affect semantic processes due to their heuristic and general computation nature, syntactic processes would be unaffected, as they are often considered algorithmic and encapsulated. The ERP were time-locked to correct or incorrect (50%) adjectives (target word) in sentences with the structure Det-N-Adj-V while subjects performed a correctness judgement. The adjective could also be positive, negative, or neutral, but there was no mention about the emotional content of the words. Results showed a strong effect of emotional content in the words only in the syntactic condition. Words with negative valence elicited larger amplitudes in both early (Left Anterior Negativity) and late (P600) components that emerged to syntactic violations. Semantic processes (N400), in contrast, appeared unaffected. Our results suggest that syntactic processing may share resources with other processes, i.e., that it is not as encapsulated as reported before. The relevance of emotional information in language processing is also supported, adding to recent, yet scarce evidences in this line.

#### (PS\_2.111)

##### **Affectedness as a factor at the semantics/syntax interface in sentence processing: ERP data**

RAUSCH, P.<sup>1, 2, 3</sup>, KRIFKA, M.<sup>2, 4</sup> & SOMMER, W.<sup>3</sup>. <sup>1</sup>*Berlin School of Mind and Brain. Humboldt-Universität zu Berlin. Berlin, Germany,* <sup>2</sup>*Department of German Language and Linguistics. Humboldt-Universität zu Berlin. Berlin, Germany,* <sup>3</sup>*Department of Psychology. Humboldt-Universität zu Berlin. Berlin, Germany,* <sup>4</sup>*Centre for General Linguistics. Berlin, Germany.*

From a sentence like 'The doctor cured Mary', we can infer that Mary necessarily underwent a change of state in the course of the event expressed by the verb 'cured', while the same is not true in a sentence like 'The doctor treated Mary'. Verbs thus imply different degrees of 'affectedness' for their object arguments and this factor is one of the semantic key determinants for verb-argument linking at the semantics/syntax interface. To assess the impact of affectedness for this linking process during online sentence processing, we conducted a self-paced-reading experiment and an ERP study. To minimize the influence of sentence internal syntactic cues, we used German deverbal event nominalizations of verbs implying different affectedness levels (e.g. 'admiration-treatment-assassination') embedded in sentence contexts and followed by genitives that either referred to agents or patients of an event introduced in a context sentence. ERP data were analyzed using a wavelet-based functional mixed model. First ERP analyses converge with reading time and acceptability patterns and suggest a prominent role of a frontal P600-like component, while no effect on the N400 is found. We discuss the findings in light of recent processing studies on compositional semantics and the roles of the N400/P600 component families.

## · Language production ·

## (PS\_2.112)

**What does the articulatory output buffer know about alternative picture names? Evidence against the response-exclusion hypothesis**

HANTSCH, A.<sup>1</sup> & MÄDEBACH, A.<sup>2</sup>. <sup>1</sup>*Basque Center on Cognition, Brain and Language (BCBL), Donostia, Spain,* <sup>2</sup>*University of Leipzig, Germany.*

When naming pictures in the presence of a distractor word, a semantic relation between distractor word and picture name interferes with the naming response. Some models take this to reflect a lexical-competition process, while other models assume it to result from a post-lexical response-exclusion mechanism. According to the latter view, the distractor word has privileged access to an articulatory output buffer and has to be purged from it before the picture name can be produced. This buffer is assumed to have access to information which is relevant within a given task, such as gross semantic category information. Any (semantic) similarity between the picture name and the distractor word then should render removal of the distractor more difficult and thus prolong naming latencies. However, more fine-grained semantic information is not accessible to the articulatory output buffer, and thus should not affect naming performance. We tested this assumption by comparing the effect of two semantic distractor conditions keeping the semantic relation between distractor words and the to-be-produced (basic-level) picture names constant, while manipulating only the relation between the distractor and the pictures' subordinate-level name.

## (PS\_2.113)

**The role of planning in pronunciation variation**

HANIQUE, I.<sup>1, 2</sup> & ERNESTUS, M.<sup>1, 2</sup>. <sup>1</sup>*Radboud University Nijmegen,* <sup>2</sup>*Max Planck Institute for Psycholinguistics.*

In everyday speech, words are often produced with reduced pronunciation variants, in which segments are shorter or completely absent. We investigated whether word-final /t/ reduction in Dutch past-participles is affected by the ease of planning of the preceding word, and whether previously found morphological effects may actually be planning effects. We analyzed presence of 1369 /t/s and their durations in two speech corpora representing three speech styles. /t/ appeared more often absent and shorter if the past-participle followed a word that is highly predictable given the preceding context. Furthermore, /t/ was more reduced in irregular past-participles with a high frequency relative to the frequencies of the other inflected forms in the verbal paradigm, that is, in past-participles that can be selected more easily, and thus planned more quickly. Both effects were more pronounced in more spontaneous speech styles, which is as expected if the effects are driven by speech planning. These planning effects have to be incorporated in psycholinguistic models of speech production. Abstractionist models could, for instance, adapt the articulation level. Exemplar-based models have to incorporate planning as a factor influencing the choice of exemplar, or assume an articulation level that can modify the selected exemplar.

## (PS\_2.114)

**The functional unit of Japanese word naming: evidence from masked priming**

SCHILLER, N.<sup>1, 5</sup>, VERDONSCOT, R.<sup>1, 5</sup>, KIYAMA, S.<sup>2</sup>, TAMAOKA, K.<sup>3</sup>, KINOSHITA, S.<sup>4</sup> & LA HEIJ, W.<sup>5</sup>. <sup>1</sup>*Leiden Institute for Brain and Cognition & Leiden University Centre for Linguistics, Leiden University, Leiden, The Netherlands,* <sup>2</sup>*Reitaku University, Minami-kashiwa, Chiba, Japan,* <sup>3</sup>*Graduate School of Languages and Cultures, Nagoya University, Nagoya, Japan,* <sup>4</sup>*MACCS and Department of Psychology, Macquarie University, Sydney, Australia,* <sup>5</sup>*Cognitive Psychology Unit, Leiden University, Leiden, The Netherlands.*

Theories of language production generally describe the segment to be the basic unit in phonological encoding. However, there is also evidence that such a unit might be language-specific. To shed more light on the functional unit of phonological encoding in Japanese, a language often described as being mora-based, we report the results of four experiments using word reading tasks and masked priming. Experiment 1 using Japanese kana script demonstrates that primes, which overlapped in the whole mora with target words, sped up word reading latencies but not when just the onset overlapped. Experiments 2 and 3 investigated a possible role of script by using combinations of romaji (Romanized Japanese) and hiragana, and again found facilitation effects only when the whole mora overlapped, but not the onset segment. The fourth experiment distinguished mora priming from syllable priming and revealed that the mora priming effects obtained in the first three experiments are also obtained when a mora is part of a syllable (and again found no priming effect for single segments). Our findings suggest that the mora and not the segment (phoneme) is the basic functional phonological unit in Japanese language production planning.

## (PS\_2.115)

**Naming Euros, naming Dollars. Do you know what you are naming?**

MACIZO, P.<sup>1</sup>, HERRERA, A.<sup>2</sup>, MORALES, L.<sup>1</sup> & JUÁREZ, V.<sup>1</sup>. <sup>1</sup>*University of Granada,* <sup>2</sup>*University of Murcia.*

In this study we evaluate whether people in Spain and USA access to the monetary value of Euros and Dollars when they name them. The participants named sequences of banknotes grouped by category or mixed with exemplars of other categories. They were faster naming banknotes in the blocked situation which suggests that they did not process the banknotes semantically. The absence of semantic interference effect seems to be mediated by the numbers imprinted on banknotes since participants showed semantic interference when the monetary value was removed from banknotes. These results indicate that people can say aloud the monetary value of Euros and Dollars without an obligatory semantic mediation.

## (PS\_2.116)

**Phrase frequency effects in language production**

JANSSEN, N. & BARBER, H. *Department of Psychology, Universidad de La Laguna, La Laguna, Spain.*

Traditional views on the organization of the mental lexicon argue that lexical storage is reserved for morphologically simple forms (e.g., 'red', 'car', 'plural-s'), and that multi-word sequences whose meaning is transparent

(e.g., “the red car”) are not stored, but are generated from the simple forms. In two experiments we tested this view. In Experiment 1, Spanish participants produced noun + adjective, and noun + noun phrases that were elicited by experimental displays consisting of colored line drawings and two superimposed line drawings. In Experiment 2, two groups of French participants produced noun + adjective, and determiner + noun + adjective utterances elicited by colored line drawings. In both experiments, naming latencies decreased with increasing frequency of the multi-word phrase, and were unaffected by the frequency of the object name in the utterance. These results suggest that short two and three word phrases whose meaning is transparent are stored in the lexicon. These data are inconsistent with the traditional view, and suggest that lexical storage is determined by statistical learning mechanisms that are sensitive to the distributional properties with which linguistic tokens occur in the language environment.

#### (PS\_2.117)

##### **Phonological planning during sentence production: beyond the verb**

SCHNUR, T. *Rice University.*

Previous work about the extent of phonological planning during sentence production shows that at articulation, phonological encoding occurs for entire grammatical/phonological phrases, but encoding beyond the initial phrase may be due to the syntactic relevance of the verb in planning the utterance. I conducted three experiments to investigate whether phonological planning goes beyond the verb, crossing multiple grammatical phrase boundaries (as defined by the lexical heads of phrase) within a single phonological phrase. Using the picture-word interference paradigm, I found a significant phonological facilitation effect to both the verb and noun of sentences like “She kicks the ball”. In a third experiment I altered the frequency of the direct object and found longer utterance initiation times for sentences ending with a low-frequency vs. high-frequency object offering further support that the direct object was phonologically encoded at the time of utterance initiation. These results indicate that phonological planning is not necessarily restricted by grammatical phrase boundaries. That post-verb phonological properties were activated suggests that the grammatical importance of the verb did not drive the extent of phonological planning. These results suggest that all elements within a phonological phrase are encoded before articulation. Implications for models of sentence production are discussed.

• Bi/Multi-lingualism •

#### (PS\_2.118)

##### **Tracing bilingual advantage in cognitive control: conflict processing and categorization switching**

MARZECOVÁ, A.<sup>1</sup>, BUKOWSKI, M.<sup>1</sup>, LUPÍÁÑEZ, J.<sup>2</sup>, BOROS, M.<sup>1</sup> & WODNIECKA, Z.<sup>1</sup>. <sup>1</sup>*Institute of Psychology, Jagiellonian University, Krakow, Poland*, <sup>2</sup>*Department of Experimental Psychology, University of Granada, Granada, Spain.*

Bilingual advantage in cognitive control is vastly documented, although several studies, mostly with young adults, failed to replicate the effect. To investigate effects

of bilingualism on attentional control in this age group, early Hungarian-Polish bilinguals were compared to Hungarian monolinguals by means of two tasks. The first task tapped two types of cognitive conflict - S-R (Simon) and S-S (Stroop)- in conditions with vs. without distraction. Non-verbal (arrows) and verbal (words up and down) stimuli were used. Bilinguals and monolinguals did not differ in the efficiency of conflict resolution for either type of material, despite bilinguals being faster and more accurate than monolinguals when processing verbal stimuli. The second task was a categorization switching task with social stimuli (faces). Participants categorized faces either according to gender or age following an endogenous cue (colored frame). Although no significant between-group differences were observed in RT, bilinguals were more accurate than monolinguals. Bilingual advantage was most pronounced on trials with partial repetitions; on complete repetitions (i.e. the same task performed on consecutive trials), monolinguals were as accurate as bilinguals. The results suggest that bilinguals are more efficient than monolinguals when processing verbal material and demonstrate enhanced flexibility of categorization with increasing task demands.

#### (PS\_2.119)

##### **The influence of second language instruction on first language literacy skills**

MURPHY, V. A., MACARO, E., ALBA, S. & CIPOLLA, C. *Department of Education, University of Oxford.*

The focus of this project was to identify the extent to which L2 learning impacted upon L1 reading and spelling skills. This research adopted a pre-test - intervention -- post-test design comparing 3 groups of 8-year-old children who were matched on non-verbal IQ and who all speak English as a first language. The three groups comprised children who: 1) received L2 Italian instruction 2) who received L2 French instruction and 3) who received no L2 instruction across a 15 week instructional intervention in an overall sample of 152 children. At pre-test all children were tested on baseline measures of English reading and spelling and phonological awareness, as well as a measure of nonverbal IQ for matching purposes. At post-test the children were re-tested on the measures used at pre-test and the L2 groups were also given discrete tests of Italian and French vocabulary and phrases respectively. The results indicated that on some measures the group receiving L2 Italian outperformed the other groups suggesting that L2 instruction with a transparent Grapheme-Phoneme-Correspondence system can have a more facilitative effect on L1 reading and spelling. These results are discussed within the context of models of developing literacy and L2 development.

#### (PS\_2.120)

##### **Is language control preserved in bilingual Alzheimer disease patients?**

CALABRIA, M.<sup>1</sup>, HERNÁNDEZ, M.<sup>2</sup>, MARNE, P.<sup>1</sup>, JUNCADILLA, M.<sup>3</sup>, REÑÉ, R.<sup>3</sup>, ORTIZ-GIL, J.<sup>4</sup>, UGAS, L.<sup>4</sup>, LLEÓ, A.<sup>5</sup>, BLESÀ, R.<sup>5</sup> & COSTA, A.<sup>1,6</sup>. <sup>1</sup>*Departament de Tecnologies de la Informació i les Comunicacions, Universitat Pompeu Fabra, Barcelona, Spain*, <sup>2</sup>*Center for Mind/Brain Sciences (CIMeC), University of Trento, Trento, Italy*, <sup>3</sup>*Unitat de Diagnòstic i Tractament de Demències, Servei de Neurologia de l'Hospital Universitari de Bellvitge, Spain*, <sup>4</sup>*Hospital General de Granollers, Spain*, <sup>5</sup>*Hospital de la Santa Creu i*

*Sant Pau, Barcelona, Spain, <sup>6</sup>Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain.*

Bilinguals are faster to produce words in their first language (L1) when the distractor word corresponds to the target's translation (L2) than when the distractor is an unrelated word. Could this facilitation in lexical competition be abolished in patients with an impaired cognitive control? To test it we used a cross-language version of the Stroop task in bilingual older adults, MCI and AD patients. Participants were required to name colour in Catalan with three types of Spanish words: the name of the colour, the name of a different colour and the name of an unrelated word. Older adults and patients showed the same amount of cross-language identity facilitation: 35 ms faster to name colour in L1 when the distractor word in L2 was the name of the colour than when it was an unrelated word. But slower naming latencies were found when participants had to name words with a name of different colour. This interference effect was larger for MCI (255 ms) and AD (308 ms) compared to older adult controls (177 ms). It is concluded that dementia does not affect the lexical competition during speech production since the cross-language identity facilitation was reliable in patients as in older controls.

#### (PS\_2.121)

**Counterfactual reasoning in Chinese-English bilinguals**  
BASSETTI, B. *University of York (UK).*

The English language differentiates factual and counterfactual conditionals by means of verb mood, whereas the Chinese language does not explicitly differentiate the two types of conditionals. Past research presented controversial evidence of differences between English and Chinese speakers' inferencing from counterfactual stories (Bloom, 1981), which all subsequent studies failed to replicate (e.g., Au, 1984; Liu, 1985). The present study tested the hypothesis that Chinese-English bilinguals' inferences about counterfactual stories differ when stories are presented in English or Chinese. Participants read two short stories (one in each language) and answered comprehension questions. Results confirmed effects of language of presentation. A second experiment compared Chinese-English bilinguals and (older) monolingual Chinese speakers performing the same task. Bilinguals and monolinguals performed differently. Results will be discussed in terms of linguistic relativity and bilingual cognition. REFERENCES Au, T.K. (1984). Counterfactuals: In reply to Alfred Bloom. *Cognition*, 17(3), 289-302. Bloom, A. (1981). *The Linguistic Shaping of Thought: A Study in the Impact of Language on Thinking in China and the West*. Hillsdale, NJ: Lawrence Erlbaum. Liu, L.G. (1985). Reasoning counterfactually in Chinese: Are there any obstacles? *Cognition*, 21(3), 239-270.

#### (PS\_2.122)

**A bilingual ERP study on the interaction of form and meaning of color concept: A Whorfian prospective**

TZENG, A. K. *Chung Yuan Christian University.*

Whorfian hypothesis (SWH) proposes a systematic relationship between grammatical categories of a language and the way the users understand the world. SWH is robust but sometimes misleading (Martin, 1986; Pullman, 1991). Kay has done extensive work using color names. The purpose of current study was to further investigate color SWH with Mandarin-English bilinguals. Mandarin

and English differ significantly in their composition rules to form color terms. Three experiments were conducted. In Study one, more Stroop interference was found in L1 than L2. In study two, participants were to categorically judge two color patches presented simultaneously. In study three, participants were to decide color categories of congruent color words in L1 and L2. As expected, behavioral and ERP results both showed no difference in study two. Larger N400 was found in L1 than L2 in study three. We then concluded SWH was accounted for by the difference of the two languages.

#### (PS\_2.123)

**Do words in the bilingual's two lexicons compete for selection? Evidence from Polish-English bilinguals**

WODNIECKA, Z.<sup>1</sup>, ZEELENBERG, R.<sup>2</sup>, MARZECOVÁ, A.<sup>1</sup>, SZEWCZYK, J.<sup>1</sup> & TAFT, M.<sup>3</sup>. <sup>1</sup>*Institute of Psychology, Jagiellonian University, Krakow, Poland*, <sup>2</sup>*Institute of Psychology, Erasmus University Rotterdam, The Netherlands*, <sup>3</sup>*School of Psychology, University of New South Wales, Sydney, Australia*.

In bilinguals, both languages are activated in parallel. How does this simultaneous activation affect language selection? Polish-English bilinguals with varying degrees of language balance participated in a competitor priming paradigm study. During the study-phase, participants read words presented in either English or Polish and performed a word completion task. During the test phase, participants named pictures in both languages. The pictures were either 1) old items named in the same language as during study (congruent), 2) old items named in the other language (incongruent) or 3) nonstudied items. Half of the participants named pictures in separate language blocks and half switched between languages within block. Participants were faster to name congruent items than new items, but the item repetition effect was attenuated in the incongruent condition. When pictures were named in L1, participants were as slow for the incongruent items as they were for new items (and even slower when naming involved switching between languages). When pictures were named in L2, the pattern depended on L2 proficiency: balanced bilinguals showed a similar pattern as for L1, whereas unbalanced showed no competition effect for incongruent items. The results indicate involvement of inhibition during language selection.

#### (PS\_2.124)

**Cross-situational learning in mono- and bilingual adults**

FRANCO, A., SAN ANTON, M. E., DESTREBECQZ, A. & CLEEREMANS, A. *Université Libre de Bruxelles.*

Prior research has shown that learners possess powerful statistical learning abilities to solve the word-to-world mapping problem. However, little is known about people's capacity to use statistical information to map a new word onto an already known object. Here, we explore monolingual and bilingual participants' ability to map two different words onto the same object. To do so, we adapted the cross-situational learning paradigm proposed by Smith & Yu (2008). Participants were first exposed to twelve word-referent pairs (Language A). They were then exposed to another set of twelve word-referent pairs (Language B) composed of the same objects but now associated to new words. On each trial, two spoken words were presented with the two related

objects along with 0, 2 or 4 distractors. The test phase consisted in an adaptation of the Process Dissociation Procedure (Jacoby, 1991) so as to test people's ability to consciously control their knowledge. We found that monolingual and bilingual participants learn both languages in the 0 distractors condition. However, in the 2 and 4 distractors condition, we found that while both groups learn Language A equally well, only bilinguals were able to learn Language B.

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**POSTER SESSION 3**  
**Sunday Evening**

**Author Present: 18:00-20:00**

**· Aging and dementia ·**

**(PS\_3.001)**

**Using brain stimulation to study noun and verb processing in primary progressive aphasia**

LACEY, E.<sup>1</sup>, GORDON, B.<sup>1</sup> & HILLIS, A.<sup>2</sup>. <sup>1</sup>*Cognitive Neurology/Neuropsychology, Johns Hopkins University School of Medicine, Baltimore, MD, USA*, <sup>2</sup>*Department of Neurology, Johns Hopkins University School of Medicine, Baltimore, MD, USA*.

Studying the breakdown of language due to degenerative processes in relatively circumscribed brain areas has provided information about where different aspects of language might be stored in the brain. The treatment of impaired language processes and assessment of generalization effects can also tell us how the areas supporting these processes might be interconnected. The brain stimulation technique transcranial direct current stimulation (tDCS), which involves the passing of weak electrical currents through the scalp and skull, has been shown to improve performance in degenerative diseases such as Alzheimer's and Parkinson's disease, but has not yet been used in primary progressive aphasia (PPA). The current study used tDCS and behavioral methods to treat noun writing in a person with PPA. Results indicate that tDCS applied over posterior temporal lobe improves noun writing and that this effect may generalize to both written and oral production of verbs. Ongoing data collection examines the effects on noun and verb production of applying tDCS to frontal regions. Results for this participant and others will be discussed in terms of therapeutic mechanisms of tDCS for this population as well as the potential benefits of tDCS in studying noun and verb processing.

**(PS\_3.002)**

**Cerebral correlates of language plasticity in old adults without cognitive impairment**

EMILIE, C.<sup>1, 2, 3</sup>, PERRONE-BERTOLOTTI, M.<sup>1, 3</sup>, JOUVENEL, L.<sup>1, 3</sup>, MOREAUD, O.<sup>1, 4</sup>, TOESCU, E.<sup>5</sup> & BACIU, M.<sup>1, 3</sup>. <sup>1</sup>*Laboratoire de Psychologie et Neurocognition, UMR CNRS 5105 Université Pierre Mendès-France, Grenoble, France*, <sup>2</sup>*Structure Fédérative de Recherche N°1, RMN Biomédicale et Neurosciences, Unité IRM 3T, CHU Grenoble, France*, <sup>3</sup>*Structure Fédérative de Recherche « Santé et Société », Université Pierre Mendès-France, Grenoble, France*, <sup>4</sup>*Service de Neurologie, CHU Grenoble, France*, <sup>5</sup>*Clinical and Experimental Medicine, School: Clinical and Experimental Medicine, College of Medical and Dental Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT*.

The evolution of our knowledge of normal aging and its evolution now allow the development of strategies to prevent cognitive decline, knowing that dementia increases with age. In this study, we aim at highlighting cerebral correlates of language plasticity in old adults without cognitive impairment by using 2 neuroimaging methods: (i) resting state fMRI (RS-fMRI) in which the magnitude of deactivated regions underlines task-

negative network (TNN) and (ii) fMRI of language task activations in which the magnitude of activated regions underlines task-positive network (TPN). 7 young adult volunteers and 7 old adults without cognitive impairment performed categorization tasks (Living) on words and images, respectively. These tasks were used to explore TPN. Moreover, they performed RS-fMRI (participants were instructed to fixate a cross in the middle of the screen during 7 min) in order to explore TNN. Our major result is that older people without cognitive impairment show (when compared to young adults) altered deactivations (decrease) of several TNN regions and higher levels of activation (reduced hemispheric asymmetry) within TPN regions, and particularly in bilateral prefrontal and temporal regions, during language tasks. Reduced asymmetry is congruent with the HAROLD model and compensation mechanism could explain altered links between TPN and TNN.

**(PS\_3.003)**

**Aging and lexical inhibition: the effect of aerobic exercise on visual word recognition**

DIOUX, V.<sup>1</sup>, MATHEY, S.<sup>2</sup>, LACASSAGNE, M.<sup>1</sup>, COMETTI, D.<sup>1</sup>, ROBERT, C.<sup>2</sup> & ZAGAR, D.<sup>1</sup>. <sup>1</sup>*Laboratoire Socio-Psychologie et Management du Sport, Université de Bourgogne*, <sup>2</sup>*Laboratoire de Psychologie, Santé et Qualité de Vie, Université Bordeaux 2*.

Age-related changes in adults have recently been shown to affect the process of visual word recognition. Older adults generally take longer to respond to words in the lexical decision task (LDT) than young adults. In addition, the inhibitory process of competition between lexical candidates (orthographic neighbourhood frequency and syllable frequency effects) has also been shown to be impaired in older adults. Several previous studies have shown that aerobic exercise can improve reaction times but not inhibitory mechanisms in older adults. This study aimed to investigate the influence of aerobic exercise on both reaction times and syllable frequency inhibitory effect in the LDT. The experiment consisted of a baseline session (LDT alone) and a moderate exercise session (walking + LDT). Forty older and 20 younger adults participated in the experiment. The results showed no inhibitory effects for older adults in the baseline session. More important, the beneficial effects of acute exercise were observed for half of the older adults. They displayed both shorter RTs and a syllable inhibitory effect. These data suggest that exercise, when it is effective, can improve the whole word recognition mechanism.

**(PS\_3.004)**

**Online games training aging brains**

VAN MUIJDEN, J.<sup>1, 2</sup>, BAND, G. P.<sup>1, 2</sup>, COLZATO, L.<sup>1, 2</sup> & HOMMEL, B.<sup>1, 2</sup>. <sup>1</sup>*Leiden University, Faculty of Social Sciences*, <sup>2</sup>*Leiden Institute for Brain and Cognition (LIBC)*.

The number of people over age 65 is increasing rapidly worldwide. The social and economic consequences of large-scale cognitive aging have instigated increasing commercial and scientific interest in prevention and reduction of cognitive decline. The goal of our research is to understand individual differences in susceptibility to specific cognitive interventions. We have been developing custom brain training games for over two years. The games are partly inspired by commercially available brain training games, but specifically designed to tax executive

functions. Transfer of training is typically assessed in a randomized controlled trial by means of an extensive cognitive test battery. Some limited transfer effects have already been found. The games were more effective as compared to quizzes in improving task set shifting, inhibition of automatic response tendencies and working memory updating (Van Muijden et al., in prep.). Moreover, the BDNF (brain-derived neurotrophic factor) Valine homozygous genotype was associated with a larger positive transfer effect to divided attention than the Methionine/-carrying genotype (Colzato et al., submitted). These findings support the notion that the success of cognitive interventions depends not only on the quality of an intervention, but also on the suitability of the intervention for an individual.

#### (PS\_3.005)

##### **Aging and working memory: A time-based resource-sharing account**

GAILLARD, V. *Université Libre de Bruxelles.*

It is well-established that working memory capacity (WMC) declines with age. The present experiment investigates the mechanisms underlying this deficit in the context of the Time-Based Resource-Sharing model (Barrouillet et al., 2004). According to this model, the dual functioning of working memory is achieved through a mechanism of time-based resource-sharing between processing and storage. Young and older adults (aged 20-30 and 70-86) performed a computer-paced operation span task, in which they had to maintain series of letters while verifying 2-operands additions. We manipulated cognitive load in two conditions, depending on whether the additions require a carry (high cognitive load) or not (low cognitive load). Above and beyond the main effects of age group and cognitive load, results indicate that cognitive load has a more detrimental effect on recall in the older group. Implications for the development and aging of WMC are discussed.

#### • Applied cognitive psychology •

#### (PS\_3.006)

##### **Repeated testing can enhance retention in medical education**

LOGAN, J.<sup>1</sup>, MARSHAK, D.<sup>2</sup> & THOMPSON, A.<sup>3</sup>. <sup>1</sup>Rice University, <sup>2</sup>University of Texas Medical School – Houston, <sup>3</sup>Baylor College of Medicine.

Students in the health professions should remember human anatomy well enough to apply that knowledge later, in a clinical setting. Unfortunately, human anatomy is one of the most challenging courses a first year student takes. We examined how repeated testing could benefit overall retention for medical students in a human anatomy class. In the classroom, testing is typically reserved for determining mastery of material and assigning grades, but testing one's knowledge can provide substantial benefits to learning and retention. In two studies, medical students in a human anatomy course took weekly quizzes over information learned in class, for 6 weeks. Each quiz was given three times, repeated in a slightly different form each time. Repetitions were spaced out over a short delay (1 hour) or long delay (1 week). A final test was given 1 week after all quizzes to assess retention. On each subsequent test, the students showed robust improve-

ment. The scores were 28% higher on the third test than on the first, and there was a positive correlation between quiz grades and final exam grades at the end of the semester. These results suggest that repeated testing can be a simple yet powerful learning aid in medical education.

#### (PS\_3.007)

##### **Associative priming between faces and voices**

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A traditional priming paradigm was used to explore the implications of a theoretical framework in which face processing and voice processing represent two parallel pathways in a single multi-modality person-recognition system. Participants were presented with either the face or the voice of one celebrity, followed by the face of another celebrity, and the two celebrities were either semantically associated or were unrelated. The participants' task was to give a speeded familiarity judgement to the second face. The results revealed the anticipated within-modality associative priming effect in which the face of one celebrity facilitated the familiarity judgement to the face of an associate. Importantly, the results also revealed cross-modality associative priming such that the voice of one celebrity successfully facilitated the familiarity judgement to the face of an associate. These data provide a clear demonstration of the capacity for one modality to influence the other. As such, they provide support for the existence of a framework in which the processing within different modalities sits in parallel within a single multi-modal system.

#### (PS\_3.008)

##### **The role of the visuo-spatial sketchpad when learning with text and pictures**

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The main goal of the reported study was to investigate whether recent specifications concerning the structure of the visuo-spatial sketchpad (VSSP) have implications for learning with text and pictures. In particular, it was assumed that pictures are beneficial for learning only when the text conveys non-spatial rather than spatial information, because the processing of spatial text contents, of the picture, and the execution of eye movements may interfere with each other in the spatial part of the VSSP. To test this hypothesis, 85 students were randomly assigned to one of four conditions, which resulted from a 2x2 between-subjects design, with picture presentation (with vs. without) and text contents (visual vs. spatial) as factors. The results confirmed the expected interference between processing of spatial text information and pictures: the beneficial effect of picture presentation was observed only when the texts conveyed visual information, but not when it conveyed spatial information. Importantly, when no pictures were presented also no differences emerged between learners with either visual or spatial texts contents, indicating that the findings are not caused by absolute differences between the two texts such as their difficulty. The theoretical and practical implications of these results are discussed.



## (PS\_3.009)

**Inhibitory control across mental disorders**

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From early definitions of psychotic disorders (e.g. schizophrenia) there has been a strong emphasis on the cognitive deficits associated to many psychotic symptoms. However, possible cognitive dysfunctions have been scarcely studied in personality and affective disorders. These patients have been classically considered to have preserved intelligence and good cognitive functioning. In previous studies, we have found that schizophrenic patients have clear deficits in inhibitory control, and that these deficits are related to some symptoms (e.g. hallucinations). Now we have extended our research to other diagnostic groups. We think that inhibitory deficits can be observed in most mental disorders and that cognitive impairment is related to symptoms and functioning, more than to specific diagnostic categories. In order to explore this issue, we have studied inhibitory control across different disorders, with a variety of experimental and neuropsychological tasks. Results show that impairments in inhibitory control are present in affective and personality disorders, as well as in schizophrenia, supporting the idea that there are important commonalities between different mental disorders. Research about cognitive function can be a valuable tool in the classification of mental disorders.

## (PS\_3.010)

**Rumination and worrying are linked to an impaired shifting ability**

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It is commonly assumed that rumination and worrying play an important role in the development of major depressive disorder (MDD) and generalized anxiety disorder (GAD). But, despite their clinical significance, little is known about the underlying mechanisms of rumination and worrying. The present study investigated the shifting capacity of working memory, when processing non-emotional and emotional verbal information, using an Internal Shift Task (IST). The IST was administered to a group of high-ruminators (N=31) and high-worriers (N=32) versus non-ruminators (N=39) and non-worriers (N=38). The main finding was that rumination and worrying were both related to general shifting impairments. This increased shifting cost for ruminators and worriers was most pronounced when they had to shift from a negative to a neutral word. Interestingly, these results were only found when the negative words we used reflected relevant worry-themes for the participants. The possible implications of these findings in relation to vulnerability for MDD and GAD are further discussed.

## (PS\_3.011)

**Procura-PALavras (P-PAL): A web application for a new European Portuguese lexical database**

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Procura-PALavras (P-PAL) is a web application for a new European Portuguese (EP) lexical database that provides a series of objective (lexical and sublexical) and subjective indexes for ≈250.000 non-lemmatized and ≈42.000 lemmatized EP words. Based on a corpus of over 200 million EP words, the P-PAL web application enables users to obtain a broad range of statistics concerning the properties of word stimuli, including several measures of word frequency, syllable frequency, bigram and biphone frequency, orthographic and phonological structure, morphological and syntactic structure, orthographic and phonological similarity, lexical semantic indexes, concreteness, familiarity, imageability, valence, arousal, and dominance measures. In order to obtain these statistics the user should decide between a lemma or wordform search in the application and between two word-based queries: (i) generate lists of words with specific characteristics (objective and/or subjective); or (ii) analyze word lists in specific characteristics (objective and/or subjective). In this work we present the wordform and lemma frequency indexes already available (per million words and contextual diversity), as well as some structure and similarity orthographic measures such as word length, neighborhood density and frequency, transposition neighbors, and addition and deletion neighbors. Bigram and trigram type and token frequencies will be also presented.

## (PS\_3.012)

**A tendency to lie in everyday life - construction of a test**

WOJCIECHOWSKI, J., DRYLL, E. & RUDZIŃSKA-WOJCIECHOWSKA, J. *Faculty of Psychology University of Warsaw*.

Lying is a fact of everyday life - people deceive strangers as well as their relatives and friends. However, not everyone lies with the same frequency and for the same reason. To address the issue the first non-self-descriptive Polish test measuring a tendency to lie was created. It considers various types of lies: from altruistic to manipulative or destructive ones. The test consists of descriptions of various social interactions and three reactions to them: telling the truth, lying or avoidance. The subjects are asked to indicate the probability of each reaction on a 1 to 4 scale. The poster depicts stages of the test construction. Firstly, over 50 items were created and examined by the judges. According to their evaluation 25 scenes were chosen. Then the test was administered to the sample of 90 undergraduates. The analyses indicated high reliability of the test scales (Cronbach's  $\alpha$  equaled 0.87 for the lie scale, 0.829 for the truth, and 0.77 for the avoidance). After the factor analysis the number of the items was further reduced. Ongoing research aims at assessing a personal tendency to lie and personality inventory scores and at validating the test in real-life situations.

**(PS\_3.013)****"Science XL" project: How the use of smartphones can revolutionize research in cognitive science**

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Investigating human cognitive faculties such as language, attention, and memory most often relies on testing small and homogeneous groups of volunteers coming to research facilities where they are asked to participate in behavioral experiments. We show that this limitation and sampling bias can be overcome by using smartphone technology to collect data in cognitive science experiments from thousands of subjects from all over the world. We used iPhones and iPads to measure response times in a lexical decision study involving seven languages (Basque, Catalan, Dutch, English, French, Malay, Spanish). This innovative method allows millisecond-precise measurements, identical equipment across multiple countries, standardized cross-language studies, low experimental costs, and rapid transfer of data. The data collected so far show that response time distributions are strikingly similar to those obtained in laboratory conditions and predicted by mathematical models of decision processes i.e., right-skewed normal distribution. This mass coordinated use of smartphones creates a novel and powerful scientific "instrument" that yields the data necessary to test universal theories of cognition. This increase in power represents a potential revolution in cognitive science.

**• Attention •****(PS\_3.014)****Anxiety-related attentional biases and cognitive control**  
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Attentional biases toward threat-related stimuli have been observed in a number of studies and are considered as a robust phenomenon. Moreover, attentional bias research suggests that these biases occur in equal magnitude in all anxiety-related disorders. The aim of the presented study was to examine the processing of emotional stimuli (angry vs neutral faces) in low and high anxious individuals. Based on attentional control theory, we hypothesize that anxiety disrupts the two central cognitive functions: inhibition and shifting. In order to assess attentional control, a modified anti-saccade task was used. The modification allowed the assessment of not only inhibition (as is done in its classical version) but also the shifting function. Preliminary results conform predictions of attentional control theory. Furthermore, it was shown that relatively slight differences in intensity of trait anxiety can lead to significant decrease in inhibition function. Further data is being collected.

**(PS\_2.015)****ANTI-V task: Sample size can be fitted to task assessment requirements?**

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Experimental behavioral tasks developed for assessing cognitive processes should be adapted to sample characteristics and time demands depending on the context to

which they will be applied (e.g. schools, cognitive impaired patients, etc). The ANTI-V (vigilance) task can be beneficial to be used in different contexts because it measures vigilance (plus the ANTI measures of phasic alertness, attentional orienting, and executive control) by adding the detection of infrequent, unpredictable and intermittent stimuli. The present study aims to create a useful tool that will allow the user of the ANTI-V to previously determine the sample size and the amount of experimental blocks that will be needed to obtain the expected attentional effects according to the evaluation context. Eighty participants completed the ANTI-V task. We analyzed RT measures for phasic alertness, executive control and orientation networks and SDT (Signal Detection Theory) measures for tonic alert. We performed a block analysis (2 to 7 experimental blocks, of 4 min each) of the effects for each attentional network in reduced samples of 10, 20, 30 and 40 participants. As a result of these analyses, researchers will be provided with a simple and useful tool that will give robustness to the results to be obtained.

**(PS\_3.016)****Shared gender membership modulates gaze-mediated orienting in human children**

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Gaze-mediated orienting, namely the tendency to shift attention in the direction gazed by another individual, is a fundamental component of social attention. Although the eyes are a social stimulus, the possibility that social factors modulate gaze-mediated orienting has attracted interest only in recent years. In the present research, we tested the impact of shared gender membership between the cuing face and the participant on gaze-mediated orienting. This hypothesis was tested in an ecological context, namely in children attending the same class, Grade 4 at primary school. During this age, gender is one of the most relevant dimensions influencing group formation and friendships. Moreover, in the present study, children played the role of both participants and stimuli. Indeed, female and male participants were presented with a spatial-cuing paradigm in which they viewed photographs of their classmates gazing left or right before the onset of a lateralized target requiring an identification response. A significant gaze-mediated orienting emerged only towards same-gender classmates. The results highlight the role of gender as a moderator of social attention in children and emphasize the social nature of gaze-mediated orienting.

**(PS\_3.017)****When radial seems horizontal: Bisection of words and lines in patients with spatial neglect**

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In radial line bisection tasks, neurologically unimpaired participants (UP) transect the line too far (up) from the body with respect to the objective midpoint of the stimulus, while right-brain damaged patients with unilateral

spatial neglect (USN) could do so close (down) to the body (Halligan and Marshall, 1993). In a recent study with UP, Arduino, Previtali and Girelli (2010) reported a "length effect" specific to orthographic stimuli in the bisection of horizontal strings, with a leftward bias for long stimuli, and a rightward bias for short ones. In the present study, nine USN patients and matched healthy controls were asked to bisect radial words (5-10 letters) and comparable lines. A directional bias closer the body in USN patients with respect to controls was found. Furthermore, both patients and controls bisected differently words and lines, with a "length effect", i.e., a bias toward the body for short stimuli, limited to words. This pattern of results mimics what reported by Arduino et al. (2010) in lateral bisection: visuo-perceptual and linguistic features of the stimulus modulate the participants' performance in lateral and radial bisection.

#### (PS\_3.018)

##### **A paradigm to study the relationship between "Inhibition of Return" and "Cost" and "Benefits" orienting effects**

MARTÍN-ARÉVALO, E. & LUPIÁÑEZ, J. *University of Granada, Spain.*

Attentional orienting is traditionally described as driven by either of two mechanisms: endogenous orienting and exogenous orienting. The cost and benefit paradigm has been used to study these two spatial attention mechanisms: to study the endogenous orienting, a central symbolic informative cue predicts the most likely location of target appearance, orienting attention voluntarily. In contrast, for investigating exogenous orienting, an uninformative peripheral cue is used, which is supposed to involuntarily capture spatial attention. In the present work we have developed an adaptation of the cost and benefit paradigm to measure both types of attentional effects separately, as indexed by "costs" and "benefits" orienting effects, and the "Inhibition of Return" (IOR) effect, respectively. Endogenous and exogenous cues were presented in each trial and their validity was manipulated across experiments to examine whether they have independent effects on detection and discrimination tasks. Results showed that both effect could be separately measured. Interestingly, IOR correlated negatively across participants with the Cost effect. Moreover, the attentional benefits at validly cued locations decreased with practice while the costs at invalidly cued locations were constant across blocks of trials, thus, showing an interesting dissociation between them. The possible mechanisms for these effects are discussed.

#### (PS\_3.019)

##### **Endogenous versus exogenous attention in inhibition of return in schizophrenia patients**

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Previous research has failed to report significant inhibition of return (IOR) with a single cue procedure in schizophrenia patients (Huey & Wexler, 1994). This finding has been attributed to a deficit (Fuentes & Santiago, 1999) in voluntary re-orientating attention to the centre, however this hypothesis has not been tested directly. In this study the target appeared in 60% of the trials in the centre in an

otherwise typical single cue IOR procedure (Posner & Cohen, 1984), to encourage endogenous shifting of attention to the center after the cue. In line with Posner and Cohen's findings early facilitation effects were eliminated in the group of healthy adults. However, facilitation persisted in the group of schizophrenia patients. Most important patients similarly to healthy controls were able to shift their attention to the center according to expectations (overall faster responses to the central targets). These results suggest that endogenous manipulation of attention does not remove abnormally increased facilitation in schizophrenia. Furthermore, the lack of significant IOR in the group of patient cannot be attributed to a re-orienting deficit.

#### (PS\_3.020)

##### **Attentional shifts between audition and vision in Autism Spectrum Disorders**

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Previous evidence on adults shows that the presentation of a stimulus allocates the attention to its modality, resulting in faster responses to a subsequent target presented in the same (vs. different) modality. In this study, we compared the performance of a group of patients with Autism Spectrum Disorders (ASDs; high-functioning; N=14; age: 12-16 yrs) and a group of neurotypical controls (N=17; 11-17 yrs). Participants were asked to detect a target (S2), auditory or visual, which was preceded, at different SOAs (i.e., 150, 600, 1,000 msec), by an uninformative cue (S1), either in the same or a different modality. Besides a generalized slowing down of the responses in the ASD patients (vs. controls), systematic differences between the two groups emerged. In controls, regardless of SOA, when S2 was visual, S1 modality did not affect performance. Unlikely, when S2 was auditory, and SOA was long, a visual S1 produced longer RTs as compared to when it was auditory. In the ASD group, an a-specific speeding up of responses was observed when S1 was auditory (vs. visual), with no effects on the detection of S2. The discrepancy of performance suggests that ASDs affect the processing of sensory inputs and the attentional crossmodal shift.

#### (PS\_3.021)

##### **Visual word recognition is influenced by the oscillations of auditory attention**

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Background music affects the speed of visual discrimination. For example, pictures are processed faster when they are displayed "on beat", i.e. in synchrony with a highly expected time position of an auditory rhythm. The objective of our study was to investigate if similar effects could be observed with written words. 32 participants were presented with bisyllabic words which were displayed on the screen while a to-be-ignored binary sound sequence looped. In each trial, a first group of letters, corresponding to the first part of an item (P1), was displayed for 40 ms. Then it was erased (for 125 ms) until

the remaining part of the item (P2) was displayed (also for 40 ms). Depending on the trials, the letters of P1 could be congruent with the correct syllabation of the item (e.g. pan in pan/da) or not (e.g. pa in pa/nda). Participants had to perform a lexical decision on P1+P2. Our results showed that incorrect syllabation of written words led to longer RTs. More interestingly, this disadvantage was increased when P1 occurred on-beat with the auditory rhythm. This suggests, in accordance with Jones's Dynamic Attending Theory, that the visual word recognition can be influenced by the oscillations of auditory attention.

#### (PS\_3.022)

##### **Cambridge Neuropsychological Test Automated Battery and low and superior cognitive processes in the elderly**

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Memory and attentional processes have been classically related to processing resources in middle-aged and elderly persons, including speed of response. In most of these studies, these processes have been measured through paper-and-pencil tasks. In this research, we aim to replicate these findings through computerized tasks. We applied to a Spanish sample of 88 elders (age =69,99; s.d.=6,66) a set of test from the Cambridge Neuropsychological Test Automated Battery (CANTAB), including Paired Associates Learning (PAL, visual memory and new learning), Intra-Extra Dimensional Set Shift (IED, shifting and flexibility of attention), Reaction Time (RTI, Five-choice speed of response) and Motor Screening (MOT, simple speed of response). Pearson bivariate correlations showed significant relations, some of them inverse, between age and RTI ( $r=0.337$ ,  $p=0.002$ ), MOT ( $r=0.297$ ,  $p=0.007$ ) and PAL stages completed on first trial ( $r=-0.240$ ,  $p=0.031$ ), total errors adjusted ( $r=0.350$ ,  $p=0.001$ ), first trial memory score ( $r=-0.297$ ,  $p=0.007$ ) and stages completed ( $r=-0.312$ ,  $p=0.005$ ), but not between age and IED. Low to moderate but inversely significant correlations were found between MOT and stages completed of PAL and IED ( $r=0.315$ ,  $p=0.003$ ;  $r=-0.243$ ,  $p=0.024$ ). These results point to a some kind of relation between speed of response and superior processes. Other different factors should be studied.

#### • Executive control •

#### (PS\_3.023)

##### **Punishing errors increases post-error slowing but does not affect post-error accuracy**

HOUTMAN, F., VAN DER BORGH, L., FIAS, W. & NOTEBAERT, W. *Ghent University*.

It has been shown that people who are more sensitive for errors demonstrate a different reaction to errors. For example, adults with an obsessive-compulsive disorder show increased post-error slowing (Veale, Sahakian, Owen, & Marks, 1996). In the present study, we manipulated error sensitivity experimentally in an arrow flanker task. Participants were either rewarded for correct trials, or punished for error trials. Moreover, both the reward and the punishment groups were further divided in a high and low reward/punishment condition, resulting in 4

between-subjects conditions. Post-error slowing was observed in the punishment groups but not in the reward groups, indicating that more attention was directed to the errors in the punishment group, in line with the orienting account for post-error slowing (Notebaert et al., 2009). Interestingly, there was post-error accuracy decrease in all groups. This indicates that post-error slowing is not functional and does not improve performance and, more important, that post-error accuracy is dissociable from post-error speed. While reaction times on trial  $n$  depend on the amount of attention directed to the action outcome of trial  $n-1$ , accuracy on trial  $n$  is more directly correlated with accuracy on trial  $n-1$ .

#### (PS\_3.024)

##### **Switching to worse ? Response suppression studied by change task**

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In conflicting situations, control of responses activation is crucial in order to provide actions appropriated to the context. By studying those processes using a Simon task, previous studies have led to the development of the activation-suppression model. According to this model, the early activation of the spatially-corresponding response is followed by the inhibition of this response. We test this model using a Simon task, combined with a Change task: on some trials of a classical Simon task, during the subject's reaction time, a change of stimulus color indicates the need to change the response (thus, congruent trials become incongruent, and incongruent trials become congruent). Using different delays between the first stimulus presentation and the color change allow us to investigate the dynamics of the responses activation and inhibition. A non-trivial prediction of the activation-suppression model is that when the color change occurs at a long delay after the stimulus, switching from a congruent to an incongruent response should be easier than from an incongruent to a congruent response, because of the (relative) suppression of the spatially-corresponding response at this moment. First results seem to confirm this prediction.

#### (PS\_3.025)

##### **Working memory, executive functions and neurological soft signs in obsessive-compulsive disorder**

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Obsessive-compulsive disorder (OCD) is a psychiatric disease associated with abnormalities of the orbitofrontal prefrontal cortex. This study was aimed at clarifying the relationships between working memory capacities, executive abilities and neurological soft signs (NSS), i.e. three measures that have been linked to prefrontal brain areas, in OCD patients. Participants were 43 patients and their individually-matched controls. The verbal and visuo-spatial components of participants' working memory were evaluated using the reading span and the backward location span tests. Executive functions were assessed through selective attention tests involving active

inhibition (the Stroop and d2 target crossing tests), tests assessing information retrieval from long-term memory (the verbal fluency and Hayling sentence completion tests), and a task switching test. OCD patients' working memory spans were both reduced compared to controls. All OCD patients' executive abilities were impaired, but their performance was particularly low on all tests involving active inhibition processes. NSS were more frequent in OCD patients than in controls, and there was a negative correlation between the OCD patients' intensity of NSS, their working memory spans and their performance on the Stroop and d2 selective inhibition tests. This suggests that NSS might be used as an index of the prefrontal abnormalities underlying OCD.

#### (PS\_3.026)

##### **Social-evaluative stress differentially modulates brain activities for mixing and switching costs**

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This functional magnetic resonance imaging (fMRI) study examined the acute effect of social-evaluative stress on task switching. Participants performed a switching task under both stressful (negative feedback about performance) and control (no feedback) conditions. Behavioral results indicated a trend of shorter RTs and smaller local switching effect in the stressful than in the control condition. Voxelwise GLM analysis of BOLD signals revealed that while stress modulated activations for global switching effect in visual regions (right middle occipital gyrus and cuneus), it had a wider spread influence on activations for local switching effect across anterior (bilateral putamen; right caudate and medial frontal gyrus) and posterior areas (right middle occipital gyrus, precuneus and cuneus, lingual gyrus). Interestingly, in the local-effect related region-of-interests (ROIs), activations for single task blocks were smaller in the stressful than in the control condition, whereas activations for repeated trials in the mixed task blocks showed the opposite pattern. On the other hand, in the global-effect related ROIs, activations for switched trials remained constant regardless of stress, while those for repeated trials were larger in the stressful condition. To conclude, task switching requires executive processes that are differentially prone to the influence of social evaluative stress.

#### (PS\_3.027)

##### **Obsessive-Compulsive symptoms, Cognitive Self-Consciousness and cognitive inhibition**

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Difficulties in the inhibition of irrelevant information or reaction are supposed to be an important aspect of Obsessive-Compulsive Disorder (OCD). Moreover, OCD subjects' cognitive deficits observed in several studies may be accounted for by non-effective attentional resource allocation (especially a tendency to monitor one's cognitive processes). The aim of the present study was to explore the relation between cognitive inhibition and the intensity of OCD symptoms in a subclinical group. Participants were administered with the Vancouver Obsessive-Compulsive Scale (VOCI) and a battery of tasks measuring

inhibitory processes (based on Stroop, Go/No Go, Stop Signal and Navon tasks). The tendency to focus on internal processes was assessed with the Cognitive-Self-Consciousness Scale (CSC). The intensity of depressive symptoms (BDI), state and trait anxiety (STAI) were controlled as well. It is expected that measures of inhibition would negatively correlate with VOCI, CSC and STAI scores. Positive correlations between self-reported measures of OCD symptoms, the Cognitive Self-Consciousness Scale and anxiety scale scores are also expected. The data is currently under analysis.

#### (PS\_3.028)

##### **Does the phonological buffer represent stimulus-response rules for task-set preparation and maintenance?**

VAN 'T WOUT, F., MONSELL, S. & LAVRIC, A. *School of Psychology. University of Exeter. Exeter, UK.*

A growing body of evidence suggests that linguistic, and specifically phonological, representations might be involved in task-set preparation and maintenance (e.g. Miyake et al., 2004). But the precise nature of this contribution remains unclear. Accounts of task-switching generally assume that the current task's stimulus-response (S-R) rules must be elevated to and maintained in a privileged state of activation. The two experiments reported here test the hypothesis that the phonological buffer is used to represent them. To this end, two variables that should reveal phonological buffer involvement - the word length and phonological similarity of the stimulus terms - were manipulated within a task-cueing paradigm. Specifically, participants were required to switch between classifying sets of images depicting nouns of longer or shorter spoken duration (Experiment 1), or between classifying sets of phonologically similar or dissimilar consonants (Experiment 2). The results demonstrate that neither word length nor phonological similarity affected task switching performance, or indeed performance in general. Only at the very start of Experiment 2 were reaction times reliably longer for phonologically similar than dissimilar consonants, suggesting a very transient role of the phonological buffer in representing S-R rules.

#### (PS\_3.029)

##### **Role of phonological short-term memory in global but not local task switch costs**

ALLEN, C. & MARTIN, R. *Department of Psychology. Rice University. Houston, TX, USA.*

Previous research has suggested that phonological short-term memory (STM) is involved when self-cueing of task switches is required. In this study, we examined whether semantic STM also plays a role in shifting. Using a predictable, cued shifting paradigm, we assessed the effect of increasing task memory load and of individual differences in both phonological and semantic STM capacity. Older adults were tested on a cued shifting paradigm under low and high memory load conditions, and in both standard and articulatory suppression (AS) conditions. For global switch costs, AS disrupted performance in the high but not the low load condition; in addition, performance in the high load condition was negatively correlated with phonological retention. For local switch costs, AS did not disrupt performance in either load condition; local switch

costs showed no relation to any measure of STM capacity. In line with previous research, we hypothesize that a phonological code is used to maintain task sequence in mixed task conditions under high load conditions, and is equally involved in shift and repeat trials; in contrast, semantic STM does not play a critical role in this measure of executive function.

#### (PS\_3.030)

##### **How is cognitive control fine-tuned? ERP evidence for reactive and proactive cognitive control**

CZERNOCHOWSKI, D. & SAßE, J. *Heinrich-Heine-University Düsseldorf.*

According to the dual mechanisms of control framework (Braver et al., 2007), two alternate routes may lead to correct response selection. When response conflict is detected, reactive control processes can be recruited immediately before the response, at the expense of longer RTs. If advance preparation is feasible, control processes can be recruited proactively to allow for both rapid and correct response selection. Here, informative or uninformative cues were presented in a cued task-switch paradigm, making advance preparation either feasible or not. Event-related potentials (ERPs) were recorded to identify dissociable neural correlates for both control processes. Following informative cues, participants responded about 300 ms faster relative to uninformative cues, suggesting proactive control was recruited successfully. In the corresponding ERPs, a sustained (right-) frontal positivity was observed between 200-500 ms post-cue onset following informative, but not uninformative cues. By contrast, accuracy was high following both types of cues, suggesting that reactive control was recruited successfully. Starting around 200 ms pre-response, the corresponding ERPs revealed a (left-) frontal activity (pre-response negativity) following uninformative relative to informative cues. Both components and performance differences were evident only during mixed-task blocks, consistent with the notion that control processes are recruited selectively to meet higher task demands.

#### • Multisensory integration + Motor control •

#### (PS\_3.031)

##### **When a non specific action enhances visual entry**

VALLET, G.<sup>1, 2, 3</sup> & SHORE, D.<sup>1</sup>. <sup>1</sup>*Multisensory Perception Laboratory (PNB), McMaster University; Hamilton, Canada,* <sup>2</sup>*Laboratoire EMC, Lyon2 University, Lyon, France,* <sup>3</sup>*School of Psychology, Laval University, Quebec City, Canada.*

**Objective.** Explore how action can influence the perception and integration of multisensory stimuli. **Method.** Participants initiated each trial by pressing a left or a right key of the keyboard. A visual or an auditory stimulus was presented immediately (0ms SOA) or after 500ms. The second stimulus was presented after an additional 100, 200, 300 or 400ms. The light (Experiment 1) or the sound (Experiment 2) was lateralized to the ipsilateral or contralateral side of the action. Observers judged which of the two stimuli were presented first. **Results.** The point of subjective simultaneity (PSS) and just noticeable difference (JND) was computed. The PSS was shifted between the two SOAs such that the auditory stimulus had to be presented sooner in the 0 SOA condition (-106ms) com-

pared to the 500ms SOA condition (-14ms). This contrasts starkly with classical results where the light must be presented before the sound (50ms) to be perceived simultaneously. The JND was smaller for the 0ms SOA condition. There was no effect of side of presentation. **Conclusion.** Action seems to speed the processing of visual stimuli relative to auditory stimuli. There was no support for the application of the unity assumption with action.

#### (PS\_3.032)

##### **Establishing and relearning action-effect associations**

NATKEMPER, D. & FRENCH, P. A. *Humboldt University Berlin, Germany.*

Investigating the effects of action-effect compatibility has provided valuable insights into human action control. These studies show that responses are initiated faster if there is an overlap between features of the response and features of the effect. This observation emerged (among others) from experiments showing that a variant of the so-called SNARC-effect can be generated when persons produce numbers by key-presses. The SNARC-effect is a spatial compatibility effect which is usually observed when numbers are processed. Small numbers are preferentially responded to with the left hand and large numbers with the right hand. For explanation it is assumed that mental representations of numbers are associated with spatial information; relatively small numbers are associated with 'left' and relatively large numbers with 'right'. These relative spatial codes get activated when number identity is processed. Similar effects are observed when persons produce nominally task-irrelevant numbers by key-press responses to visual stimuli: Small numbers are preferentially produced with the left hand and large numbers with the right hand. This suggests that participants represented the relations between actions and their effects and used this knowledge in action control. We report a series of studies that aimed at investigating the details of action-effect acquisition and usage.

#### (PS\_3.033)

##### **Effects of visual speech on syllable processing speed in babble and white noise: An event-related potential study**

VALSØ, A. M. & BEHNE, D. M. *Speech Lab, Psychology Department, Norwegian University of Science and Technology.*

Behavioral research on audio-visual speech perception has long shown an increased use of visual information when speech is imbedded in white noise (e.g., Sumbly & Pollack, 1954). More recently, use of visual speech information has been shown to be even greater in babble than white noise (e.g. Alm et al., 2009). The current study investigates temporal effects of white noise and cafeteria babble on speech processing, and the effect of visual speech on the respective conditions. Continuous EEG was recorded while thirteen healthy Norwegians were presented with audio-visual, audio-only, and visual-only productions of the syllable /ba/ in quiet or masked with white noise or babble. Latency analyses of the N1 component showed that early speech processing was later in noise conditions compared to quiet, and to a greater degree in cafeteria babble than in white noise. Results also showed that the access to visual speech cues increased processing speed in the noisy conditions and

reduced the gap in processing speed of syllables between quiet and noise. These findings will be discussed in terms of the principle of inverse effectiveness

• Human learning/Implicit learning •

(PS\_3.034)

**Learning what, when, and where in an associative learning framework**

NELSON, B.<sup>1</sup>, NAVARRO, A.<sup>1</sup> & P.LEON, S.<sup>2</sup>. <sup>1</sup>*Basic Processes in Psychology. University of the Basque Country. San Sebastian, Spain,* <sup>2</sup>*Department of Psychology. University of Jaen. Jaen, Spain.*

Associative learning goes well beyond “spit and twitch” autonomic responding and provides a framework for investigating how humans and animals learn about and represent their world. Three experiments were conducted to determine the extent to which knowledge about what events were to occur, when they were to occur, and where they would occur, could be assessed with a behavioral associative-learning paradigm in humans. A novel video-game task was used where behavioral responses were associated with the appearance of spaceships, and later those spaceships were predicted by sensors. The discussion of the resulting behavioral data elucidates how the data can be used to show that participants indeed learned what was about to occur in the presence of these signals as well as rich information about when it was about to occur. Eye-tracking, using a SensoMotoric Instruments system, revealed that participants also acquired knowledge of where the predicted event would occur in parallel with both “what” and “when.” Autonomic pupil responses appeared as conditioned responses along with these other response forms, but did not add any significant evidence of association formation over the other measures. Complex processes of learning in humans remain accessible without reliance on self-report.

(PS\_3.035)

**Visual perceptual learning: Effects of pre-exposure schedule, task demand, and feedback**

VÁZQUEZ, G., ARRIOLA, N. & ALONSO, G. *University of the Basque Country.*

A series of experiments investigated the effect of pre-exposure schedule (concurrent, intermixed, and blocked) to two very similar visual stimuli (two coloured checkerboards) on the ability of human participants to discriminate between them in a “same/different” judgment task. When participants were also required to judge stimuli as same or different during pre-exposure, accuracy on the subsequent task was greater after concurrent and intermixed pre-exposure than blocked pre-exposure. Reaction time was lower after concurrent pre-exposure. This pattern was attenuated or disappeared when feedback was not given after performance during the task. These results are discussed in relation to the selective attention mechanism proposed for explaining perceptual learning. Acknowledgements: Grants from MICINN (PSI2008-00412) and the Basque Government (IT-276-07).

(PS\_3.036)

**Multisensory statistical learning**

GLICKSOHN, A. & COHEN, A. *Psychology. Hebrew University of Jerusalem. Jerusalem, Israel.*

Statistical learning concerns detection of regularities distributed in space/time. Previous studies typically focused on unisensory learning. Here, we examine multisensory learning over time. In a preliminary experiment, subjects were familiarized with either a single visual stream composed of ‘triplets’ - reoccurring successive shapes, or a single auditory stream composed of ‘words’ - reoccurring syllables. Tests contrasting a triplet / word with random shapes / syllables revealed a similar rate of unisensory visual and auditory learning. In Experiments 2-3 subjects were familiarized with a combined Audio-Visual stream, where each shape appeared simultaneously with a syllable, and each triplet uniquely matched a word. When subjects were tested on separate visual and auditory tests (Experiment 2), they showed reduced learning, particularly in the auditory domain. However, when subjects were tested on a multisensory test contrasting a word-triplet combination with a triplet-random syllables or word-random shapes combination (Experiment 3), they showed a high rate of learning. Subsequent experiments revealed that the strongest learning occurs between simultaneous stimuli either within or across senses, and that it can mask learning regularities over time within modalities. Multisensory learning over time is minimal. We suggest that learning requires grouping cues, with simultaneous temporal cues dominating other within-modality grouping cues.

(PS\_3.037)

**A probabilistic perspective for incremental learning in processing center-embedded structures**

LAI, J. & POLETIEK, F. *Cognitive Psychology, Leiden University, Leiden, the Netherlands.*

Hierarchical center-embedded structures, such as AnBn, cause difficulties for language learners due to their complexity (Bach, Brown & Marslen-Wilson, 1986; Chomsky, 1957; Corballis, 2007). Recent artificial grammar learning (AGL) studies (Lai & Poletiek, 2011) demonstrated a starting small (SS) effect. In particular, sufficient exposure to zero-level-of-embedding exemplars and a staged-input were the critical conditions in learning AnBn structures. The present 2 AGL experiments aim to replicate the SS effect and test another possible facilitating effect of the input, i.e. the frequency distribution of the input stimuli. Participants were exposed to a set of non-words consisting of CV syllables generated by a hierarchical recursive grammar, and were required to deliver grammaticality judgments over novel items. We propose that learning is facilitated most when SS works under other conditional cues, such as a skewed frequency distribution with simple stimuli being more numerous than complex ones (Poletiek & Chater, 2006)

(PS\_3.038)

**A battle over implicit resources - does it affect modus operandi in AGL?**

ROCZNIĘWSKA, M., STERCZYŃSKI, R. & POPŁAWSKA, A. *Faculty in Sopot. Warsaw School of Social Sciences and Humanities. Sopot, Poland.*

Since the discovery of the implicit learning phenomenon (Reber, 1967), the mechanism of learning described by

concurrent hypotheses still invites inquiry. To tackle this problem, we decided to adopt dual task paradigm, developed as a tool designed to test competition over resources. In this procedure, participants are asked to perform two tasks simultaneously; a decrease in performance (as compared to single-task) is interpreted as a result of the competition. As the learning in AGL task is deemed implicit, the second task is implicit as well. In our experiments, participants are exposed to a second tacit rule while performing regular AGL tasks. In three experiments conducted, we have observed: a decrease in classification accuracy when second tacit rule was present (first experiment) and no change in classification accuracy but in strategy used to distinguish regular from irregular strings (second and third experiment). Namely, participants included regular strings into grammatical category more often than excluded irregular strings from this category (classification for regular items was significantly more efficient than for irregular), but only in the group with a second implicit rule. We discuss these results in the light of the role of the resources determining the effectiveness of learning process.

#### (PS\_3.039)

##### **External feedback on performance in a serial reaction time task**

HOMBLE, K., VANDENBOSSCHE, J., SOETENS, E. & DEROOST, N. *Vrije Universiteit Brussel, Belgium.*

It is generally assumed that providing feedback on task outcome will enhance performance. Most studies on this subject have been conducted in the field of motor learning, by providing subjects with knowledge of results (KR) about the outcome of their performance. Yet, little research exists whether the use of external feedback can have beneficial effects in cognitive tasks. Therefore, we examined the effect of different types of KR-feedback on implicit learning in an exploratory study. In a serial reaction time (SRT) task, in which participants incidentally acquire sequential regularity, we manipulated the amount and timing of external feedback based on KR-learning principles. Subjects received either trial-by trial feedback, summary feedback, both or no feedback on their performance. Results will be discussed at the presentation.

#### (PS\_3.040)

##### **Regularity killed the cat - when too complex rules impair implicit learning**

STERCZYŃSKI, R., ROCZNIĘWSKA, M. & POPŁAWSKA, A. *Faculty in Sopot. Warsaw School of Social Sciences and Humanities. Sopot, Poland.*

In our studies we aim to verify whether implicit rules consume resources and how this phenomenon affects performance of participants. In two experiments conducted we decided to adopt sequence learning paradigm by using D2 Test of Attention (Brickenkamp, 1998). The task of the participant is to cross out signal letters among distracters in 14 rows, 20 seconds per line. Since in the original tool the exact same arrangement of letters is repeated every three rows, this task shares the features of sequence learning. To test the effect of such regularity on participants' performance, the original (regular) and modified (irregular) version of D2 Test was used. Unexpectedly, we observed better performance in irregular condition. The results lead to a supposition that such

complex rule overloaded the processor and debilitated performance. In experiment 2 the test was presented in three conditions - without regularity, with 1-line regularity repeated in every three rows, with regularity in 3-line blocks. Moreover, the semantical vs perceptual nature of signal was taken into account. The results showed that a) perceptual signals were easier to detect than semantical; b) the 3-line blocks debilitated performance in both conditions; c) semantical signal impaired performance in one-line regularity only.

#### · Memory ·

#### (PS\_3.041)

##### **False recognition for 75 DRM lists with three critical words: Forward associative strength**

BEATO, M. S.<sup>1</sup>, PULIDO, R. F.<sup>1</sup>, PINHO, M. S.<sup>2</sup>, GOZALO, M.<sup>3</sup> & CADAVID, S.<sup>1</sup>. <sup>1</sup>*Universidad de Salamanca. Spain,* <sup>2</sup>*Universidade de Coimbra. Portugal,* <sup>3</sup>*Universidad de Extremadura. Spain.*

A normative study was conducted using the Deese/Roediger-McDermott paradigm to obtain false recognition for 75 six-word lists in Spanish. In this paradigm, participants study word lists highly associated with a nonpresented critical word. Using this procedure, true recall and recognition of the studied words is observed at the same time as false recall and recognition of the critical words. In this study the 75 lists were designed with a new methodology: Six words (e.g., fire, war, gun, weapon, shot, bullet) simultaneously associated with three critical words (e.g., CANNON, FUSIL, RIFLE). Forward associative strength between critical and lists words was taken into account when creating the lists. Results showed that all lists produced false recognition and presented a wide variability in the effectiveness to elicit false recognition. Moreover, some lists had a very high false recognition rate, interesting aspect to raise the signal-to-noise ratio in false recognition event-related potential studies.

#### (PS\_3.042)

##### **Interplay between identity of objects and their spatial trajectories in infants**

RESSEL, V. & SEBASTIAN-GALLES, N. *Universitat Pompeu Fabra.*

Infants' abilities have been the focus of many studies in the past decades. Here, we explored if 12-month-old infants are able to recall features of episodes: the identity of objects, the performed trajectory of the objects and an expected outcome. Thirty-one healthy infants were investigated using a newly developed implicit recall task, which eliminates the need for verbal output. A video was presented in which pictures of four puppets performed a trajectory from the middle upper part to the left bottom or to the right bottom part of a screen (two puppets moving all the trials to the same side). After an encoding phase, the trajectory was occluded in the retrieval phase to assess if infants remember the identity and trajectory of the puppets. An eye tracking system was used to record eye fixation length for anticipatory gaze during the occlusion. Correct performance by looking longer to the expected side was seen, suggesting interplay between encoding and the retrieval of identity of objects and their spatial trajectories. Although a high variability between participants was found, evidence for early episodic-like memory was present in this age group.



**(PS\_3.043)****Is the testing effect dependent on an overt testing procedure?**

JÖNSSON, F. & KUBIK, V. *Department of psychology, Stockholm University.*

A combination of study and memory testing trials during learning is sometimes more beneficial for final recall performance than repeated study only (i.e., the testing effect), and in particular it seems to decrease the rate of forgetting over time. Previous research has almost exclusively demonstrated the testing effect with an overt testing procedure. In a learning session we let three groups (Study/Overt/Covert) of 20 participants study 40 paired associates three times. The Study group only did this. The Overt and Covert testing groups also performed three cued recall tests where they were shown the first word in a pair and should generate the second. The Overt group entered their response on the keyboard, whereas the Covert group was instructed to covertly retrieve the item. Final cued recall tests were given 15 minutes and 1 week later. As measured in terms of the rate of forgetting between the first and the second final recall test, the Overt group forgot significantly less information over a week than the two other groups, which did not differ. This demonstrates that the overt testing procedure is required for testing to effectively mitigate forgetting.

**(PS\_3.044)****Why is retrieval "expensive"? An analysis of component-processes**

VRANIC, A. & TONKOVIC, M. *Department of Psychology, University of Zagreb.*

Research shows that division of attention during retrieval affects memory performance only minimally. This relative immunity of episodic retrieval is offset by a cost, as measured by the concurrent secondary task in a divided attention paradigm. This experiment was conducted with the aim of further exploring this relative immunity and the attentional costs associated with what seems to be obligatory retrieval processes. More specifically, we aimed at exploring the attentional cost associated with each of three retrieval component-processes: 1) cue-encoding, 2) cue elaboration, 3) retrieval mode (Tulving, 1983). A componential analysis, as introduced by Naveh-Benjamin et al. (2000), was employed to assess attentional demands of four different retrieval tasks: two tapping the episodic and two tapping the semantic memory system. Furthermore, within each of these „system tasks“, one task was data-driven and one was conceptually-driven, as proposed by the transfer-appropriate processing (TAP) approach. Our results show a similar pattern of attentional costs of the three retrieval component-processes, across various types of retrieval. The cue elaboration was found to be the most attention demanding of the three component-processes, and also this process was shown to demand significantly more attention in the non-TAP situation. These findings are interpreted within the TAP framework.

**(PS\_3.045)****Recollection, sensitivity, and bias in false memories with visual and auditory study**

ŞAHİN, G. & TEKMAN, H. G. *Psychology Department, Uludağ University, Bursa, Turkey.*

Recollection, sensitivity and bias parameters for false memories after visual or auditory study in the Deese-Roediger-McDermott (DRM) paradigm were examined using signal detection theory (SDT). Hit and false alarm rates were determined for three types of words: Critical words of DRM lists; members of DRM lists, which were related to the other list words; and members of lists made of unrelated words. In a visual recognition test, participants indicated their confidence in having studied each item on a six-point scale. According to the analyses of the recollection, sensitivity, and bias parameters of the best-fitting ROC curves, sensitivity was lower for critical and related words and there was significantly greater bias for accepting critical words as old. It appeared that participants did not experience false recollection for the critical words but they were more willing to call them "old" and they had difficulty distinguishing whether they had actually been studied. Key words: False memory, modality effect, signal detection theory, recollection, sensitivity, bias.

**(PS\_3.046)****Episodic and semantic musical memory in elderly people**

PIGLIAUTILE, M.<sup>1</sup>, NARDO, D.<sup>1, 2</sup> & OLIVETTI BELARDINELLI, M.<sup>1, 2</sup>. <sup>1</sup>*Department of Psychology, Sapienza University of Rome, Italy,* <sup>2</sup>*ECONA, Interuniversity Center for Research on Cognitive Processing in Natural and Artificial Systems. Rome, Italy.*

The present study evaluates the role of salience and tonality of music on recognition memory in elderly non-musicians. A recognition memory task for unknown musical stimuli belonging to different categories [tonal/salient, tonal/non-salient, non-tonal/salient and non-tonal/non-salient] was administered to 42 subjects (mean age  $75 \pm 7.5$ ). Correct and incorrect 'remember' (R) and 'know' (K) responses, respectively related to episodic and semantic memory according to Tulving's model, and 'no' recognition responses (X) were analyzed. A comparison with a population of young subjects was performed too. Results show that saliency is a significant factor for correct R (episodic memory), whereas tonality is a significant factor for correct K (semantic memory). The number of times the 'study list' was listened to does not seem to substantially affect memory recognition. Elderly adults' performances show similar trends as young subjects' for correct R, K, and X. Viceversa, elderly subjects gave significantly more incorrect answers for R and X, while no difference between the two groups was found for incorrect answers related to semantic memory (X), confirming the acculturation value of tonality.

**(PS\_3.047)****Effects of typeface on metamemory**

LUNA, K. & OLIVEIRA, J. *School of Psychology, University of Minho, Portugal.*

Past research has shown that font size increases the judgments of learning that a word will be remembered at a later time, but that it does not affect memory performance in a recall test. This dissociation has been

explained because participants erroneously consider that the subjective ease of processing a large word will be predictive of future ease of retrieval, even though the font size do not affect performance. Our aim was to test if another perceptual characteristic, namely boldface, could also lead to a misinterpretation of the ease of processing. A second objective was to examine if font size or boldface could affect another measure of metamemory, i.e., retrospective confidence. Participants read words in a small font, in a large font, and in a small font in boldface, and made judgments of learning. After a distractor task a recognition test and a confidence rating that the answer was correct was required. Results suggested that boldface words did not elicit the misinterpretation of the ease of processing elicited by large font words, and that retrospective confidence was not very sensitive to changes in the typeface.

(PS\_3.048)

**Analyzing categorical and associational false memories with signal detection theory**

ÖZKILIÇ, Y. & TEKMAN, H. G. *Psychology/Faculty of Arts and Sciences. Uludağ University, Bursa, Turkey.*

Signal Detection Theory parameters of false memory phenomena in DRM (Deese-Roediger-McDermott) word lists and category lists were examined. Typically, both types of word lists generated false memories; however, using DRM lists generates more of them. Participants studied lists composed of 15 words related to one critical word. In addition, they studied two unrelated word lists that were not related to either critical or related words. Bias, sensitivity and recollection values were calculated for the critical, related and unrelated words. Subjects rated their confidence that they had studied each word on a six-point scale in a recognition test. The results showed that bias, sensitivity and recollection parameters did not differ between the two kinds of lists. Only the bias values differed among the word types: Subjects indicated greater confidence that they had studied the critical words compared to the other types of word. This result suggests that participants did not experience false recollection for the critical words or had more difficulty distinguishing studied from nonstudied critical words but they used a more liberal criterion for these kinds of words at the test phase.

(PS\_3.049)

**The failure of deactivating intentions: Aftereffects of completed intentions in the repeated prospective memory-cue paradigm**

WALSER, M., FISCHER, R. & GOSCHKE, T. *Technische Universität Dresden.*

Previous research has yielded conflicting findings with respect to aftereffects of completed intentions (e.g., inhibition, persisting activation). We used a newly developed experimental paradigm to investigate aftereffects of completed intentions on subsequent performance that required the maintenance and execution of new intentions. Participants performed a primary number categorization task and an additional prospective memory (PM) task, the execution of which was signaled by a specific PM cue. While the PM task changed in each block, the irrelevant PM cue of the previous PM task was occasionally repeated in the subsequent block. In a series of four

experiments we demonstrated that performance in the primary task was substantially slowed for trials representing repeated PM cues compared to baseline trials (i.e., intention interference). These findings are interpreted as persisting intention activation once intentions are completed. Activation related to the previous PM task persists over some time and triggers the spontaneous retrieval of the old PM response.

(PS\_3.050)

**The role of domain-general working memory in text reading: An eye tracking study**

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Reading text requires the reconstruction of information that was degraded during sentence processing. This process of reconstruction involves relocating previously presented information. To explore the nature of this relocation process during reading and its relationship with verbal and spatial working memory (WM) capacity, we employed a "who-done-it" task with an eye-tracking technique. In our task, text information was available on a PC screen while participants answered questions such as "Who done it?" after reading a text. We recorded participants' eye movements while they performed this task and measured the distance between the fixation point immediately after reading each question and the location of the target word in the text. The mean distance was negatively correlated with both verbal and spatial WM scores, and a partial correlation analysis indicated that the shared variance of verbal and spatial WM scores accounted for individual differences in the distances between fixation points. These results suggest that domain-general WM capacity underpins the relocation processes during text reading.

(PS\_3.051)

**Memory for press advertisements: influence of thematic congruence, product interest and typicality**

MARTÍN-LUENGO, B.<sup>1</sup>, LUNA, K.<sup>2</sup> & MIGUELES, M.<sup>1</sup>. <sup>1</sup>*Faculty of Psychology, University of the Basque Country, Spain,* <sup>2</sup>*School of Psychology, University of Minho, Portugal.*

Previous studies with radio and television advertisements showed an influence of the context in which they were embedded. We were interested in the influence of the context on memory for press advertisements. Specifically, we manipulated the congruency between the theme of the press article and the advertisement. We also studied the influence of the interest of the product advertised and the typicality of the elements of the advertisements. We expected better memory for congruent advertisements than for incongruent ones, and more hits and false alarms for the high typicality elements. Participants read two newspapers articles with advertisements embedded. After that, they completed a distractor task and finally a true/false recognition test with a confidence scale. There were more hits and false alarms with high than low typicality elements. There were no differences on accuracy (A') but participants were more conservative (B''D)

with low than high typicality elements. Confidence was higher for hits for congruent advertisements. The confidence for the false alarms showed that confidence was higher for the interesting products embedded on congruent than on incongruent articles. Thematic congruence do not affect the memory of the press advertisements and schemata can explain the typicality influences.

#### (PS\_3.052)

##### **Inhibition and Item-Method Directed Forgetting: Behavioral and ERP Studies**

CHENG, S.<sup>1</sup>, LIN, W.<sup>1</sup>, LIU, I.<sup>1, 2</sup>, HUNG, D.<sup>1</sup> & TZENG, O. J.<sup>1, 3</sup>. <sup>1</sup>National Central University, Taiwan, <sup>2</sup>Chung-Yuan Christian University, Taiwan, <sup>3</sup>Academia Sinica, Taiwan.

An obvious interpretation for the item-method directed forgetting effect emphasizes the different processing of to-be-remembered (TBR) and to-be-forgotten (TBF) items during encoding. TBR items are well remembered because they receive elaborative rehearsals following the presentation of the Remember cue. It is however not yet clear whether TBF items are passively decayed or actively inhibited in response to a Forget cue. To address this issue, behavioral and ERP studies were conducted to examine the processing depths of TBR/TBF items and how active inhibition might be involved in item-method directed forgetting. The P200 and N400 waves were used to index the attention allocation and the semantic processing following the presentation of the Remember and Forget cues. We also examined the modulation of attention load on directed forgetting by incorporating a dual task to the item-method directed forgetting. The results suggest that forgetting is indeed effortful and demands active inhibition.

#### (PS\_3.053)

##### **Retrieval-induced forgetting of positive vs. negative retrospective and prospective life experiences**

MIGUELES, M. & GARCÍA-BAJOS, E. *University of the Basque Country.*

This study examines retrieval-induced forgetting (RIF) using personal retrospective or prospective life experiences. In the study phase, following a variant of the Crovitz method, participants were given hints to produce autobiographical experiences of their past or to think in experiences that may occur in their future. In both conditions half of the life experiences were positive and the rest negative. In the retrieval practice phase participants retrieved half of the positive or negative experiences using cued recall or they retrieved capitals of the world (control groups). In the final phase the participants tried to recall all the experiences. Although there was a tendency to remember more positive than negative experiences, there were no significant differences in the recall of both types of experiences. In addition, there were no differences between remembering past or future events. Retrieval practice produced two main effects: facilitation for practiced experiences and inhibition for non-practiced experiences when compared to the control groups which performed no retrieval practice. An interesting aspect that may have practical implications is that selective retrieval practice leads to greater inhibition of negative than positive experiences.

#### • Working memory •

#### (PS\_3.054)

##### **Transfer effects from working memory training to executive control processes**

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Recent studies have reported an increase in fluid intelligence following extensive and adaptive working memory (WM) training. However, it is still unclear which components of such training can generalize to other, untrained tasks. In the present study, we investigated transfer effects from a demanding WM task, which requires simultaneous performing of a visual and an auditory n-back task, to other, untrained tasks tapping different cognitive domains: WM updating, coordination of performing multiple tasks, and attentional processing which, taken together, constitute executive control processes. Compared to an untrained control group, it was found that training led to improvements in the trained task as well as in the transfer WM updating task, and to enhancements in attentional processing. Transfer to the coordination of performing multiple tasks was marginal. Thus, these results confirm previous findings that WM can be trained and, importantly, they show that these training effects can generalize to other tasks that are not part of the training regimen.

#### (PS\_3.055)

##### **Age difference in affective bias : The effect of context valence in working memory**

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In previous studies, younger adults demonstrated an affective bias for negative context, and an impairment of memory for neutral target words simultaneously-presented (Rabinowitz & Carlson, 2010). Though older adults seem to be even more susceptible to the influence of negative and highly arousing stimuli, it remains unclear whether this affective bias would also occur in negative and low arousal context (Mather & Knight, 2005). We explored the effect of negative, low arousal context using three different reading span tasks (RST): positive-context, negative-context, and control (neutral-context) conditions. In the positive-context condition, the sentences had positive content, whereas the negative-context condition sentences had negative content. We selected sentences that had low arousal levels to remove the effect of automatic processing and attention. Additionally, target words had a relatively neutral content. In each RST, participants were asked to read sentences and targeted words aloud, while memorizing the targeted words. The results suggest that there was no affective bias for negative or low arousal context in older adults. In younger adults, recall accuracy was worse when the sentences proceeding target words had negative valence as opposed to positive. However, in older adults, there was no performance difference between negative and positive conditions.

## (PS\_3.056)

**Serial coding of verbal information in working memory**

GINSBURG, V.<sup>1</sup>, VAN DIJCK, J.<sup>2</sup>, VAN OPSTAL, F.<sup>2</sup>, MAJERUS, S.<sup>3</sup>, FIAS, W.<sup>2</sup> & GEVERS, W.<sup>1</sup>. <sup>1</sup>*Unité de recherche en Neurosciences Cognitives, Université Libre de Bruxelles, Brussels, Belgium*, <sup>2</sup>*Department of Experimental Psychology, University of Ghent, Ghent, Belgium*, <sup>3</sup>*Département de Sciences Cognitives, Université de Liège, Liège, Belgium*.

Recently, a lateralized position effect in working memory was observed (Van Dijk & Fias, 2011). Words (fruits/vegetables) were sequentially presented and were to be remembered for later recall. During the retention interval, participants performed a categorization task with lateralized responses embedded in a go-nogo procedure such that participants only responded to the words inside the WM sequence but not to the words outside the WM sequence. Words presented early in the sequence were faster responded to with the left hand whereas words later in the sequence were responded to faster with the right hand. First, we replicated this lateralized position effect using the same go-nogo paradigm but with different categories of words on each sequence (e.g. with 10 different categories of words instead of one) and with a smaller working memory load. In the second experiment, participants responded to all words, both inside and outside the WM sequence. This manner, the WM sequence was no longer relevant for the categorization task. The results show that in this case the lateralized position effect disappeared. We conclude that the lateralized position effect is a robust observation that crucially depends on the relevance of the working memory sequence for the lateralized response categorization.

## (PS\_3.057)

**Slowing down after an error is related to working memory updating and rule rehearsal**

DORCHIN, S. & MEIRAN, N. *Ben-Gurion University of the Negev*.

Responses usually slow after an error, indicating Post-Error Slowing (PES). We propose that PES is associated with Working Memory (WM) updating and the rehearsal of task-rules in WM in order to prevent future errors. Using a task-switching paradigm, we manipulated the need to update WM and rehearse rules by varying the information presented in the cues. Half of the participants received mapping cues providing information regarding both the relevant task identity and its rules, and half were shown dimensional cues providing only task identity information. As predicted, larger PES was observed with dimensional cues as compared with mapping cues.

## (PS\_3.058)

**Working memory capacity compensates hearing related phonological processing deficit**

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Post-lingually acquired hearing impairment is associated with decreasing phonological processing abilities. This study aimed to examine whether working memory capacity (WMC) compensates for this effect. Individuals with acquired hearing impairment (HI) and with normal hear-

ing (NH) performed a visually presented rhyme judgment task in four conditions. Word pairs consisted of rhymes (R+) and non-rhymes (R-) that were orthographically similar (O+) or dissimilar (O-). The groups were matched on age, education level, WMC and verbal as well as non-verbal abilities. Each group was subdivided into high- and low-WMC individuals by a median split of reading span scores. In agreement with earlier studies NH performed significantly better than HI. Further, high-WMC individuals performed better than low-WMC individuals and this effect interacted with group and condition. Specifically, WMC had an impact on the performance of HI, but not NH. HI with high WMC performed on a par with persons with normal hearing. In contrast, HI with low WMC made significantly fewer correct judgments than HI with high WMC and NH with high or low WMC in the phonologically most demanding conditions (R+O-, R-O+). Results thus indicate good WMC can compensate for hearing related phonological processing deficit.

## (PS\_3.059)

**Maintaining cross-domain information in working memory, what resources are involved?**

LANGEROCK, N., VERGAUWE, E. & BARROUILLET, P. *Developmental Cognitive Psychology Team, University of Geneva, Geneva, Switzerland*.

Domain-general attentional as well as domain-specific resources have been shown to be involved in maintaining verbal (e.g., letters) or visuo-spatial (e.g., locations) information in working memory. However, it is not clear whether these same kind of resources are involved in maintaining cross-domain information (e.g., letters in locations). The involvement of domain-general resources was tested using a complex span task in which cross-domain storage of letters presented in different locations was combined with a neutral processing task (tone discrimination) involving either a low, a medium, or a high cognitive load. Span decreased as the cognitive load of the neutral processing task increased, which is in line with the involvement of domain-general resources. The involvement of domain-specific resources, over and above domain-general resources, was tested using the same cross-domain storage task but combined with either a verbal (semantic judgments) or a spatial (fit judgments) processing task, in which the cognitive load was manipulated in the same way. Interference with domain-specific resources was found only in the verbal domain. This suggests that domain-general attentional resources are clearly involved in maintaining cross-domain information, as well as verbal domain-specific resources.

## · Numerical cognition ·

## (PS\_3.060)

**Biases in numerosity processing**

GEBUIS, T. & REYNVOET, B. *Laboratory of Experimental Psychology, Katholieke Universiteit Leuven*.

It has been suggested that proficiency in approximating numerosities is related to mathematical abilities. Insights in numerosity processing could therefore be of great value for intervention studies for children that have difficulties with mathematics. To date, many studies try to unravel the mechanisms underlying our ability to approximate numerosities. Most of these studies focus

on the higher order stages of numerosity processing while paying little attention to the visual processes preceding numerosity processing. This is a potential problem as numerosity stimuli and their visual properties are highly correlated. To account for this problem, numerosity stimuli are generally created in such a manner that their visual properties are uninformative about number. Using electroencephalography data I demonstrate certain weaknesses of the predominant method and offer possibilities for improvements. First I present data revealing that visual cues can exert influence on event-related components that mimic results generally attributed to numerosity. Next I will show that when these visual cues are properly controlled, no significant effects of numerosity remain. Last, I will directly compare the event-related components related to passive viewing and approximation of numerosity.

(PS\_3.061)

**Are operands' quantity representation automatically accessed during multiplication solving? Evidence from size congruity effects?**

ESTUDILLO HIDALGO, A. J.<sup>1</sup>, GARCÍA-ORZA, J.<sup>2</sup> & DAMAS-LÓPEZ, J.<sup>2</sup>. <sup>1</sup>University of Edinburgh, <sup>2</sup>Universidad de Málaga.

Some models assume that operands' magnitude representations are activated during multiplication solving (McCloskey, 1992). Further models assume that multiplications are solved using verbal codes (Dehaene, 1992). In this research, the role of operands' magnitude representations in multiplication problems was explored. To accomplish this we manipulated the size congruity effect. The physical and numerical magnitude of the operands within each problem was either congruent (the biggest numerical magnitude appears in bigger size), or incongruent (the smallest numerical magnitude appears in bigger size) or neutral (same physical size). Problem-size and order of the operands (8x9 vs. 9x8) were also manipulated. In our first experiment a verification task (e.g.: are the following problems correct?) was carried out. In the second experiment we employed a production task (e.g.: say the results of the following problems). Results showed longer response times in the incongruent condition than in the congruent conditions in both experiments. Although main effects of problem-size were also found, no interactions were observed between size congruity and the rest of variables. Operands' magnitude representations are automatically activated even in the context of multiplication problems, however, the lack of interaction suggests that this activation is not related to the multiplication solving process.

(PS\_3.062)

**The Fast and the Inhibitory 2x3**

DAMAS-LÓPEZ, J. & GARCÍA-ORZA, J. *Faculty of Psychology. Universidad de Málaga.*

Previous studies have shown faster responses naming Arabic digits primed with congruent multiplications (e.g., prime: 2x3=, target: 6) as compared with unrelated ones (e.g., prime: 4x8=, target: 6) using a masked priming paradigm (SOA = 50 ms). However, it is unclear whether this priming effect is a facilitatory process given by congruent multiplications or an inhibitory process given by incongruent ones, as well as the temporal course of this

effect. In the present experiment we use the same paradigm, but including a neutral condition (e.g., prime: XxX=, target: 6), and also manipulating SOA (50 vs. 120 ms). The ANOVA showed an interaction between type of prime and SOA, showing longer response times for incongruent primes compared to congruent and neutral ones using the shortest SOA, but no differences regarding prime using the longest SOA. A visibility task ensured that participants were unaware of the primes. Results therefore suggest that multiplication priming is an inhibitory early effect.

(PS\_3.063)

**The influence of number sense acuity and mathematical expertise on mental addition strategies**

GUILLAUME, M., NYS, J. & CONTENT, A. *Laboratoire Cognition, Langage et Développement. Université Libre de Bruxelles. Brussels, Belgium.*

In the field of numerical cognition, the acuity of the number sense has been associated with overall arithmetic performance from childhood to adulthood. Therefore, choosing an efficient and elaborate strategy during arithmetic processing might be facilitated by a more accurate number sense. In this study, we investigate the potential influence of the number sense on strategic choice and its relation to mathematical expertise. We set up an experiment composed of one complex addition resolution task and one non-symbolic comparison task. Participants were either Engineering or Psychology students. During the arithmetic task, they were asked to verbalize the strategy they used to solve each addition. Individual Weber fractions were computed from their performance in the comparison task as estimates of number sense acuity. Our results revealed that Engineering participants were more accurate in the comparison task than Psychology students. As for the strategic aspect, overall, the utilization of more elaborate calculation strategies was associated with higher comparison acuity. Moreover, Engineering students referred to memory retrieval to a greater extent and used more elaborate strategies than Psychology students did. Taken together, these results suggest that number sense accuracy is related to mathematical expertise and to the use of more elaborate strategies.

(PS\_3.064)

**What can the same-different task tell us about the development of magnitude representations?**

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We wanted to clarify the moderators (i.e. numerical distance, size, physical similarity) that influence adults' and children's responses when conducting a symbolic (i.e. digits) and non-symbolic (i.e. dot collections) same-different task and to investigate whether these influences change over development. In addition, we examined the relationship between these moderators and mathematical ability. Our findings demonstrate that the responses of the youngest children in the symbolic same-different

task were equally influenced by the magnitude information and the physical similarity of the digits, while the older age groups mainly used the physical similarity. Apparently, a same-different task with digits is not an ideal measure to study the development of magnitude representations. In our non-symbolic task, the size of the distance effect was similar in all age groups, which suggests that the representations of non-symbolic numerosities are stable over development. The size of the distance effects was not influenced by subjects' mathematical ability.

(PS\_3.065)

**Access to numbers quantity is not automatic: evidence from two versions of Indian numbers**

GARCÍA-ORZA, J.<sup>1</sup>, PEREA, M.<sup>2</sup>, ABU MALLOUH, R.<sup>3</sup> & CARREIRAS, M.<sup>3, 4</sup>. <sup>1</sup>*Universidad de Malaga, Spain*, <sup>2</sup>*Universitat de Valencia, Spain*, <sup>3</sup>*Basque Center for Cognition, Brain, and Language, Donostia-San Sebastian, Spain*, <sup>4</sup>*IKERBASQUE, Basque Foundation for Science, Bilbao, Spain*.

Numerical quantity seems to affect the response in any task that involves numbers, even when the task does not demand access to quantity (e.g., perceptual tasks). One piece of evidence in favour of this view comes from the "distance effect": when comparing two numbers, reaction times are a function of the numerical distance between them. However, recent studies suggest that physical similarity between Arabic numbers and the numerical distance are strongly correlated, and the former might be a better predictor of RT data (Cohen, 2009). The present study explored the Persian and Arabic version of Indian numbers (Experiment 1 and 2, respectively). Naive participants (speakers from Spanish) and users of these notations participated in a same/different number matching task. The RTs of users of the Indian notation were regressed on perceptual similarity (estimated from the Spanish participants' RTs) and the numerical distance effect. In Experiment 1, both distance and perceptual similarity alone were significant predictors of reaction times, however, when both variables were included in the regression, we only found a significant contribution of perceptual similarity. In Experiment 2, only perceptual similarity contributed to the regression. Thus, Indian integers do not automatically activate their quantity representation in simple, perceptual tasks.

• Reasoning and problem solving •

(PS\_3.066)

**Grasping isomorphism: review of Hinton's "Learning distributed representations of concepts"**

VARONA-MOYA, S. & COBOS, P. L. *Department of Basic Psychology, University of Málaga, Málaga, Spain*.

Multilayer perceptron networks' ability to perform sensible inferences by analogy was pointed out by Hinton from the results of knowledge generalization tests between two isomorphic family trees. Due to its importance, a comprehensive review of this work was tackled to improve some methodological aspects in order to find statistically grounded answers to the questions posed by the author. Using the same network architecture and learning procedure, 500 simulations were trained in the task proposed by Hinton. In this review (1) the degree of isomorphism grasped by a simulation was computed

through an ad hoc algorithm applied to principal component analysis scores of hidden units' activation vectors and (2) the relationship between the network's ability to perform inferences by analogy and its grasp of isomorphism was examined on a mixed factorial design basis, using corrected generalization tests. The main conclusions are these: (1) isomorphism grasp is not as consistent a property as Hinton suggested, since many simulations failed to build identical representations for both family trees, and (2) statistically significant interaction effects between isomorphism grasp and learning the second family tree proved that the more isomorphism a simulation grasped, the better it generalized from one tree to another.

(PS\_3.067)

**Does the presentation frequency of obligatory and prohibitory traffic signs influence their information interpretation?**

VARGAS, C., MORENO RÍOS, S. & CASTRO, C. *University of Granada. Spain*.

The frequency of a traffic sign could alter the difficulty of interpreting the situations referred to by the sign. Different traffic signs can be used at a T-junction to indicate that the road on the right is allowed: obligatory right, prohibitory left or both. Firstly, a right turn is referred and the "no left turn" is inferred. The opposite happens when signalling with a prohibitory left a right turn. This study test how we evaluate traffic scenarios under time pressure, where a car is shown in the situation signalled or in the inferred one. The frequency of presentation of prohibitory and obligatory signs was manipulated. When the signs were shown with a same frequency, responses to the referred situations were faster and more accurate, but the negative effect was found in the inferred situation. However, when the more frequent sign was shown, responses to the referred situations were faster and more accurate, and the negative effect was greater in the inferred situation. For example, when the obligatory signs were more frequent, the highest number of errors was found for the prohibitory left sign when a car was taking the right turn. Safety driving implications and suggestions will be further discussed.

(PS\_3.068)

**Personality, individual difference & counterfactual thinking**

MALONEY, D. *Psychology department. Mary Immaculate College. Limerick, Ireland*.

How we imagine what might have been, called counterfactual thinking, is influenced by several factors. Much of the existing literature has focused on the contextual or situational factors that goad people to think counterfactually. This research suggests that more extensively studied situational factors (e.g., how normal/controllable/mutable an event was) do not fully explain counterfactual thoughts, and investigates the role of personality and individual differences in how we construct alternative simulations of the past. Participants completed a series of difficult cognitive tasks (e.g. anagrams) and were then asked to think about how their performance on the tasks might have been better. Participants then repeated the cognitive tasks, and answered a battery of psychological personality measures. The results suggest that autonomy may be a particularly important

personality trait in terms of counterfactual thinking and in how performance might improve as a result of considering alternative exemplars. Person's high in autonomy generated significantly more self-regulating counterfactual thoughts than person's low in autonomy and a greater total number of counterfactual thoughts than person's low in autonomy. These results suggest that personality traits may influence both the activation and focus of counterfactual thinking. Results are discussed in relation to the functional theory of counterfactual thinking.

## (PS\_3.069)

**The influence of the analogical context on the similarity judgements of compared events**

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<sup>1</sup>Universidad de Buenos Aires, <sup>2</sup>CONICET, <sup>3</sup>Universidad Nacional del Comahue.

An experiment was carried out to demonstrate that judgments of analogical relatedness between two events vary as a function of the analogy in which they take part. In a control condition, participants used a 7-point Likert-scale to rate the analogical similarity of two events (e.g., Mary bought a play station vs. John borrowed a Wii). In the two experimental conditions, participants received these same events framed within base and target analogs aimed at rendering both events more or less similar. For instance, whereas in the pro-similarity condition the protagonists criticize each other's actions as having broken their agreement to devote exclusively to their studies, in the less-similarity condition the protagonists criticize each other's actions as having broken their agreement to cut unnecessary expenses. As predicted, similarity scores assigned by participants under the pro-similarity condition were much higher than scores given by participants under the less-similarity condition, with scores from the control condition falling somewhere in between. Data proved that the analogical similarity between two compared situations depends on the way in which they are related to the broader analogy in which they participate, thus posing a challenge to the role of semantics within traditional theoretical approaches of analogical mapping.

## (PS\_3.070)

**Cognitive processes in reasoning about moral dilemmas**

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We report the results of two experiments that examine cognitive processes in moral reasoning using different versions of the well-known 'trolley' problem. Participants were asked to imagine they were at the wheel of a runaway train approaching a fork in the tracks. They were asked to judge if they would allow the train to continue to the left, killing five railway workmen on that track; or hit a switch turning the train to the right, killing a single workman. In the first experiment, participants judged that they would push the switch for this standard version of the dilemma, more so than for a version with just a single workman on each track; but they judged they would look for an alternative solution in a version in which the train would reach the fork in thirty minutes. In the second

experiment, participants judged they would push the switch in a version that described good qualities of the single workman, but not in a version that described the single workman as a close relative. We discuss implications of the results for alternative theories of moral reasoning.

## (PS\_3.071)

**The probability of events in a conditional: how this changes the way it is represented**

RODRÍGUEZ-GUALDA, I. & MORENO RÍOS, S. *Facultad de Psicología. Universidad de Granada (Spain).*

Does the probability of the events mentioned in conditionals influence the way the conditionals are represented? From the suppositional theory, the comprehension of a conditional depends on the perceived probability of occurrence of the consequent, given the antecedent. From the mental model theory, the comprehension of a conditional is based on the initial representation derived from it (not on the probability of the events). In the present study, the contents were constructed in order to create more probable or less probable situations based on the empirical experience. Thus, three kinds of content were used, depending on their frequency of occurrence in the world: very frequently, not very frequently or their occurrence is arbitrary in the world. Three tasks were used to evaluate how people understand semifactual (even-if) conditionals that connect two events (antecedent and consequent). Participants were tested with different measures: judgments about the probability of each event mentioned in the conditionals, the probability of the even-if statements and the degree of strength of a causal sentence. Results are shown and discussed from those theories.

## (PS\_3.072)

**Problem structure mediates the effects of numeracy in Bayesian reasoning**

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Understanding probabilistic information is essential for success in school and in the job market, as well as for making good health and financial decisions. Despite its importance, probabilistic reasoning remains difficult even for mathematically informed university students. Recent studies have shown that individual differences in numeracy modulate the effects of numerical format in the context of risk perception, decision-making, and Bayesian reasoning. Inconsistent results have been found, however, in the direction of this interaction, with frequency formats sometimes benefiting those higher in numeracy and at other times facilitating performance for the less numerate. The present research addresses these inconsistencies through a series of Bayesian reasoning problems differing in numerical complexity, a standard measure of numeracy, and a number comparison task thought to index basic numerical representation. Extending previous studies using the same numeracy scale, results reveal an interaction between individual numeracy and problem structure: the effect of numeracy only clearly arises in problems involving more complex numerical relations. Preliminary results also indicate that higher-level probabilistic reasoning ability can be at least

partially explained in terms of basic numerical representation. Accordingly, the current research provides a more complete account of the role of individual numerical ability in reasoning with probabilistic information.

• Music perception •

(PS\_3.073)

**Musical expertise and age modulate how we recognize emotions in music**

CASTRO, S. L. & LIMA, C. *Faculty of Psychology and Education at the University of Porto, Portugal.*

Listening to music is like going through a landscape that offers multiple views. How are the views on emotions shaped by two experiential factors, musical expertise proper and age? Forty musicians and forty musically naive persons, in each group half young adults (18-30 years) and half middle-aged adults (40-60 years), listened to music excerpts validated to express happiness, sadness, peacefulness and fear. They rated how much each excerpt expressed these four emotions on 10-point intensity scales. Intended emotions were consistently perceived as more intense than the non-intended ones, but the pattern of judgements differed according to age and musical expertise. Middle age was associated with decreased responsiveness to sadness and fear, whereas responsiveness to happiness and peacefulness remained invariant since young adulthood. Years of musical training correlated with enhanced sensitivity to the intended emotions. Middle-aged musicians, but not younger ones, were more accurate than musically naive listeners. These effects were independent of domain-general cognitive abilities and personality traits. Mechanisms supporting emotion recognition in music are robust, but also variable: they are shaped by age and musical expertise.

(PS\_3.074)

**Musical stimuli causes spatial shifts of attention**

ALONSO CÁNOVAS, D.<sup>1</sup>, MOLINA, I.<sup>1</sup>, F. ESTÉVEZ, &<sup>1</sup>, MARTÍNEZ, L.<sup>1</sup> & FUENTES, L. J.<sup>2</sup>. <sup>1</sup>*Universidad de Almería, Almería, Spain,* <sup>2</sup>*Universidad de Murcia, Murcia, Spain.*

Previous evidence suggests that tones are mentally represented as a spatial line in the vertical dimension. This study evaluated whether pre-exposure to a particular melodic contour or a single tone (experiments 1 and 2) reduces the latency to detect a visual stimulus in a screen. Additionally we tested if musicians and non-musicians exhibit the same profile. We included two experimental conditions: 1) compatible condition, where the auditory stimulus, ascending/high or descending/low contour/pitch, were followed by a visual stimulus located up/down respectively, in the screen; 2) non-compatible condition, where the visual stimulus was located bottom/up, respectively. The results showed a reduced latency in the compatible vs non-compatible condition when the auditory stimulus was a contour, but only in musicians when the auditory stimulus was a single pitch. Present data suggest that listening a contour caused a shift in cover attention in the vertical plane related to the particular contour direction. We conclude that a spatially oriented 'mental musical line' is automatically activated whenever we listen a melodic contour; musicians extend this activation in response to a tone pitch.

(PS\_3.075)

**Does musicians' interpretation influence music perceptual grouping?**

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In inquiring musical grouping the focus has been posed, time by time, on different features of the musical surface, making extensive use of ad hoc created stimuli often far from real music. An ecological approach was developed by Irène Deliège (1990) in her study on the segmentation of Berio's *Sequenza VI*. Since the detection of musical meaning is highly influenced by the differences in performance, we investigated the role of the instrumentalist's interpretation on the perceived segmentation. At the scope we used two versions of *Sequenza VI* performed respectively by Desjardins (1998) and Knox (2006). These variants are different in duration (12.13min. vs 13.14min.) and show differences in dynamics, accents distribution and gaps duration. Thirty subjects were invited to attentively listen to each piece, to understand its plan and to mark off the sections of the work pushing a computer key. The order of presentation of the two performances was balanced. We hypothesize that musical structure affects grouping more than performance. Results show a good number of coinciding segmentations in the two versions but a different number and location of segmentations in the central part of the piece. These differences are discussed with regard to Deliège's Cue Abstraction Hypothesis.

• Speech perception/ Auditory perception •

(PS\_3.076)

**Consonants and vowels support rule learning in rats**

DE LA MORA, D. & TORO, J. M. *Universitat Pompeu Fabra.* Recent research suggests that structural generalizations seem to be preferentially performed over vowels, but not over consonants. Nevertheless, the source of these functional differences between consonants and vowels is unknown. One possibility is that participants transfer the acoustic differences between consonants and vowels to functional differences. If so, we could expect to find similar results in nonhuman animals. Our aim was to study rats' capacity to generalize rules implemented over vowels and consonants. In Experiment 1, rats were trained to discriminate CVCVCV nonsense words in which vowels followed an AAB structure in half of the words and an ABC structure in the other half, whereas consonants were combined randomly. In Experiment 2, rules were implemented over the consonants and vowels varied at random. In the test phase of both experiments eight new test words were presented. Following the presentation of each AAB or ABC word lever-pressing responses were registered and food was delivered. We found that rats could generalize to new tokens rule-like structures over both vowels and consonants. Our results support the hypothesis that acoustic differences between consonants and vowels, per se, are insufficient to trigger differences over which units are preferentially used for rule learning.



## (PS\_3.077)

**The “spoon effect”: How a spoon over the tongue alters the perception of the vowel /e/**

SCHMITZ, J. & SEBASTIÁN-GALLÉS, N. *Brain and Cognition Unit. Universitat Pompeu Fabra. Barcelona, Spain.*

Recent TMS studies have shown that speech perception can be influenced by activating the motor areas involved in articulating the same sound. In this experiment we test if blocking the articulation movements of the vowel /e/ by placing a spoon over the tongue can alter the perception of different /e/ sounds in a similar way. The vowel /e/ is a close-mid-front vowel, articulated by lifting the front part of the tongue to a middle height in the mouth. A spoon over the tongue influences this movement by pressing the front part of the tongue down. The results show that when participants have a spoon over the tongue, they accept /e/ variants with a higher tongue position in the back of the mouth more often compared to when they have no spoon in the mouth or a spoon at the side of the mouth. This indicates that participants take into account their current tongue position (front part of the tongue down and back part of the tongue relatively more up) when rating the different /e/ sounds they hear. This is in line with previous research showing a role of the motor cortex in speech perception in difficult tasks.

## (PS\_3.078)

**Eye tracking during French Cued Speech perception: preliminary results**

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French Cued Speech (CS) was developed to help deaf people to understand speech. Since this system is multi-signal, involving lip movements and cues (hand movements), we conducted an eye tracking study to examine whether this perception implies integrative treatment and how expertise affects it. Our paradigm consisted of three conditions without sound: (1) a multi-signal condition consisting of a speaker's video who simultaneously spoke and cued words/pseudowords, (2) a meaningless multi-signal condition consisting of a video showing a speaker producing words/pseudowords with meaningless hand movements, (3) and a lipreading condition, consisting of a video showing a speaker uttering words/pseudowords without movement. Participants were presented three options (i.e. correct answer, labial distractor and gestural distractor) and instructed to select the correct answer from among the three. Distractors were words/pseudowords that shared the same labial image or cue as the words/pseudowords uttered. Behavioral and eye tracking data (i.e. interest region: lips or hand) were collected on two groups of hearing people: beginner CS-experts and completely naïve toward CS. The first results, very promising, suggest that only beginner CS-experts integrate cue and labial information. We are currently testing hearing experienced CS-experts and deaf CS-experts. This new data will be reported at the conference.

## (PS\_3.079)

**Training French listeners to perceive word stress**

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Native speakers of French, a language without contrastive stress, have difficulty perceiving stress contrasts. Using a pretest-posttest design with 10 trainees and 10 controls, we examined whether French listeners can improve their stress perception with auditory training. We used naturally spoken, phonetically varied stimuli in a sequence recall task, in which participants have to recall sequences of two auditorily presented non-words that differ either in the position of stress (test condition) or in a phoneme (control condition). At the end of six 30-minute training sessions on stress contrasts, the trainees showed no improvement in their perception of stress: an ANOVA with factors Session (Pretest/Posttest), Group (Trainees/Controls) and Contrast (Phoneme/Stress) yielded an effect of Contrast only ( $F(1,18)=53.9$ ,  $p<.0001$ ), with worse performance on the stress contrast. This result contrasts with previous findings that listeners can be effectively trained to improve their perception of non-native contrasts. We argue that the lack of a training effect is task-specific. In particular, contrary to previous studies that used a 2AFC identification task, in the sequence recall task participants can neither use a low-level acoustic response strategy nor rehearse the stimuli subvocally. We discuss the consequences for theories of phonological learning.

## (PS\_3.080)

**Malleability of the French voicing perception after auditory training in young children**

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The present study aimed at investigating the effects of an auditory identification training on the categorical perception of a/də/-/tə/ voicing continuum in healthy French speaking 6-year-old children. The training consisted of fourteen thirty minutes identification sessions (fading procedure) with feedback designed to emphasize the temporal cue (Voice Onset Time - V.O.T.) to be trained. For 10 children, training was focused on the French phonological boundary (0 ms V.O.T.) and for ten other children, training was focused on a universal boundary (-30 ms V.O.T.). Ten other control children did not receive any training. Pre- and post-training assessments were performed through identification and discrimination tasks aimed at evaluating categorical perception along the entire V.O.T. continuum. Whereas no significant change was observed in the control group, boundary precision (across the French phonological boundary) increased in the 0 ms V.O.T. training group. Data are currently collected for the -30 ms V.O.T. training group. These results showed that categorical perception of voicing may be improved in healthy children after quite a few training sessions.

## (PS\_3.081)

**Auditory memory: It is auditory, but it's not memory**

MACKEN, B. & JONES, D. *School of Psychology, Cardiff University, U.K.*

The ability to compare the frequency of two tones separated by an interval of a few seconds decreases as the length of the interval increases and is also impaired by the presence between standard and comparison tones of other, task-irrelevant tones. Such performance is typically attributed to auditory memory processes, such that a volatile representation of the first tone is subject to decay and/or interference as a function of time and/or the presence of similar intervening material. Here we show that such an auditory memory account is wrong since, in direct contradiction to such an account, tone discrimination can be shown to actually improve under conditions where the temporal interval between standard and comparison is increased and where the quantity of similar intervening material is increased. Rather than explaining this performance in terms of auditory memory, we argue that it reflects processes involved in comparing features within and across auditory objects, with the latter leading to poorer discrimination performance than the former.

## · Orthographic processing ·

## (PS\_3.082)

**Related word primes alone do not inhibit target RTs in a masked prime LDT**

ZIMMERMAN, R., GELLER, J. & GOMEZ, P. *DePaul University.*

Interactive-Activation based models of lexical access predict that a word prime inhibits processing of an orthographically related target item in the lexical decision task (LDT). Although results supporting this hypothesis have been found, many other studies have failed to find the predicted inhibitory effects of related word primes. In Experiment 1 (n=124), we presented subjects with a standard LDT, and we failed to find inhibition with related word primes. In Experiment 2 (n=44), we manipulated the duration of several primes during the LDT to draw attention to the temporal location of the prime. Doing so increased the magnitude of other predicted effects, and yielded the expected inhibition only for related low frequency word primes. In Experiment 3 (n=23) we used a LDT while recording pupil dilation along with RT's. Again, while we obtained the expected frequency effects, neither RT nor pupil dilation indicated inhibition or increased arousal/processing of related word primes. Our results emphasize the difficulty in obtaining inhibition of related word primes.

## (PS\_3.083)

**The neural substrates underlying reading and its age-related changes in Japanese children: A functional magnetic resonance imaging study**

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Studies have shown that the fusiform gyrus (FG), inferior parietal lobes (IPL), and inferior frontal gyrus (IFG) play important roles in the reading of alphabetic languages. Functional MRI (fMRI) studies on alphabetic languages show that the activation of the FG is associated with fluent-word recognition in skilled readers. Although FG has been identified to be crucial for the reading of Japanese logographic kanji characters, but not of phonographic kana characters, it is activated even for kana characters when their visual familiarity is high. This indicates the dynamic changes in reading systems during the development of skills required for reading Japanese. To delineate the age-related changes in the reading system, we conducted an fMRI with 48 school-aged children. Subjects performed a picture-word matching task: they judged whether the given pictures matched the written words and nonwords. The left FG and left IPL were activated more strongly when the students were presented with familiar words than with letter strings (nonwords). This activation in the IPL and left IFG decreased with age, but there was no such decrease in the FG region. This age-related diminishing activation might indicate a change in the reading skill, from letter-by-letter decoding to fluent-word recognition.

## (PS\_3.084)

**Imaging orthographic learning: Differential contributions of the fusiform gyrus and hippocampus**

SCHUBERT, T. & RAPP, B. *Department of Cognitive Science. Johns Hopkins University. Baltimore, USA.*

Research has identified the role of the left mid-fusiform gyrus in reading (Cohen et al., 2002) and spelling (Rapp & Lipka, 2011). Furthermore, this region -often referred to as the VWFA (Visual Word Form Area) has been implicated in acquisition of literacy (Dehaene, et al. 2010) and also shows increased processing efficiency with increasing word frequency and with repeated presentations of written words (Pugh et al., 2008). The current study examined the involvement of the VWFA and the hippocampus in the real-time learning of orthographic representations by normal adults. During scanning, participants learned mappings between auditory pseudowords and orthographic forms. Whole-brain analysis revealed that the orthographic learning recruited the left mid-fusiform gyrus, left inferior gyrus, and left supramarginal gyrus. Learning trials were categorized both by presentation number (Pugh et al., 2008) and memory strength (Law et al., 2005) to investigate the time course of learning. Results revealed that activation in the functionally-defined VWFA decreased as both memory strength and number of repetitions increased. Conversely, activation in the bilateral hippocampus increased as a function of memory strength. These results provide novel evidence of the distinctive roles played by the VWFA and hippocampus in acquisition of orthographic representations.

## (PS\_3.085)

**Location-invariant visual word recognition in a hierarchical generative model**

DI BONO, M. G. & ZORZI, M. *Department of General Psychology, University of Padova.*

Relative-position and transposition priming effects in visual word recognition have inspired alternative proposals about the nature of orthographic coding. The Open-

Bigram model assumes that the relative position of a letter within a word is coded through its constituent ordered letter pairs. Alternatively, the Overlap model assumes that each letter is coded by a gaussian distribution of activation across the ordinal positions in a word. We asked what type of intermediate coding would emerge in a neural network learning location-invariant representations of written words. We trained a “deep” network with many layers on an artificial dataset of 120 words (trigrams) presented at five possible locations. The network learned a hierarchical generative model of the sensory input (unsupervised learning). We analysed the internal representations across layers as a function of input stimulus type (words, letters, bigrams). Word selectivity and location invariance increased as a function of layer depth. The activation pattern of each word was highly correlated with those of the first constituent letter and the constituent open bigram (i.e., the first and the last constituent letters). These results, though preliminary, suggest that bigram coding plays an important role in word recognition.

(PS\_3.086)

**When less is more: Feedback, priming, and the pseudo-word superiority effect**

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The present study combined masked priming with electrophysiological recordings to investigate orthographic priming effects with nonword targets. Targets were pronounceable nonwords (e.g., STRENG) or consonant strings (e.g., STRBNG), that both differed from a real word by a single letter substitution (STRONG). Targets were preceded by related primes that could be the same as the target (e.g., streng-STRENG, strbng-STRBNG) or the real word neighbor of the target (e.g., strong-STRENG, strong-STRBNG). Independently of priming, pronounceable nonwords were associated with larger negativities than consonant strings, starting at 290 ms post-target onset. Overall, priming effects were stronger and longer-lasting with pronounceable nonwords than consonant strings. However, consonant string targets showed an early effect of word neighbor priming in the absence of an effect of repetition priming, whereas pronounceable nonwords showed both repetition and word neighbor priming effects in the same time window. This pattern of priming effects is taken as evidence for feedback from whole-word orthographic representations activated by the prime stimulus that influences bottom-up processing of prelexical representations during target processing.

• Language acquisition/Cognitive development •

(PS\_3.087)

**Adaptation to Basque of the McCarthy scales of children's abilities (MSCA)**

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To date there has been no adapted tool in Basque for neurodevelopmental assessment of preschool children. The aim of this study is to adapt and validate the MSCA to Basque. This adaptation will allow the neuropsychological follow-up of the INMA-Gipuzkoa cohort at 4 years and 4 months in the dominant language of each child. A back-translation approach has been used, with translation of the instrument to Basque and back to Spanish and comparison of the conceptual equivalence with the original language version. A pilot has been implemented with a sample of 41 children. Based on the quantitative and qualitative analysis carried out after the pilot phase, changes have been made in some items and we have drawn up a version of the MSCA in Basque. This version is being administered individually to each children of the experimental sample. The total experimental sample will consist of 500 children, aged between 4 years and 2 months and 4 years and 8 months, of whom 60% are Basque speakers and will be given this new adapted version. In this paper, however, results will be presented for an initial sample of just 80 children. We present the preliminary results concerning the psychometric properties of the instrument.

(PS\_3.088)

**What visual attention processing skills better predict reading speed in elementary school children?**

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In this study, we explored how parallel processing skills develop and relate to reading speed from ages 7 to 11. Parallel processing skills were evaluated using two different visual attention theoretical frameworks. The Visual-Attention Span, defined as the number of individual visual elements that can be processed in parallel, was evaluated using a global report task. The Theory of Visual Attention uses performance on multi-element parallel processing to compute two parameters: visual processing speed (C) and visual apprehension span (K). Text and single word reading speed were evaluated. Results show that both the Visual-Attention Span and visual processing speed increase significantly from ages 7 to 11 contrary to visual apprehension span. Multiple-regression analyses show that the VA span relates to TVA parameters. However, once the effects of age have been taken into account, only the Visual-Attention span explains a significant part of the remaining reading speed variance. These results emphasize the role of visual attention mechanisms involved in parallel processing in reading speed. They support the relevance of reading models that include parallel processing visual attention mechanisms. Results further suggest a potential specificity of parallel processing when applied to horizontally displayed elements.

## (PS\_3.089)

**Early Use of Spanish Verbal Gender Markers to Anticipate a Referent**

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In Spanish, the most common rule for assigning gender is that for nouns ending in 'a', the grammatical gender is feminine and for nouns ending in 'o' is masculine. Toddlers are sensitive to article-noun gender agreement (Lew-Williams & Fernald, 2007). Furthermore, 30-month-olds use adjective gender-markers to infer an unnamed referent (Arias-Trejo, Falcón, & Alva-Canto, 2010). However, at present it remains unclear whether toddlers benefit from exposure to gender information contained in alternative grammatical categories such as verbs. In a preferential looking task (Golinkoff, Hirsch-Pasek, Cauley, & Gordon, 1987), we explored whether the endings 'lo' (masculine) and 'la' (feminine) at the end of imperative verbs provided toddlers with sufficient information to infer an unnamed referent. In each trial toddlers saw two different-gender pictures and heard an imperative verb with a gender marker included at the end (e.g., míralo or mírala). Thirty-six-month-olds, but not 30-month-olds, correctly inferred the unnamed referent, demonstrating an extraordinary ability to extract gender cues from different grammatical categories other than nouns to correctly infer a target. This ability might enhance a more rapid and accurate online language processing. Age differences suggest a developmental change in toddlers' ability to capture informative gender cues in online language processing.

## (PS\_3.090)

**The acquisition of gender agreement in L3 English by Basque/Spanish bilinguals**

IMAZ, A. & GARCÍA MAYO, M. D. P. *Euskal Herriko Unibertsitatea/Universidad del País Vasco, Vitoria-Gasteiz, Spain.*

This paper examines the acquisition of gender agreement in English third person singular possessive pronouns (his/her) by Basque/Spanish bilinguals. Computational (White et al. 2004) and representational (Hawkins and Tsimpli, 2009) accounts within a generative framework disagree about the acquisition of uninterpretable features (i.e. grammatical gender in Spanish) by L2 learners, whereas interpretable features (i.e. gender in English and Basque) are claimed to be acquirable (Sagarra and Herschensohn, 2011). Previous research on Catalan/Spanish (Muñoz, 1991, 1994) and French learners of English (J. White and Ranta, 2002) show gender agreement errors. This study analyzed the L3 (advanced and intermediate level) English interlanguage of 34 Basque/Spanish bilinguals to investigate the possible effect of the internal structure of the determiner phrase (DP) and proficiency on gender agreement errors. Data from oral elicitation and picture description tasks revealed that (i) gender agreement errors were influenced by Spanish syntax, (ii) participants establish gender agreement with the possessor in both animate and inanimate nouns and (iii) advanced learners outperform intermediate learners, although the former still have production problems. Contrary to representational accounts our findings indicate that the acquisition of the interpretable gender feature poses persistent problems for L3 learners.

## (PS\_3.091)

**Time course of phonological and orthographic information in written word recognition in children in 5th grade: study in masked priming**

SAUVAL, K. & CASALIS, S. *University of Lille North of France.*

The importance of phonological coding considered under strategic control is widely recognized in the young readers. Our study aims evaluating the role of early, non-strategic phonological information in written word recognition. This study aims to reflect the time course of phonological code in French, compared to the orthographic code that occurs before the phonological information. Fifth graders had to complete a lexical decision task with masked priming. There 2 SOAs: 53 and 65 ms. Each target was paired with 4 different primes: pseudohomophone, orthographic, identification, control. The response latencies varied according to conditions and SOAs. The identity prime is the condition which reduces the processing time over the target. Orthographic and phonological codes involved so dissimilar as the SOA.

## • Language comprehension •

## (PS\_3.092)

**The processing of semantic and grammatical anomalies in sentence processing**

PÉREZ MUÑOZ, A. I., MACIZO, P., PAOLIERI, D. & BAJO, M. T. *Experimental Psychology and Behavioral Physiology. University of Granada. Granada. Spain.*

To evaluate the processing of semantic and grammatical anomalies, event-related potentials (ERPs) were recorded while participants read Spanish sentences and decided whether they were anomalous or correct. ERPs were time-locked to critical words (adjectives). The adjectives were plausible in the context of the sentence (e.g., La vecina estaba muy ilusionada con su hijo -The neighbor was very excited with her son-) or they disagreed in number (e.g., ilusionadas), grammatical gender (ilusionado), or they were semantically anomalous relative to a noun previously read in the sentence (e.g., preferida - favourite-). Compared with plausible sentences, semantically incongruent sentences modulated ERPs in the 350-450 ms time-window, while grammatically incongruent sentences (number and gender disagreement) modulated ERPs in the 550-650 ms time-window. These results agree with the processing competition account in which the distinction between semantic and structural processing is evidenced with electrophysiological measures (Kos, Vosse, van den Brink, & Hagoort, 2010).

## (PS\_3.093)

**The embodiment of speed in language; evidence from eye movements**

SPEED, L. & VIGLIOCCO, G. *UCL.*

The embodied approach to language processing describes understanding sentences as the mental simulation of the described events, recruiting the same resources as those used in perception and action. This research looks specifically at the representation of speed in language (e.g. walking vs. running). Presenting results from an eye-tracking study, I will provide evidence for the mental simulation of speed in language. Participants were presented with visual scenes and spoken sentences

describing fast or slow events (e.g. The lion ambled/dashed to the balloon). Speed was either encoded in the verb of the sentence (e.g. amble) or with an adverb (e.g. quickly). Additionally, sentences had either a fast or slow speaking rate. Scenes contained the subject of the sentence, the target and a distractor. Results show a differential pattern of eye movements between fast and slow events with an early interaction with speaking rate. Thus, eye movements reflect the understanding of speed events being described in language in a similar way to viewing the same event in the world. There is also an indication that other sources of speed information (e.g. in speaking rate) can be used in the online interpretation of events and can hinder processing when sources are in competition.

(PS\_3.094)

**Distance effect on sentence comprehension in French language**

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The aim of current study is to investigate the effect caused by the distance of head and its complement. Previous studies revealed that the distance between head and complement affects the acceptability of sentences in English and Japanese. Especially, a neuroimaging study has reported the existence of that effect in Japanese. However, it was still weak to say that this effect is universal because this effect was observed only in one head-initial language (English) and one head-final language (Japanese). Therefore, we have conducted behavioral experiment in French language. Participants were asked to read 60 ungrammatical sentences and 60 grammatical filler sentences in self-paced reading and judged to what extent the sentence was natural in seven degrees. The conditions were that head and its complement was far each other (Long), and closer than Long condition (Short). The result showed that, as same as previous studies, Long condition was statistically more acceptable than Short condition. This result strongly implies that the gap between head and complement is, in addition to grammar, one of the factors that determine the acceptabilities in human sentence comprehension universally.

(PS\_3.095)

**Does the motor cortex process verbs? A transcranial magnetic stimulation study**

MERTENS, B., KEMP, N. & GARRY, M. *School of Psychology. University of Tasmania. Hobart, Australia.*

Previous research suggests processing of motor-related language involves motor cortex structures. This study aimed to investigate how the influence of the motor cortex during language processing may be impacted by creating a motor association to words that previously had no motor association. Reaction time (RT) and electromyographic data were recorded from 15 participants in response to hand-action and non-action verbs across two sessions. Between sessions participants practised simple sign language. Real or sham transcranial magnetic stimu-

lation (TMS) was applied over the motor cortex during word processing on some trials. It was expected that real TMS would interfere with motor cortex function resulting in a delay when processing words with high motor association (hand-action words with signs), whereas there would be minimal impact on RT when processing words with low/no motor association (non-action words with no signs). The hypothesised effect of TMS on word type was not supported, however, it was observed that in the first session, regardless of word type, RT was delayed when real, but not sham TMS was delivered. The role of TMS pulse timing and intensity are being investigated as a possible explanation for the observed results.

(PS\_3.096)

**Linguistic interferences during speech-in-speech comprehension: results from intelligibility and lexical decision tasks**

GAUTREAU, A., HOEN, M. & MEUNIER, F. *Centre de Recherche en Neurosciences de Lyon, CNRS - INSERM - Université Lyon 1.*

Most psycholinguistic models of lexical access, although making different proposals regarding nature of competitors, postulate that word identification is the result of strong competitive mechanisms between simultaneously activated lexical candidates (see for example NAM, Luce and Pisoni, 1998; the revised Cohort model, Marslen-Wilson et al., 1996, TRACE, McClelland and Elman, 1986, or Shortlist, Norris, 1994). In that context, situation of speech-in-speech comprehension could be of great interest. In our studies, nature and language of background noises were manipulated to identify information levels in which linguistic interferences can occur. Native speakers of French had to identify French target words inserted in babbles or in fluctuating noises generated in French, Breton, Irish, Italian, with signal-to-noise ratio of 0 or -5dB. Globally, performances are always better when background is noise rather than speech, revealing that linguistic information from babbles competes with target signal comprehension. The results also showed that at -5dB it is more difficult to understand French target words with babbles in French than in languages unknown to listeners, and that some languages interfere more with French than some others. These results will be discussed with a particular enhancement on the differences observed between intelligibility and lexical decision tasks.

(PS\_3.097)

**Mind's picturing wor(l)ds. Saying what we see, or seeing what we say?**

VOLPE, R.<sup>1</sup> & ESPOSITO, A.<sup>2</sup>. <sup>1</sup>University of Perpignan, <sup>2</sup>Second University of Naples.

We consider the notion of groundlessness as related to the process of meaning structure, which depends on linguistic and non-linguistic information. Bringing awareness to the fact that experience of reality is tied to the cognitive system's experience of the world allows to posit the role mental representations play within such process. Our study on the role mental representations play on the understanding of written sentences describing visual ones, measures both the length of time participants took to decide whether or not the written sentence described the visual one, and the number of errors occurred during this decision making process. We found that more errors occurred when the written text describing the visual

sentence was implausible, and length of time was shorter when both the visual and the written sentence were plausible. We discuss our results under the perspective of Vygotsky's non-classical psychology implying a philosophical understanding of holography.

(PS\_3.098)

**The role of inflectional regularities in agreement comprehension: a comparison between Spanish and Italian**

MANCINI, S.<sup>1</sup>, MOLINARO, N.<sup>1</sup>, AVILÉS, A.<sup>1</sup> & CARREIRAS, M.<sup>1,2</sup>. <sup>1</sup>*Basque Center on Cognition, Brain and Language (BCBL). Donostia, Spain*, <sup>2</sup>*IKERBASQUE, Basque Foundation for Science. Bilbao, Spain*.

We investigated the mechanisms underlying agreement comprehension in two typologically-close languages - Spanish and Italian - using two eye-tracking experiments. Italian and Spanish native speakers read sentences containing person and number anomalies in their own language. Both violations produced longer total-reading times and regression-path durations compared to correct sentences, with no difference between person and number anomalies, neither in Italian nor in Spanish. However, the two features differed in the probability and in the number of regressions out of the interest area (a past participle verb), with number violations showing a greater probability and number of regressions towards earlier parts of the sentence than person ones. Crucially, this difference emerged in Italian but not in Spanish. An explanation for this may reside in Spanish greater inflectional regularity in signaling number information across grammatical categories ("-s") than Italian. The presence of an "-s" either on the auxiliary (e.g. "hemos") or on the subject (e.g. "ellos") may lead Spanish speakers to actively rely on morphological regularities to interpret agreement dependencies. On the contrary, Italian variability in plural number suffixes may require the parser to perform more regressions to check the number information contained in previous words and interpret the dependency.

• Language production •

(PS\_3.099)

**Distractor frequency effects in picture-word interference tasks with vocal and manual responses**

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A number of studies have recently reported that in picture-word interference tasks, distractors with a low frequency of occurrence interfere more with picture naming than distractors with high frequency. This finding is not straightforward to accommodate within traditional accounts of word production in which lexical access is typically conceptualised as competitive. Instead, the distractor frequency effect has been taken to support a view according to which lexical access is not competitive, and picture-word interference effects arise at a post-lexical preparation stage. Two experiments are reported which contrasted picture naming with a manual task performed on the picture name (Experiment 1: syllable judgment; Experiment 2: phoneme monitoring). In both studies, an equivalent effect of distractor frequency was observed for vocal and manual tasks, suggesting that the

effect arises at a shared, abstract processing level. Consequently, the distractor frequency effect should not be interpreted as evidence for the claim that distractors have to be excluded from an articulatory response buffer before target naming can proceed.

(PS\_3.100)

**Word sequences in the mental lexicon: the case of irreversible binomials**

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Irreversible Binomials (IBs) are complex linguistic constructions consisting of two words, or constituents, conjoined by a linking element (e.g. "hit and run"). The aim of this study is to explore how IBs are represented in the mental lexicon and how their processing is influenced by transparency and by other psycholinguistic variables (familiarity, frequency, length, and conditional probability of both whole-sequences and constituents). Thirty three university students performed a reading aloud task. Experimental stimuli consisted of 60 IBs and 60 fillers. IBs were divided into 30 opaque IBs (e.g., "odds and ends") and 30 transparent IBs (e.g. "paper and pencil"). Participants were asked to read stimuli aloud as fast as possible. Data were analyzed through Mixed effects models (Baayen, 2007). The dependent variable was the reading latency and several psycholinguistic variables were considered as predictors. Results showed that increases in word-sequence familiarity and transparency were associated with shorter reading latencies. Thus, a whole-word representation of sequences may be crucial in IB processing. Data are discussed in relation to major theories of lexical representation (e.g., Caramazza, 1997; Levelt, Roelofs, Meyer, 1999).

(PS\_3.101)

**Conceptual planning during language production**

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Several studies have reported evidence for a phrasal planning scope in sentence production, which researchers have often attributed to advanced lexical planning. However, studies manipulating lexical variables have failed to find effects beyond the first item in a phrase, suggesting incremental lexical planning. The purpose of the current study was to characterize the representational level involved in phrasal planning. In Experiment 1, subjects were presented with a prime picture to name, followed by three pictures to produce in a sentence. Although priming the first item in a phrase led to facilitation, priming the second item led to interference. In Experiment 2, subjects were presented with a preview of either the pictures or the structure to be produced in a sentence. The picture preview did not modulate phrasal planning, whereas the structural preview did. Results of the current study support the notion that phrasal planning involves conceptual, rather than lexical, planning.

## (PS\_3.102)

**General principles of sequence representation: Evidence from perseveration errors**

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Perseverations errors, inappropriate intrusions of items from a previous trial into the current response, are observed in a variety of tasks. These errors provide a window into how the immediate past competes with current processing. Here, we analyze factors that predict which items are going to perseverate in three cognitive domains - spelling, spoken word production and verbal working memory. In each case, items from previous responses (e.g. the letter L in the written response MOTEL) intrude into subsequent responses (e.g. spelling "under" as UNDEL). A number of striking similarities were observed across the three domains. First, items occurring in a stimulus but not in the corresponding response do not perseverate into subsequent responses, whereas items occurring erroneously in a response do perseverate. Second, item perseverations are increasingly more likely with greater overlap between the current target and the previous response. Third, perseverated items tend to maintain position between the error and the previous response, specifically position defined relative to both the beginning and end of the sequence. We discuss how each of these results constrains theories of sequence representation and processing. Because similar results were found across cognitive domains, we suggest that perseverations reveal some general principles of sequential processing.

## (PS\_3.103)

**Planning messages and sentences with familiar perceptual and syntactic structures**

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If message and sentence planning are closely linked processes, planning scope may vary depending on what speakers want to say and how they say it. We compared speakers' gaze pattern to pictures in displays eliciting sentences like "The lion and the tiger are above the basket" when speakers were a) more familiar or less familiar with the spatial layout of these displays, and b) more familiar or less familiar with the phrasal structures used in these sentences. Familiarity with spatial layout was induced by presenting prime trials with a similar or dissimilar layout of pictures ("The bell and the nail are above/below the crutch") before the target trial, and familiarity with sentence structure was manipulated via structural priming (prime trials elicited sentences like "The bell and the nail are above the crutch" or "The bell is above the nail and the crutch"). When describing pictures on target trials, speakers looked earlier at the second object (tiger) when they were familiar with both the spatial layout and sentence structure, but speech onsets were reduced (structural priming) only when both spatial layout and sentence structure were repeated. The results show that linguistic planning is facilitated by congruence between message-level and sentence-level structure.

## (PS\_3.104)

**Pragmatic factors condition a word's pronunciation**

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Words are often shorter and contain fewer segments in casual than in formal speech. For instance, in casual Dutch, the word <natuurlijk> 'of course' is often reduced to <tuurlijk>, or even <tuuk>. This type of pronunciation variation is generally ascribed to general mechanisms of speech production. We investigated whether it is also conditioned by pragmatic factors. We studied the acoustic characteristics of 177 tokens of Dutch <natuurlijk> and 184 tokens of Dutch <eigenlijk> 'actually', extracted from spontaneous speech corpora. We classified their Turn Constructional Units (TCUs) as constituting responses to prior TCUs or as initiating new conversational topics. We hypothesized that <natuurlijk> and <eigenlijk> are more reduced in initiating TCUs, since in these TCUs they typically convey that aspects of the turn contain old information and violate a norm of conversation. This hypothesis was supported by our data. <Natuurlijk> and <eigenlijk> are shorter in duration and in number of syllables in initiating than in responsive TCUs. Nevertheless, the syllable <na> of <natuurlijk> is more often present in initiating than in responsive TCUs. These results show that pragmatic factors condition degree and type of reduction. Psycholinguistic models of speech production have to account for interactions between pragmatics and general production mechanisms.

## · Bi/Multi-lingualism ·

## (PS\_3.105)

**The bilingual and monolingual differences in comprehension processing: An fMRI study**

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Kovelman et al., (2008) have addressed the neural signature of bilingualism. They considered the left inferior frontal cortex (LIFC, Broca's area) to be the best candidate. Wartenburger et al., (2003), in the same direction, found that early bilinguals showed higher activation in similar areas for L2 grammatical judgment rather than for semantic, but not late bilinguals. This can be interpreted in terms of the declarative/procedural model of language (Ullman, 2004) where grammatical rules are dependent on implicit knowledge sub served by Broca's area and basal ganglia. Late L2 acquisition might not rely on the same structures as it would be acquired explicitly. We explore if grammatical and semantic processing in bilinguals differ in L1 too. An fMRI study was conducted where bilinguals and monolinguals performed a grammatical and semantic judgment task. We observed a more extensive activation of the bilingual brain in both judgments. More interestingly, higher activation of LIFC

for L1 grammatical judgments than semantic was found in bilinguals and specially in less proficient. These results are in agreement with those observed for L2 processing, suggesting that bilinguals recruit a more extensive network than monolinguals in L1 too. However, our data question the interpretation based on the declarative/procedimental model.

#### (PS\_3.106)

##### **Cued language switching in sentence reading: exploring the asymmetry of the cost**

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The asymmetric switching cost between languages has been widely found in bilingual production tasks (Meuter and Allport, 1999). This asymmetry has been suggested to be the result of a top-down inhibitory process directed to the language not in use. However, alternative explanations have been proposed as well (Finkbeiner, Janssen, Almeida, Caramazza, 2006). The goal of the current study is to investigate the relationship between the asymmetric cost and top-down processes. In order to do so, we designed a sentence reading task for later repetition in which two types of color cues indicated the language of the sentence. In Experiment 1, participants were presented with the cues immediately before the appearance of sentences (external language cuing); in Experiment 2, the language of the sentence was cued by the color of the first word (internal language cuing). Our rationale was that external cuing would strengthen the top-down processes, while internal cuing would not elicit a top down expectancy of the language of the sentences. Then, if the asymmetric cost is an index of inhibitory control, we would expect that switching asymmetries will be more pronounced in the case of external cuing.

#### (PS\_3.107)

##### **Grammatical gender effect in English!**

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Recently the importance of grammatical gender in monolingual (Cubelli et al., 2005) and bilingual (Paolieri et al., 2010) production has been observed. In this study we explored whether the grammatical gender of the native language affects the production of words in a second language where the grammatical gender system is absent. Twenty-four Spanish-English bilinguals were instructed to name pictures in English during a picture-word interference task, producing the bare noun. Words distractors were presented in Spanish and half of the nouns were gender congruent with the Spanish translation of the target while the other half were gender incongruent. The results showed slower English naming times in the L1 gender-congruent pairs relative to the L1 gender-incongruent pairs. This interference effect confirms that grammatical gender selection is crucial in languages with a complex morphological structure, like Spanish. Moreover, it suggests that in L2 naming task the grammatical gender of L1 is always active and can affect lexical selection also in a language, like English, where the grammatical gender is absent.

#### (PS\_3.108)

##### **Are eye-fixations in cognate processing dependent on entropy?**

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Decades of research have brought more insight into how bilinguals recognize cognates presented in isolation. However, little is known about what bilinguals actually look at when they process cognates. Cognates are translation equivalents with form overlap across languages, such as WINTER, which is spelled in the same way in Dutch and German (and English). Cognates provide form-ambiguous input in a word identification task, because they could belong to both the target and non-target language. In the case of non-identical cognates, such as GENERATIE (Dutch) and GENERATION (German, English), language-specific orthographic cues solve this ambiguity. We reasoned that if bilinguals do indeed use such cues during word identification, this might be reflected in their eye-fixations, which would be longer on the position at which the two cognates differ. In a Dutch (L2) lexical decision task, German-Dutch bilinguals were presented with German-Dutch identical and non-identical cognates, and with Dutch non-cognate control words while their eye-movements were monitored. The Dutch orthography of the non-identical cognates differed at either the beginning (e.g., CILINDER/ZILINDER) or end (MYSTERIE/MYSTERIUM) of the word from its German equivalent. As a separate test, pseudowords were included that differed at the beginning or end from existing cognates or Dutch non-cognate words.

#### (PS\_3.109)

##### **On the effects of a brief L2 immersion on executive control**

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There is ample evidence showing that bilingualism has an influence over the cognitive control abilities: bilinguals outperform monolinguals in different attentional tasks requiring conflict resolution. The link between bilingualism and cognitive control stems on the continuous engagement of the control mechanisms to solve cross-language competition during production. In the present experiment we explore the extent to which this bilingual advantage can be observed for low-proficient bilinguals that for a brief time of L2 immersion will use both their languages. The changes in the magnitude of the conflict effect across the immersion period were explored in two tasks (the Numerical-Stroop and the ANT) by comparing the beginning and the end of the immersion. As a control, a group of Spanish monolinguals was tested. The results revealed no differences between the groups in the ANT task due to the immersion experience. In contrast, the conflict effect in the Numerical-Stroop task reduced significantly for the immersed group but not for the monolingual group. These results suggest that the intensive practice in managing two languages in the L2 immersion context uniquely enhances those cognitive processes related to the inhibition of the more automatic response



(L1) to successfully respond to the less automatic one (L2).

**(PS\_3.110)**

**Lexicality effect and stress assignment in bilingual children reading Italian as a second language**

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Contrary to the claim that in transparent orthographies word reading is accomplished mainly by the nonlexical route, Italian developing readers show lexicality and frequency effects and seem to be sensitive to the distributional properties of the language. How do bilingual children with different age of L2 (Italian) first exposure and vocabulary size read L2 words and pseudowords? Two reading aloud experiments investigated lexicality effect and stress assignment in fourth and fifth grade bilinguals and monolinguals. Naming latencies and pronunciation accuracy were analyzed. In Experiment 1, lexicality effect (words read better than pseudowords) and differences between groups (bilinguals and monolinguals) emerged. In Experiment 2, word frequency effect emerged. Moreover, late bilinguals, who are also characterized by lower L2 vocabulary size, were less accurate than early bilinguals and monolinguals in assigning the less dominant stress. Similarly to monolinguals, lexical information seems to be employed in reading Italian as a second language. Furthermore, bilingual readers are sensitive to the distributional properties of the language. Stress assignment pattern seems to be affected by the characteristics of second language learners: results are discussed with respect to L2 vocabulary size and age of L2 first exposure.

**(PS\_3.111)**

**Digits vs. Pictures: the influence of stimulus type on language switching**

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The preferred stimuli in language-switching studies are either digits or pictures. However, the relation between both types of stimuli remains unclear and the influence of stimulus type on language switching has not been examined so far. Yet, one could assume that digits are quite specific as they represent one single semantic group and usually have a large phonological overlap between languages - which is not necessarily present in a set of pictures. In the present study, we directly compare digit naming and picture naming in a German/English language-switching experiment. To further examine the role of semantic and phonological similarity, participants performed four conditions with nine stimuli each: 1) Digits, 2) Semantically-related pictures, 3) Pictures depicting cognates, and 4) Control pictures. While digits were named significantly faster than pictures, there seemed to be a less pronounced effect with respect to switch costs. However, while switch costs were similar between cognates and numbers, we observed smaller switch costs for numbers than for the semantically-related condition. Thus, the experiment suggests a role of phonological overlap in language switching.

- ABADIE, M., 95  
 ABDEL RAHMAN, R., 55  
 ABDELRAHIM, S., 157  
 ABU MALLOUH, R., 182  
 ABUTALEBI, J., 133  
 ACHA, J., 5  
 ACHESON, D., 83, 149  
 ACOSTA, A., 113  
 ADLER, N., 76  
 AGUADO, L., 71  
 AGUS, T., 44  
 AKILA, R., 123  
 ALARIO, F., 66  
 ALBA, A., 157  
 ALBA, S., 163  
 ALBERS, A. M., 91  
 ALBUQUERQUE, P., 140, 147  
 ALEGRIA ISCOA, J., 156  
 ALFIMOVA, M., 62  
 ALLEN, C., 173  
 ALMEIDA, J. J., 169  
 ALONSO CÁNOVAS, D., 184  
 ALONSO, G., 175  
 ALONSO, L., 172  
 ALTMANN, G. T., 2, 33  
 ALTVATER-MACKENSEN, N., 76  
 ALVA CANTO, E. A., 188  
 AMADOR, J. A., 136  
 AMEDI, A., 41  
 AMORE, V., 131  
 ANDERSON, A., 102  
 ANDIARENA, A., 187  
 ANDREWS, M., 63  
 ANELLI, F., 86  
 ANSORENA, X., 172  
 ANZULEWICZ, A., 170  
 ARANBARRI, A., 93, 187  
 ARCARA, G., 83, 190  
 ARDIALE, E., 35  
 ARDUINO, G. M., 171  
 ARDUINO, L. S., 100, 133, 170  
 ARIAS-TREJO, N., 39, 188  
 ARIGA, A., 107  
 ARISTEI, S., 53, 55  
 ARNAUD, R., 106  
 ARNEDO, M., 117  
 ARNOLD, G., 71  
 ARNON, I., 49  
 ARRANZ, E., 93  
 ARRINGTON, C. C., 95  
 ARRIOLA, N., 175, 187  
 ASANOWICZ, D., 100, 106, 111  
 ASHBY, A., 83  
 ATAS, A., 77  
 AUBANEL, V., 126  
 AVECILLA RAMIREZ, G. N., 157  
 AVECILLA, G., 158  
 ÁVILA, C., 191  
 ÁVILA, V., 160  
 AVILÉS, A., 190  
 AVRAAMIDES, M., 69, 152  
 AZNAR-CASANOVA, J., 136  
 AZNARTE, J. I., 169  
 BACHOUD-LÉVI, A., 19  
 BACIU, M., 167  
 BADE, F., 108  
 BAHRAMI, B., 102  
 BAJO, M. T., 53, 62, 133, 143, 147, 169, 188, 192  
 BAKER, A. G., 65  
 BALAS, R., 61, 77, 85, 145  
 BALL, L., 119  
 BALLUERKA, N., 187  
 BALOUCH, S., 148  
 BAND, G. P., 26, 51, 86, 167  
 BARANDIARAN, X., 136  
 BARBER, H., 162  
 BARBERIA, I., 65  
 BARCA, L., 156  
 BARDI, L., 113  
 BARENBERG, J., 66  
 BARRETT, D., 124  
 BARROUILLET, P., 82, 148, 180  
 BARSALOU, L., 41  
 BARTELS, M., 154  
 BARTOLOMEO, P., 100, 101  
 BASSETTI, B., 164  
 BASSO, D., 152  
 BASTERRECHEA, M., 93, 187  
 BASTIAANSEN, M. C., 50  
 BAUS, C., 192  
 BAUSENHART, K. M., 56  
 BAYARD, C., 185  
 BAYEN, U., 121  
 BAYER, M., 141  
 BEAMAN, P., 96  
 BEATO, M. S., 176  
 BEATTY, E., 119  
 BECKER, R., 158  
 BECKWÉ, M., 169  
 BEDNAREK, H., 139  
 BEGIRISTAIN, H., 93  
 BEHNE, D. M., 174  
 BEINTNER, R., 101  
 BEKKERING, H., 37, 64  
 BELL, R., 60, 121  
 BELLOCCHI, S., 193  
 BENGOTXEA, E., 105  
 BERSE, T., 66  
 BERTELS, J., 65, 145  
 BERTHOMMIER, F., 74  
 BERWIG, M., 131  
 BEVER, T., 130  
 BEYENS, U., 135  
 BEYERSMANN, L., 132  
 BIEDERMANN, B., 132  
 BIEN, H., 128  
 BILALIC, M., 85  
 BINKOFSKI, F., 108  
 BISIACCHI, P., 83  
 BLANCO, F., 65  
 BLANKE, O., 69  
 BLAUT, A., 105  
 BLES, R., 163  
 BLUEMEL, E., 69  
 BOBB, S., 160  
 BÖCKLER, A., 63  
 BOLBECKER, A., 125  
 BOLDINI, A., 111  
 BONINO, D., 152  
 BONNEFON, J., 96  
 BONNEFOND, A., 134  
 BORGHI, A. M., 86, 99, 108, 128  
 BOROS, M., 163  
 BOSCO, A., 68  
 BOSSE, M., 70  
 BOTTA, F., 100  
 BOULENGER, V., 126  
 BOULINGUEZ, P., 55  
 BOURGEOIS, A., 101  
 BOURKE, L., 149  
 BOWERS, J. F., 31  
 BRACCO, G., 155  
 BRAEM, S., 26  
 BRANDIMONTE, M. A., 146  
 BRANDNER, C., 140  
 BRANIGAN, H., 132  
 BRANZI, F. M., 133  
 BRASS, M., 38, 63, 81, 91, 95  
 BRAUER, J., 127  
 BRAVERMAN, A., 119  
 BRAZEAL, J., 185  
 BRENDERS, P., 30  
 BRIEBER, S., 61  
 BROCHARD, R., 171  
 BROUILLET, D., 146  
 BROUILLET, T., 146  
 BROULIDAKIS, J., 117  
 BROWN, S., 153  
 BROZZOLI, C., 21, 82  
 BRUNET, M., 37  
 BRUNETTI, R., 150  
 BRYLSBAERT, M., 5, 63, 79  
 BUCHNER, A., 60, 73, 121  
 BUKOWSKI, M., 163  
 BULTENA, S., 160  
 BURANI, C., 133, 193  
 BURLE, B., 59, 66, 81, 90, 95, 172  
 BYRNE, R., 59, 183  
 CACCIARI, C., 48, 49, 159  
 CADAVI, S., 176  
 CALABRIA, M., 163  
 CALDERON, M., 158  
 CALLEJA, M., 116  
 CAMEIRÃO, M., 134  
 CAMOS, V., 74, 82, 123, 148  
 CAMPBELL, J., 86  
 CAÑADAS, E., 153  
 CARBONE, R., 86  
 CARBONNELL, L., 51  
 CARDINALI, L., 21, 82  
 CARREIRAS, M., 5, 54, 70, 182, 190, 192  
 CARRILLO GALLEGO, M. S., 156  
 CASADO MARTÍNEZ, P., 161  
 CASADO, P., 54  
 CASALIS, S., 188  
 CASELLI, M. C., 156  
 CASINI, L., 59, 90, 95, 172  
 CASTELLANOS, M. C., 110, 113  
 CASTELLI, L., 110, 170  
 CASTELO-BRANCO, M., 145  
 CASTLES, A., 90  
 CASTRATARO, M., 156  
 CASTRO, C., 68, 110, 170, 182  
 CASTRO, S. L., 184  
 CATTANEO, Z., 42  
 CAVERNI, J., 51  
 CECCARELLI, I., 193  
 CECILIANI, A., 81  
 CESTARI, V., 121  
 CHANG, B., 109  
 CHANG, E., 173  
 CHANG, T. T., 24  
 CHAVES, N., 70  
 CHENG, S., 179  
 CHERDIEU, M., 122  
 CHETAIL, F., 89  
 CHEVALÈRE, J., 117  
 CHICA, A., 100, 101  
 CHIRIVELLA, J., 117

- CHRISTIENSEN, M., 144
- CHRISTOFFELS, I., 83
- CHRYSIKOU, E., 125
- CICOĞNA, P. C., 146
- CIPOLLA, C., 163
- CIPORA, K., 116, 140, 151
- CLASSON, E., 180
- CLEEREMANS, A., 11, 12, 77, 100, 120, 135, 164
- COBOS, P. L., 3, 182
- COHEN KADOSH, K., 18
- COHEN KADOSH, R., 18
- COHEN, A., 23, 175
- COLIN, C., 70, 73, 185
- COLIN, S., 118
- COLLET, G., 73, 185
- COLTHEART, M., 56
- COLTHEART, V., 149
- COLZATO, L., 22, 143, 167
- COMESAÑA, M., 62
- COMETTI, D., 167
- COMPARETTI, C. M., 138
- CONA, G., 83
- CONKLIN, K., 49
- CONSON, M., 152
- CONTENT, A., 89, 116, 150, 151, 181
- CONTENTO, S., 193
- COOKE, M., 126
- COOMANS, D., 75, 85, 120
- COPET, P., 117, 143
- CORBIN, L., 82
- CORLETT, P., 57
- CORLEY, M., 1
- CORREA, A., 56, 117
- COSENZA, M., 146
- COSTA, A., 1, 3, 133, 163, 169, 192
- CRESS, U., 7
- CROISILE, B., 112
- CRONE, E., 51
- CROSS, E., 37, 87
- CROWTHER, J., 190
- CUBELLI, R., 147, 151, 153, 192
- CULLEN, V., 4
- CUNILLERA, T., 9
- CZAJAK, D., 140
- CZERNOCHOWSKI, D., 174
- D'AUSILIO, A., 150
- DAEL, N., 142
- DAL BOSCO, S., 170
- DALE, R., 33
- DALMASO, M., 110
- DAMAS, J., 116
- DAMAS-LÓPEZ, J., 181
- DAMBACHER, M., 90
- DAMIAN, M., 83, 190
- DAMPURE, J., 109
- DAPRATI, E., 99
- DAVIDSON, D., 29
- DAVIES, S., 140, 149
- DAVIS, C. J., 5
- DAVIS, M. H., 10, 31, 43
- DE BAENE, W., 91, 95
- DE DIEGO-BALAGUER, R., 18, 19, 156
- DE HOUWER, J., 10, 11, 90, 101, 144
- DE LA MORA, D., 184
- DE LANGE, F. P., 64
- DE LISSNYDER, E., 169
- DE MARCHI, C., 190
- DE MARTINO, M., 159
- DE NEYS, W., 96
- DE PAEPE, A., 82
- DE RUITER, J., 191
- DE SCALZI, M., 159
- DE SMET, B., 34
- DE TIÈGE, X., 144
- DE VEGA, M., 130, 159
- DE VOLDER, A. G., 42
- DE VRIES, M., 145
- DE WEERD, P., 45
- DECHENT, P., 86
- DECLERCK, M., 193
- DECO, G., 93
- DEFEVER, E., 6, 181
- DEFIOR, S., 59
- DEKERLE, M., 126
- DEL GATTO, C., 150
- DEL GROSSO, E., 150
- DELIENS, G., 146
- DELL'ACQUA, R., 78, 131
- DELOGU, F., 75, 150, 152
- DELPERO, E., 99
- DELTENRE, P., 73
- DEMANET, J., 95
- DEMOULIN, C., 145
- DENIS, M., 152
- DERAKSHAN, N., 27
- DERING, B., 46
- DEROOST, N., 67, 75, 85, 120, 169, 176
- DESCHRIJVER, E., 63
- DESCOUST, M., 172
- DESMET, C., 63
- DESTREBECQZ, A., 65, 120, 145, 164
- DI BONO, M. G., 186
- DI PAOLO, E., 136
- DIAZ, J., 76
- DÍAZ, U., 172
- DIDINO, D., 115
- DIEDRICHSSEN, J., 22
- DIELER, A., 21
- DIENES, Z., 12, 13
- DIEPENDAELE, K., 5
- DIJKSTRA, T., 30, 50, 160, 192
- DIMITROPOULOU, M., 70
- DIOUX, V., 167
- DITTRICH, K., 96
- DOBEL, C., 101, 160
- DOIGNON-CAMUS, N., 134
- DOLK, T., 138
- DOMÍNGUEZ, A., 159
- DONALDSON, D., 1
- DORCHIN, S., 180
- DORIANNE, G., 68
- DORICCHI, F., 17
- DOWD, R., 86
- DOWELL, N., 117
- DOWKER, A., 18
- DREISBACH, G., 10, 11, 27, 110
- DRESZER-DROGORÓB, J., 114
- DRUEY, M., 10, 47, 102
- DRYLL, E., 169
- DUBOIS, M., 74, 187
- DUFAU, S., 69, 170
- DUFF, F., 8
- DUMAY, N., 31, 111, 141, 157
- DUÑABEITIA, J. A., 5, 54, 70, 187
- DUSSIAS, P., 30, 53, 192
- DUTHOO, W., 91
- DUTKE, S., 66
- DUYCK, W., 59
- DYE, C., 156
- EASTON, A., 122
- ECALLE, J., 118, 125, 126, 127, 128
- EDER, A., 154
- EGURZA, M., 93
- EIMER, M., 46
- EINERT, M., 114
- ELMAN, J. L., 1
- EMILIE, C., 167
- ENTWISTLE, R., 147
- ERDFELDER, E., 60
- ERDOCIA, K., 78
- ERNESTUS, M., 162, 191
- ESAULOVA, Y., 161
- ESPOSITO, A., 189
- ESPOSITO, G., 171
- ESTEBAN, L., 122
- ESTÉVEZ, A., 122
- ESTUDILLO HIDALGO, A. J., 181
- EVERAERT, T., 101
- EYAL, T., 26
- F. ESTÉVEZ, 184
- FACAL, D., 172
- FACOETTI, A., 155
- FAHRAT, S., 130
- FAÏTA-AÏNSEBA, F., 89
- FAJARDO, I., 160
- FALKENSTEIN, M., 51
- FAN, Z., 141
- FANO, E., 93, 187
- FARNÈ, A., 21, 82
- FAUROUS, W., 111, 141
- FEENEY, A., 35, 36
- FELDKER, K., 126
- FERJAN RAMIREZ, N., 158
- FERNANDES, A., 140
- FERNÁNDEZ-HERNÁNDEZ, A., 54, 161
- FERNANDEZ-CAHILL, M., 71
- FERRARO, L., 138
- FERRÉ, P., 62, 112
- FERRER, A., 160
- FERRIER, L., 146
- FIAS, W., 51, 63, 172, 180
- FINOCCHIARO, C., 132
- FIORI, N., 122
- FIORINO, L., 147
- FISCHER, R., 178
- FISCHER, U., 7
- FISCHER-BAUM, S., 191
- FITZPATRICK, I., 133
- FLORES, A., 3, 116
- FOLTZ, A., 154
- FONDEVILA, S., 54, 161
- FORGUES, L., 37
- FORMISANO, E., 45
- FORSTER, M., 139
- FORSTMANN, B. U., 22, 118, 119, 153
- FORTEmps, P., 71
- FOSTER, M., 78
- FOUCART, A., 132
- FOUSTANA, A., 35
- FRADE, S., 62
- FRAGA, I., 62
- FRANÇA, P., 169
- FRANCO, A., 65, 145, 164
- FRANK, S., 78
- FRASCA, M., 172
- FRENSCH, P. A., 65, 84, 174
- FRIEDERICI, A. D., 54, 97, 127, 158
- FROEBER, K., 27
- FROST, S., 134
- FU, Q., 135

- FUENTES, L. J., 68, 184  
 FUNES, M. J., 142  
 FULBRIGHT, R., 134  
 GADE, M., 10, 67, 102  
 GAILLARD, V., 120, 168  
 GALATI, A., 69, 152  
 GALENDE, N., 93  
 GALER, S., 144  
 GALERA, C., 124  
 GALTANO, G., 110, 170  
 GALLEGGO, C., 127, 157  
 GALLESE, V., 138  
 GÁLVEZ GARCÍA, G., 136  
 GANUSHCHAK, L., 83  
 GARAIZAR, P., 107  
 GARCÍA MAYO, M. D. P., 188  
 GARCÍA, A., 105  
 GARCIA, J., 116  
 GARCIA-ALBEA, J., 130  
 GARCÍA-BAJOS, E., 179  
 GARCÍA-ORZA, J., 181, 182  
 GARRY, M., 189  
 GASCHLER, R., 65  
 GASKELL, G., 31, 71, 76  
 GATER, S., 83  
 GAUTREAU, A., 189  
 GEBUIS, T., 151, 180  
 GELLATLY, A., 137  
 GELLER, J., 186  
 GEMMINK, M., 145  
 GEMPERLE, A., 84  
 GERGER, G., 139  
 GERJETS, P., 168  
 GEUKES, S., 157  
 GEVERS, W., 17, 135, 180  
 GIANELLI, C., 96  
 GIANG, T., 60  
 GIESBRECHT, B., 67  
 GILLIOZ, C., 77  
 GINSBURG, V., 17, 180  
 GIORGIO, M., 184  
 GIRAUD, A., 19  
 GIRELLI, L., 170  
 GLENBERG, A., 15  
 GLICKSOHN, A., 175  
 GOBIN, P., 89  
 GODLEWSKA, M., 77  
 GODOY, A., 3  
 GOEBEL, S. M., 6, 17  
 GOETHE, K., 67  
 GOLDENBERG, G., 21  
 GOLIMBET, V., 62  
 GÓMEZ MARTÍNEZ-PIÑEIRO, F., 157  
 GOMEZ, P., 5, 186  
 GÓMEZ-ARIZA, C. J., 53, 133, 147, 169  
 GONZÁLEZ, J., 191  
 GONZÁLEZ, M. F., 172  
 GONZÁLEZ-MARTÍN, E., 3  
 GORDON, B., 167  
 GOROSTIAGA, A., 187  
 GOSCHKE, T., 178  
 GOTO, T., 143  
 GOUDBEEK, M., 142  
 GOZALO, M., 176  
 GRABNER, R. H., 34  
 GRAINGER, J., 6, 29, 69, 101, 106, 187  
 GRASMAN, R., 153  
 GRAZIANO, K. M., 124  
 GREEN, C., 149  
 GREENAUER, N., 69  
 GRICE, M., 123  
 GRONOSTAJ, A., 105  
 GRUBER, O., 86  
 GRZYB, K. R., 48  
 GUASCH, M., 112  
 GUBBINS, E., 183  
 GUERRA, E., 99  
 GUILLAUME, M., 181  
 GUNTER, T. C., 54  
 GUNTHER MOOR, B., 51  
 GUO, T., 52, 76  
 GUO, Y., 97  
 GUY, M., 75  
 GYGAX, P., 77  
 GYSELINCK, V., 68  
 HAAVISTO, M., 105  
 HADJIKHANI, N., 140  
 HAERING, C., 84  
 HAGMAYER, Y., 3  
 HAGOORT, P., 83, 149  
 HALGREN, E., 158  
 HAMILTON, A. C., 97  
 HAMILTON, A. F. D. C., 87  
 HAMMING, J., 86  
 HANCOCK, E. N., 96  
 HANCOCK, R., 130  
 HANDJARAS, G., 152  
 HANIQUE, I., 162  
 HANNULA-SORMUNEN, M., 7  
 HANTSCH, A., 162  
 HANULIKOVA, A., 128  
 HARE, M., 1  
 HARMONY, T., 157, 158  
 HARRIS, A., 4  
 HARRISON, N., 115  
 HARTENDORP, M., 79  
 HASBROUCQ, T., 172  
 HATRAC, M., 158  
 HAUSFELD, L., 45  
 HAVAS, V., 156  
 HAYES, B., 36  
 HEIMLER, B., 74  
 HEIN, L., 102  
 HEINEMANN, A., 96  
 HEIT, E., 36  
 HENDERICKX, D., 67  
 HENDERSON, L., 76  
 HENELIUS, A., 105  
 HERMSDÖRFER, J., 21  
 HERNÁNDEZ, M., 163  
 HERNÁNDEZ-CABRERA, J. A., 159  
 HERRERA, A., 111, 116, 162  
 HERZIG, D., 105  
 HERZMANN, G., 47  
 HETRICK, W., 125  
 HEURLEY, L., 146  
 HILBOLL, D., 66  
 HILDEBRANDT, A., 47  
 HILLIS, A., 167  
 HINOJOSA, J. A., 153  
 HIRSCHFELD, G., 126  
 HOEN, M., 189  
 HOFFMAN, E., 125  
 HOFFMANN, D., 150  
 HOLCOMB, P. J., 29, 69, 187  
 HOLMES, N. P., 21  
 HOLT, L., 44  
 HOMBLE, K., 176  
 HOMMEL, B., 15, 23, 26, 138, 143, 167  
 HONMA, R., 143  
 HOOGE, I., 79  
 HOONHORST, I., 73  
 HORN, S., 121  
 HOUTMAN, F., 172  
 HSIEH, I., 159  
 HSIEH, S., 48  
 HUANG, H., 159, 173  
 HUANG, T., 173  
 HÜBNER, R., 47, 48, 90  
 HUESTEGGE, L., 137  
 HUFFSTETLER, S., 32  
 HUGHES, R., 77  
 HULME, C., 8  
 HULTEN, A., 9  
 HULTZER, G., 86  
 HÜNEFELDT, T., 154  
 HUNG, D., 142, 173, 179  
 HUOTILAINEN, M., 105  
 HURLSTONE, M., 77  
 HUTSON, J., 190  
 HUYSE, A., 74  
 IANI, C., 136, 138  
 IBÁÑEZ, A., 192  
 IBARLUZEA, J., 93, 187  
 IDSARDI, W., 20  
 IKEDA, T., 122  
 ILIĆ, O., 99  
 IMAZ, A., 188  
 IMBERTY, M., 184  
 IMBO, I., 34, 35  
 IRIARTE, A., 169  
 IRMEN, L., 131, 161  
 ISHIBASHI, A., 122  
 ISHIBASHI, R., 124  
 ISRAEL, M., 23  
 IZA, M., 116  
 JAAFARI, N., 172  
 JACOBS, A., 55  
 JAHFARI, S., 23  
 JANCZYK, M., 96, 137  
 JANSSEN, N., 162  
 JAREMA, G., 190  
 JASKOWSKI, P., 115  
 JAUREGI, J., 117, 143  
 JEAN-BAPTISTE, D., 122  
 JELLEMA, T., 111  
 JESCHENIAK, J. D., 131  
 JIMÉNEZ, L., 13  
 JIMÉNEZ-ORTEGA, L., 54, 161  
 JOB, R., 151  
 JOERGENSEN, G., 2  
 JOHNSON, E., 183  
 JOHNSON, K., 125  
 JOLLES, J., 145  
 JONES, D., 77, 186  
 JONES, E., 13, 94  
 JONES, M., 125  
 JÖNSSON, F., 121, 147, 150, 177  
 JOUANIN, M., 101  
 JOUVENEL, L., 167  
 JUAN, C., 142  
 JUÁREZ, V., 116, 162  
 JUNCADILLA, M., 163  
 KAAAN, E., 49  
 KAHSNITZ, D., 154  
 KAJAMIES, A., 7  
 KALAKOSKI, V., 105, 123  
 KALOGEROPOULOU, F., 171  
 KARBACH, J., 61  
 KARLSSON, K., 149  
 KARNI, A., 42  
 KAROUSOU, A., 127  
 KATSUHARA, M., 179  
 KATZ, A., 50  
 KATZIR, M., 26  
 KAUFMANN, L., 6  
 KAWASHIMA, R., 125, 189  
 KEANE, M., 78  
 KELLEN, N., 157  
 KELLER, P., 94  
 KEMP, N., 189  
 KENT, J., 125  
 KERCKHOFS, E., 75

- KERZEL, D., 106  
 KESSLER, Y., 26, 75  
 KEUKEN, M., 118, 153  
 KEULEERS, E., 5, 63  
 KEUPER, K., 101, 160  
 KIESEL, A., 68, 84, 86, 95, 96, 135  
 KINOSHITA, S., 5, 162  
 KIRSCH, W., 114  
 KISSINE, M., 120  
 KIYAMA, S., 162  
 KLAUER, C., 96  
 KLAUNIG, M., 125  
 KLAUS, J., 131  
 KLEINSORGE, T., 113  
 KLEINSZ, N., 127  
 KLIEGEL, M., 114  
 KLYSZEJKO, Z., 61  
 KNECHT, S., 66  
 KNOBLICH, G., 63  
 KNOEFERLE, P., 99, 158  
 KNOLL, L. J., 127  
 KNOOP, C., 55  
 KNOPF, M., 150  
 KOCH, I., 11, 26, 27, 47, 66, 73, 133, 137, 193  
 KOEDA, T., 186  
 KOENIG, O., 61  
 KOHNEN, S., 90  
 KOLAŃCZYK, A., 94, 113  
 KOLINSKY, R., 70  
 KONOPKA, A., 191  
 KOROVAITSEVA, G., 62  
 KORPELA, J., 105  
 KOTZ, S., 18, 20, 52, 53  
 KOVIĆ, V., 99  
 KRALJIC, T., 45  
 KRAUSSE, F., 18  
 KREINER, H., 98  
 KRIFKA, M., 161  
 KROLL, J. F., 30, 52  
 KTORI, M., 69  
 KUBIK, V., 150, 177  
 KUIPERS, J., 3  
 KUNDE, W., 68, 115, 135, 137  
 KUNG, S., 159  
 KUO, W., 25  
 KUTAS, M., 1  
 KUZUGUCHI, A., 178  
 KWON, N., 129  
 KYLLINGSBÆK, S., 67  
 LA HEIJ, W., 162  
 LABAT, H., 128  
 LACAITA, G., 190  
 LACASSAGNE, M., 167  
 LACEY, E., 167  
 LADWIG, S., 21, 108  
 LAGNADO, D., 4  
 LAI, J., 175  
 LAKA, I., 78  
 LAMBERT, E., 89  
 LAMBON RALPH, M., 124  
 LANDI, N., 134  
 LANGDON, R., 57  
 LANGE, K., 56  
 LANGEROCK, N., 82, 180  
 LARGY, P., 70  
 LARSSON  
 SUNDQVIST, M., 121, 147  
 LAU, H., 12  
 LAUDANNA, A., 129, 131, 155, 159  
 LAURA GABRIELA, F., 109  
 LAURIER, V., 117  
 LAVRIC, A., 173  
 LAWO, V., 66  
 LECHUGA GARCÍA, M. T., 127  
 LECKEY, M., 36  
 LEDER, H., 139  
 LEDZIŃSKA, M., 137  
 LEE, C., 24, 25  
 LEE, J., 24, 25  
 LEE, S. W., 15  
 LEFEVRE, J., 35  
 LEHONGRE, K., 19  
 LEHTINEN, E., 7  
 LEMAIRE, P., 35  
 LEMERCIER, C., 85, 112  
 LENDINEZ  
 RODRÍGUEZ, C., 127  
 LEÓN, I., 159  
 LEÓN, J. A., 130  
 LEONARD, M., 158  
 LERTXUNDI, A., 93  
 LERTXUNDI, N., 93, 187  
 LESOURD, M., 146  
 LEY, A., 45  
 LEYBAERT, J., 74, 150, 185  
 LEZHEIKO, T., 62  
 LIEFOOGHE, B., 10, 11, 72  
 LIEN, M., 84, 108  
 LIEPELT, R., 87, 138  
 LIMA, C., 184  
 LIN, C., 133, 173  
 LIN, E. Y., 25  
 LIN, W., 179  
 LINA-GRANADE, G., 118  
 LINDEMANN, O., 18  
 LITT, R., 8  
 LIU, I., 179  
 LLEÓ, A., 163  
 LOBIER, M., 187  
 LOBINA, D., 130  
 LOGAN, J., 168  
 LOMBARDI, L., 115  
 LONCKE, M., 59  
 LÓPEZ ORNAT, S., 127, 157  
 LÓPEZ, F. J., 3  
 LOPEZ-BARROSO, D., 19  
 LÓPEZ-CRESPO, G., 122  
 LÓPEZ-RAMÓN, M., 68, 110, 170  
 LORENZ, A., 132  
 LOS, S. A., 55  
 LOWENTHAL, F., 71  
 LOZANO, V., 169  
 LOZO, L., 115  
 LUAUTÉ, J., 82  
 LUBRICH, O., 55  
 LUCIDI, A., 82  
 LUGLI, L., 86  
 LUINI, L. P., 118  
 LUKANDER, J., 105  
 LUKAS, S., 73  
 LUNA, K., 177, 178  
 LUPIÁÑEZ, J., 59, 68, 100, 110, 113, 117, 142, 153, 163, 170, 171  
 LUPKER, S. J., 5  
 LUPYAN, G., 32  
 LUWEL, K., 34, 35  
 MACARO, E., 163  
 MACGREGOR, L., 1  
 MACHADO, J., 169  
 MACIZO, P., 62, 111, 116, 162, 188  
 MACKEN, B., 186  
 MÄDEBACH, A., 162  
 MADEC, S., 106  
 MAETENS, K., 67  
 MAGNAN, A., 118, 125, 126, 127, 128, 189  
 MAGNUSON, J. S., 43  
 MAHE, G., 134  
 MAIMON, N., 98  
 MAÏONCHI-PINO, N., 125, 189  
 MAJERUS, S., 180  
 MALONEY, D., 182  
 MANCINI, S., 190  
 MANCUSO, A., 129  
 MANI, N., 39, 40, 76, 160  
 MÄNNEL, C., 158  
 MANZANO, A., 93  
 MAPELLI, D., 113  
 MARESCAUX, P., 98  
 MARINELLI, C. V., 100  
 MARINO, B. F., 128, 155  
 MARKESSIS, E., 73  
 MARKOVITS, H., 37  
 MARNE, P., 163  
 MAROTTA, A., 68  
 MARROQUÍN, J. L., 157  
 MARSHAK, D., 168  
 MARTA, S., 141  
 MARTELLA, D., 68  
 MARTÍN PUGA, M. E., 127  
 MARTIN, A. E., 2  
 MARTIN, C., 1, 3, 46  
 MARTIN, J. L., 93  
 MARTÍN, M. C., 62  
 MARTIN, R., 97, 173  
 MARTÍN-ARÉVALO, E., 171  
 MARTÍNEZ, L., 184  
 MARTÍN-LOECHES, M., 54, 161  
 MARTÍN-LUENGO, B., 178  
 MARUCCI, F. S., 118  
 MARY, A., 146  
 MARZECOVÁ, A., 163, 164  
 MARZOUKI, Y., 101  
 MASSEN, C., 107  
 MASSOL, S., 187  
 MASTROBERARDINO, S., 118  
 MASTROPASQUA, T., 79  
 MATHEY, S., 89, 111, 128, 141, 167  
 MATTHEWS, S., 125  
 MATTINEN, A., 7  
 MATUTE, H., 3, 4, 65, 107, 119  
 MAYBERRY, R., 158  
 MAYOR, J., 39, 40, 117  
 MAYR, S., 73  
 MAZZA, S., 122  
 MAZZARELLA, E., 152  
 MAZZIETTI, A., 61  
 MAZZUREGA, M., 94  
 MCCLOSKEY, M., 191  
 MCCLOY, R., 96  
 MCKAY, R., 57  
 MCRAE, K., 1  
 MEIRAN, N., 26, 48, 119, 180  
 MELCHER, T., 86  
 MELERO, R., 122  
 MELLO, C., 69  
 MENCL, W. E., 134  
 MÉNDEZ, A., 13  
 MENDOZA-MONTOYA, O., 157  
 MENEGHETTI, C., 152  
 MENOR DE GASPAR, J., 109  
 MERMILLOD, M., 109  
 MERTENS, B., 189

- MESA, I., 76  
 MESTRES MISSÉ, A., 97  
 METUSALEM, R., 1  
 MEUNIER, F., 126, 189  
 MEYER, A., 129, 131, 144, 191  
 MEYER, G., 115  
 MIAL, C., 129  
 MICHAEL, C., 69  
 MICHAEL, G. A., 136  
 MICHIMATA, C., 107, 139  
 MIDGLEY, K., 29, 187  
 MIGLIACCIO, R., 101  
 MIGUELES, M., 178, 179  
 MILHAU, A., 146  
 MINERVINO, R. A., 183  
 MIRANDA, C., 147  
 MIRMAN, D., 124  
 MISRA, M., 52  
 MOELLER, K., 7  
 MOHR, C., 105, 140  
 MOLDOVAN, C., 112  
 MOLINA, I., 184  
 MOLINARO, N., 5, 54, 190  
 MÖLLER, M., 73  
 MONDINI, S., 190  
 MONSELL, S., 61, 173  
 MONTANI, V., 155  
 MONTERRAT, C., 169  
 MORA, G., 74  
 MORAIS, J., 70  
 MORALES, B., 172  
 MORALES, J., 133  
 MORALES, L., 162, 192  
 MORDASIEWICZ, P., 113  
 MOREAUD, O., 167  
 MORENO RÍOS, S., 182, 183  
 MORENO, E. M., 2  
 MORENO, M., 136  
 MORERA, Y., 130  
 MORET-TATAY, C., 5, 89  
 MOSTOFKY, S., 156  
 MROZOWICZ, M., 173  
 MUELLER, J., 158  
 MUGGLETON, N., 142  
 MULATTI, C., 78, 131  
 MULDER, K., 192  
 MULDER, M. J., 119  
 MÜLLER, H., 84, 179  
 MULLIGAN, N., 60  
 MURPHY, R. A., 4  
 MURPHY, V. A., 163  
 MÜSSELER, J., 108, 138, 139  
 MUSSI, D. R., 155  
 MUSSOLIN, C., 150  
 NAKAYAMA, M., 107  
 NARDO, D., 177  
 NATION, K., 8  
 NATTKEMPER, D., 81, 174  
 NAVARRETE, E., 131  
 NAVARRO, A., 175  
 NAVARRO, J., 106  
 NĘCKA, E., 141  
 NEHRICH, T., 55  
 NELSON, B., 175  
 NEUMANN, R., 115  
 NEVINS, A., 132  
 NEWMAN-NORLUND, R. D., 64  
 NICKELS, L., 132  
 NICO, D., 99  
 NICOLAS, S., 122  
 NICOLETTI, R., 86, 138  
 NIEDENTHAL, P., 153  
 NIEUWBOER, A., 75  
 NIEUWENHUIS, S., 26  
 NIEUWLAND, M. S., 1, 2  
 NIGBUR, R., 143  
 NIGRO, G., 146  
 NIJBOER, T., 75  
 NILSSON, L., 150  
 NISHIMURA, A., 107  
 NOORDZIJ, M. L., 41  
 NORDT, M., 160  
 NORMAN, E., 13, 94  
 NORRIS, D., 5  
 NOTEBAERT, W., 26, 51, 91, 144, 172  
 NURK, H., 7  
 NUNEZ CASTELLAR, E., 51  
 NUSBAUM, H., 32  
 NUTT, D., 105  
 NYS, J., 116, 181  
 OAKHILL, J., 159  
 OBERAUER, K., 10, 67, 102  
 OBERHOLZER, N., 183  
 O'BRIEN, S., 133  
 OCCELLI, V., 171  
 O'DONNELL, B., 125  
 OFTINGER, A., 123  
 OHLSON, N., 83  
 OJEDA, N., 105  
 OLABARRIETA, F., 93  
 OLIVE, T., 89  
 OLIVEIRA, J., 177  
 OLIVETTI  
 BELARDINELLI, M., 69, 154, 177, 184  
 OLSZANOWSKI, M., 61  
 ONDOBAKA, S., 64  
 OPPERMAN, F., 131  
 ORGAZ, C., 119  
 ORTEGA SEGURA, A., 147  
 ORTEGA-CASTRO, N., 65  
 ORTIZ-GIL, J., 163  
 ORTU, F., 154  
 ORZECOWSKI, J., 111  
 OSAKA, M., 179  
 OSAKA, N., 122, 179  
 OSINSKI, G., 114  
 OSIURAK, F., 20  
 OSTRAND, R., 66  
 OTTOBONI, G., 81, 108  
 OWENS, M., 27  
 OZGEN, E., 33  
 ÖZKILIÇ, Y., 178  
 P. LEON, S., 175  
 PABLOS MARTIN, X., 73  
 PACHECO UNGUETTI, A. P., 113  
 PAELOCKE, M., 67  
 PAGE, M., 59  
 PAIZI, D., 133  
 PALADINO, M., 94  
 PALUMBO, L., 111  
 PANADERO SANCHIS, M. A., 110  
 PANUNZI, M., 93  
 PAOLIERI, D., 188, 192  
 PAPADATOS, Y., 35  
 PASCUCCHI, D., 79  
 PASQUALI, A., 12, 120  
 PATRO, K., 151  
 PATTAMADILOK, C., 70  
 PAULEWICZ, B., 105  
 PAVAN, G., 110, 170  
 PAVANI, F., 74, 94  
 PAZZAGLIA, F., 152  
 PÊCHER, C., 112  
 PECH-GEORGEL, C., 59  
 PEGNA, A., 46  
 PEIGNEUX, P., 144, 146  
 PELEGRINA LÓPEZ, S., 127  
 PELLI, D. G., 74  
 PELLICANO, A., 108  
 PEÑA, J., 105  
 PENHUNE, V., 19  
 PEPERKAMP, S., 185  
 PERAZZOLO, M., 81  
 PEREA, M., 4, 5, 89, 182  
 PERESSOTTI, F., 78  
 PÉREZ CUBILLAS, C., 144  
 PÉREZ MUÑOZ, A. I., 188  
 PERRIARD, B., 123  
 PERRONE-  
 BERTOLOTI, M., 167  
 PERRUSSEL, M., 68  
 PESCIARELLI, F., 78, 159  
 PETER, Z., 101  
 PETROVA, A., 71  
 PFENNIG, L., 114  
 PFISTER, R., 86, 95, 96, 135  
 PHILIPP, A. M., 66, 73, 133, 193  
 PICARD, D., 84  
 PICHON, C., 120  
 PICHON, S., 138  
 PICKERING, M., 132  
 PICUCCI, L., 68  
 PIECZYKOLAN, A., 137  
 PIEDERET, A., 86  
 PIERONI, L., 121  
 PIETRINI, P., 152  
 PIGLIAUTILE, M., 177  
 PILLING, M., 137  
 PINHEIRO, A. P., 62  
 PINHO, M. S., 176  
 PIVNEVA, I., 99  
 PIXNER, S., 6  
 PLANCHER, G., 148  
 PLAZA, B., 136  
 PLUNKETT, K., 39, 40  
 POBRIC, G., 124  
 POCHWATKO, G., 77  
 POEPEL, D., 74  
 POHL, C., 68, 135  
 POLETIEK, F., 98, 175  
 POPESCU, T., 18  
 POPŁAWSKA, A., 94, 175, 176  
 POSTAL, V., 117, 143  
 POSTMA, A., 40, 41, 75, 79  
 POTOCKI, A., 126  
 PRADO, B., 156  
 PRESSNITZER, D., 19, 44  
 PRESTON, J., 134  
 PREVITALI, P., 17  
 PRICE, M., 13, 75  
 PRIFTIS, K., 75  
 PRIMATIVO, S., 100, 133  
 PRINZ, W., 87, 138  
 PROTOPAPAS, A., 45  
 PUGH, K. M., 42  
 PUGH, K. R., 43, 134  
 PULIDO, R. F., 176  
 PUTTONEN, S., 123  
 QU, Q., 83  
 RAMSEY, R., 38  
 RAMUS, F., 19  
 RANDEATH, J., 21  
 RANZINI, M., 86, 96  
 RAPP, B., 186  
 RASANEN, P., 7

- RASS, O., 125  
 RASTLE, K., 10, 31  
 RATOFF, W., 102  
 RATTAT, A., 84  
 RAUBER, A., 62  
 RAUSCH, P., 161  
 REALI, C., 161  
 REBER, R., 154  
 REBERNJAK, B., 141  
 REED, H., 145  
 REGEL, S., 54  
 REÑÉ, R., 163  
 RENIER, L., 42  
 RENZI, C., 152  
 RESSEL, V., 176  
 RESZKO, M., 113  
 REUSS, H., 68  
 REYNAUD, E., 112  
 REYNVOET, B., 6, 17, 100, 151, 180, 181  
 RICARDO-GARCELL, J., 158  
 RICCIARDELLI, P., 138  
 RICCIARDI, E., 152  
 RICHARDSON, D., 33  
 RIDDERINKHOF, K. R., 51, 73, 144  
 RIEGER, M., 107  
 RIETHER, N., 60  
 RIGALLEAU, F., 172  
 RIGGIO, L., 128, 155  
 RIGONI, D., 81  
 RINALDI, P., 133, 156  
 RIOU, B., 121  
 RISOM, S., 108  
 ROBERT, C., 128, 167  
 ROCA, J., 68, 110, 170  
 ROCHET, N., 95  
 ROCZNIEWSKA, M., 94, 175, 176  
 RODRIGUES, A., 145  
 RODRIGUEZ, J. M., 116  
 RODRÍGUEZ-BAILÓN, R., 153  
 RODRIGUEZ-FORNELLS, A., 19, 156  
 RODRÍGUEZ-GUALDA, I., 183  
 RODRÍGUEZ-PUJADAS, A., 191  
 ROELOFS, A., 131  
 ROGGEMAN, C., 26  
 ROLKE, B., 56  
 ROLLAND-THIERS, E., 146  
 ROMÁN, F. J., 153  
 ROMÁN, P. E., 52, 53, 191  
 ROMBOUTS, S. A., 26  
 ROMMERS, J., 50  
 RÖNNBERG, J., 180  
 ROS, C., 109  
 ROSA, E., 89  
 ROSSI, E., 30  
 ROSSI-ARNAUD, C., 60, 121  
 ROTHE, A., 96  
 ROTHERMUND, K., 154  
 ROUET, J., 109  
 ROUJON, D., 98  
 ROY, A. C., 21, 82  
 RUBICHI, S., 136, 138, 153  
 RUDNER, M., 180  
 RUDZIŃSKA-WOJCIECHOWSKA, J., 169  
 RUECKL, J. G., 42, 43  
 RUEDA, M. R., 113  
 RUESCHEMEYER, S., 38  
 RUEST, T., 117  
 RUITENBERG, M., 114  
 RUIZ MUÑOZ, M. J., 143  
 RUIZ-CORREA, S., 157  
 RUMMER, R., 60, 123  
 RUSTED, J., 117, 147, 148, 159  
 RUTHRUFF, E., 84, 108  
 SCIENCE XL, 170  
 SACKUR, J., 112  
 SADER, E., 18  
 ŞAHIN, G., 177  
 SAITO, S., 107, 124, 143, 178  
 SALMERÓN, L., 160  
 SALMINEN, T., 179  
 SAMUEL, A. G., 31, 45  
 SAMUEL, F., 106  
 SAN ANTON, M. E., 65, 145, 164  
 SANABRIA, D., 56  
 SANCHEZ DE MIGUEL, M., 93  
 SÁNCHEZ-CASAS, R., 62, 112  
 SANJUÁN, A., 191  
 SANTA MARINA, L., 93  
 SANTAMARÍA GARCÍA, H., 93  
 SANT'ANNA PEREIRA, M., 124  
 SANTENS, S., 17  
 SANTESTEBAN, M., 78, 132  
 SARACINI, C., 69  
 SASANGUIE, D., 17, 181  
 SAßE, J., 174  
 SAUSSET, S., 89  
 SAUVAL, K., 188  
 SCHACHT, A., 76, 141  
 SCHAIN, C., 60  
 SCHEITER, K., 148, 168  
 SCHERER, K., 142  
 SCHILBACH, L., 155  
 SCHILLER, N., 132, 162  
 SCHILTZ, C., 150  
 SCHMIDT, J., 90  
 SCHMITZ, J., 185  
 SCHMITZ, M., 120  
 SCHMITZ, R., 144, 146  
 SCHNUR, T., 163  
 SCHOUPPE, N., 144  
 SCHREUDER, R., 192  
 SCHRIEFERS, H., 131  
 SCHROOTEN, M., 118  
 SCHUBERT, T., 84, 94, 179, 186  
 SCHUCH, S., 26, 27, 47, 66  
 SCHUETZ-BOSBACH, S., 81  
 SCHÜLER, A., 148, 168  
 SCHULTZ, B., 94  
 SCHUMANN, E., 131  
 SCHWARTZ, D., 19  
 SCHWARZ, N., 15  
 SCHWEINBERGER, S. R., 45, 46  
 SCHWEPPE, J., 60, 123  
 SCOROLLI, C., 99  
 SCOTT, R., 12, 13  
 SEBANZ, N., 63  
 SEBASTIÁN-GALLÉS, N., 40, 93, 176, 185  
 SEIBOLD, V. C., 56  
 SEIBT, B., 94  
 SEITS, A., 45  
 SEKI, A., 186  
 SELLARO, R., 147, 151, 153  
 SEMENZA, C., 190  
 SEMIN, G. R., 15  
 SEQUEIRA, H., 51  
 SERGE, N., 121  
 SERNICLAES, W., 185  
 SERRANO CHICA, F., 59  
 SESSA, P., 131  
 SEYLL, L., 151  
 SHAO, Z., 131  
 SHARMA, D., 157  
 SHEN, W. Y., 24  
 SHINODA, A., 178  
 SHIOZAKI, M., 143  
 SHORE, D., 174  
 SHORKEY, S. P., 153  
 SIEMIENIUK, A., 145  
 SIÉROFF, E., 71, 109  
 SIERRO, G., 140  
 SIKSTRÖM, S., 149  
 SIMA, J. F., 63  
 SIMÕES, A., 169  
 SIYANOVA-CHANTURIA, A., 49, 159  
 SKOTTKE, E., 138, 139  
 SLOUTSKY, V., 36  
 SMETS, K., 151  
 SMIEJA, M., 111  
 ŚMIGASIEWICZ, K., 106  
 SOARES, A., 62, 169  
 SOBANSKA, M., 115  
 SOCCINI, A., 59  
 SOETENS, E., 67, 75, 85, 120, 176  
 SOKKA, L., 105  
 SOLE, M., 136  
 SOLTESZ, F., 7, 150  
 SOMMER, W., 47, 53, 54, 55, 76, 141, 161  
 SORG, C., 179  
 SORIANO, M. F., 169  
 SOUZA DA SILVA, A., 10, 102  
 SPALEK, K., 190  
 SPATARO, P., 60, 121  
 SPEED, L., 188  
 SPIESER, L., 172  
 SPINELLI, E., 125  
 SPRUYT, A., 101  
 STADLER, W., 21  
 STEINHAUSER, M., 113  
 STELLA, G., 136  
 STENNEKEN, P., 154  
 STEPHAN, D., 11  
 STERCZYŃSKI, R., 94, 175, 176  
 STEVENAGE, S., 168  
 STEVENS, C., 94  
 STEVENS, T., 61  
 STIVERS, T., 191  
 STOCKER, C., 148  
 STOIANOV, I., 86  
 STOLARSKI, M., 137  
 STREGAPEDE, F., 129  
 STROBACH, T., 84, 179  
 STRUIKSMA, M. E., 41  
 STÜRMER, B., 143  
 STURT, P., 129  
 SUAREZ, I. C., 90  
 SUEGAMI, T., 139  
 SUELZENBRUECK, S., 20, 21  
 SUGIMOTO, M., 178  
 SÜLZENBRÜCK, S., 107  
 SUMNER, E., 149  
 SUMNER, M., 125  
 SUTTER, C., 20, 21, 108, 139  
 SWEKLEJ, J., 77, 85, 145

- SY, J. L., 67  
 SZCZEPANOWSKI, R., 135, 141  
 SZELAG, E., 114  
 SZEWCZYK, J., 164  
 SZMALEC, A., 59  
 SZUCS, D., 7, 150  
 SZUMSKA, I., 115  
 TAFT, M., 164  
 TAKAHASHI, C., 22  
 TAKAHASHI, K., 125, 189  
 TAMAOKA, K., 162  
 TAN, Y., 97  
 TANAKA, D., 186  
 TANAKA, T., 178  
 TANIDA, Y., 178  
 TAPIERO, I., 130  
 TARADAY, M., 170  
 TARANTINO, V., 83  
 TASSIN, M., 171  
 TAVARES, G., 160  
 TAYLOR, J., 8, 10  
 TEDESCO, A., 112  
 TEKMAN, H. G., 177, 178  
 TERHUNE, D., 18  
 TERRIER, P., 95  
 TESSARI, A., 81, 108  
 THEVENOT, C., 34  
 THIEBAUT DE SCHOTTEN, M., 101  
 THIELE, K., 154  
 THIERRY, G., 3, 46  
 THIERRY, H., 95  
 THOEING, M., 66  
 THOMAS, A., 18  
 THOMASCHKE, R., 55, 96, 110  
 THOMPSON, A., 168  
 THOMPSON, V., 35, 37, 86  
 THOMPSON-SCHILL, S., 32, 125  
 THUILLEAUX, D., 117, 143  
 TICINI, L., 81  
 TILLMANN, B., 94  
 TILMANT, A., 185  
 TIMMERMANS, B., 12, 155  
 TITONE, D., 99  
 TODOROV, I., 121, 147  
 TOESCU, E., 167  
 TOKOWICZ, N., 29, 30, 52  
 TOLENTINO, L., 30  
 TONKOVIC, M., 177  
 TOPOLINSKI, S., 60  
 TORO, J. M., 184  
 TORRES, C., 158  
 TORRES-QUESADA, M., 142  
 TOSCANO, H., 94  
 TRACZYK, J., 141  
 TRECCANI, B., 151, 153  
 TRÉMOLIÈRE, B., 96  
 TRENCH, M., 183  
 TRIVIÑO, M., 117  
 TROJANO, L., 152  
 TRUY, E., 118  
 TSAI, J., 25  
 TSENG, L., 142  
 TSUNEMI, K., 178  
 TUBAU, E., 183  
 TUDELA GRAMENDIA, P., 110  
 TUNINETTI, A., 30  
 TURATTO, M., 79  
 TURNER, R., 97  
 TZENG, A. K., 133, 164  
 TZENG, O. J., 24, 25, 26, 142, 173, 179  
 UCHIYAMA, H., 186  
 UGAS, L., 163  
 UHLENBROCK, K., 66  
 ULLMAN, M., 156  
 UMILTÀ, C., 75  
 URBACH, T. P., 1  
 URDANETA, E., 172  
 URRUTIA, M., 159  
 UTSUMI, K., 143  
 VACHON, F., 77  
 VADILLO, M. A., 4, 65, 107, 119, 144  
 VALDES-CONROY, B., 71, 153  
 VALDOIS, S., 187  
 VALENTE, G., 45  
 VALERO CABRE, A., 101  
 VALLAR, G., 100, 170  
 VALLET, G., 174  
 VALSØ, A. M., 174  
 VAN ASSELEN, M., 145  
 VAN BOGAERT, P., 144  
 VAN CAMPEN, D., 73  
 VAN DE VIJVER, I., 51  
 VAN DEN BUSSCHE, E., 100, 120  
 VAN DEN WILDENBERG, W. P., 23, 51, 73, 143  
 VAN DER BORGHT, L., 51, 172  
 VAN DER BURG, E., 55  
 VAN DER HAEGEN, L., 79  
 VAN DER HAM, I., 152  
 VAN DER KUIL, M., 152  
 VAN DER MOLEN, M., 50, 51  
 VAN DER STIGCHEL, S., 79  
 VAN DIJCK, J., 17, 180  
 VAN DYKE, J. A., 97  
 VAN ELK, M., 69  
 VAN GENUCHTEN, E., 148  
 VAN HELL, J., 29, 30, 52, 160  
 VAN HEUVEN, W., 49  
 VAN MAANEN, L., 118, 153  
 VAN MUIJDEN, J., 167  
 VAN OPSTAL, F., 180  
 VAN STEENBERGEN, H., 26  
 VAN 'T WOUT, F., 173  
 VAN WOUWE, N. C., 51  
 VANDENBOSSCHE, J., 75, 85, 176  
 VANDEWAETERE, M., 181  
 VANDIERENDONCK, A., 72  
 VARGAS, C., 182  
 VARONA-MOYA, S., 182  
 VATERRODT, B., 65  
 VÁZQUEZ, G., 175  
 VECCHI, T., 40, 42, 152  
 VEGAS, O., 93  
 VELASCO, D., 93  
 VENTURA-CAMPOS, N., 191  
 VENUTI, P., 171  
 VERDONSCHOT, R., 162  
 VERGAUWE, E., 148, 180  
 VERGUTS, T., 11, 17, 26, 144  
 VERLEGER, R., 106  
 VERMEIREN, A., 17, 77, 135  
 VERMEULEN, N., 109  
 VERONELLI, L., 100, 170  
 VERSACE, R., 121, 122, 146  
 VERSCHAFFEL, L., 35  
 VERWEY, W., 114  
 VESPIGNANI, F., 48, 49, 115  
 VIBERT, N., 109, 172  
 VICENTE, S., 134  
 VIDAL, F., 51, 90  
 VIGLIOCCO, G., 16, 63, 102, 188  
 VILLEGAS, J., 126  
 VILLEJOUBERT, G., 95  
 VINSON, D., 102  
 VIVAS FERNÁNDEZ, L., 127  
 VIVAS, A., 122, 171  
 VLAEYEN, J., 118  
 VOGEELEY, K., 155  
 VÖLKER, K., 66  
 VOLPE, R., 189  
 VON HOLZEN, K., 40  
 VRANIC, A., 177  
 VROOMEN, J., 44, 45  
 VUILLEUMIER, P., 138  
 VUONG, L., 144  
 VUORI, M., 123  
 WAGENMAKERS, E., 119, 153  
 WALENSKI, M., 156  
 WALENTOWSKA, W., 170  
 WALKER, P., 140  
 WALSER, M., 178  
 WARAKOMSKI, D., 115  
 WARREN, T., 30  
 WASZAK, F., 81, 95  
 WATKINS, K., 8  
 WATT, S. J., 22  
 WAUTIE, V., 71  
 WEBER, A., 128  
 WEIGHALL, A., 76  
 WEISS, C., 81  
 WENDLER, K., 108  
 WENKE, D., 10, 11  
 WENTURA, D., 120  
 WHEELDON, L., 83  
 WHITE, S., 7, 150  
 WIEMERS, M., 64  
 WIERZCHON, M., 100  
 WILD-WALL, N., 51  
 WILHELM, O., 47  
 WILLANDER, J., 149  
 WILLEMSEN, R., 51  
 WINDEY, B., 135  
 WODNIECKA, Z., 163, 164  
 WOJCIECHOWSKI, J., 169  
 WONNACOTT, E., 9  
 WOOD, G., 116  
 WOODRUFF, P., 171  
 WU, D., 25, 159  
 WUERGER, S., 115  
 WÜHR, P., 91  
 WYLIE, S. A., 51  
 YANNICK, G., 121  
 YARRITU CORRALES, I., 4, 119  
 YASUDA, H., 178  
 YEE, E., 32, 125  
 YOKOYAMA, S., 125  
 YU, J., 142  
 ZAGAR, D., 128, 167, 171  
 ZAMPINI, M., 171  
 ZAWISZEWSKI, A., 78  
 ZDRAL, B., 137  
 ZEELLENBERG, R., 164  
 ZEISCHKA, P., 85



AUTHOR INDEX

---

ZHANG, Q., 83	ZIMMERMAN, R., 186	ZWAAN, R., 158	ZWITSERLOOD, P.,
ZHU, X., 83	ZINKE, K., 114	ZWANZGER, P., 160	126, 128, 157
ZIEGLER, J., 59	ZORZI, M., 75, 86,	ZWICK, G., 136	
ZIESSLER, M., 81, 140	155, 186		













































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