



Abstracts

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SYMPOSIUM

Modality-specific representation without modality-specific perception

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Introduction to the Symposium

Sensory experiences, perception, and modality-specific mental representations typically are seen as strictly (and causally) related. On this assumption, it is logical to conclude that individuals with (total) sensory handicaps should lack mental representations within the affected modality: Blind people should not have visuospatial representations and deaf people should not have auditory-phonological representations. This conclusion raises the empirical question of how such individuals perform in tasks that are assumed to depend on modality-specific representations. Recent research, however, indicates that individuals who are deaf or blind may perform similarly to hearing and sighted peers on many relevant dimensions, suggesting that they have some form of mental representation functionally equivalent to the modality they do not possess. Such findings have a variety of theoretical implications.

The Symposium will explore empirical and theoretical issues related to the nature and modality of acquisition of visuospatial representations in the blind and auditory-phonological representations in the deaf. Implications for the study of relations between perception and mental representation will be explored.

Speech perception by eye: the phonological skills of deaf children educated with Cued-Speech

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Children born with profoundly impaired hearing derive information about the phonological structure of spoken language from two sources: lip-reading, and, at a later point of development, alphabetic orthography. These two sources have their own limitations: lip-reading presents a high degree of ambiguity, and alphabetic orthographies generally are not straightforward representations of spoken language. Experimental studies have shown that, beside general similarities between deaf and hearing children, the phonological representations of the deaf have some particular characteristics and are not always recruited in the same way in cognitive functioning as they are in hearing children.

Cued-Speech (Cornett 1967) is a system of manual cues that disambiguate the lip movements. In principle, it allows hearing-impaired individuals to perceive all the phonemic contrasts of spoken language. The effect of precocious exposure to Cued-Speech on cognitive development of deaf children has been investigated in several of our experiments. We have found that Cue-Speech educated deaf children acquire precise phonological representations which support accurate rhyme judgement and rhyme production. These subjects also develop

an internal speech which intervenes in memorization of series of pictures. The phonological representations deaf children acquire before entering school may also be used in the acquisition of reading and spelling.

These data suggest that the development of phonological sensitivity occurs in deaf children if adequate information is provided, and that this information may be delivered through exclusively visual means.

Auditory imagery in cognitive processing by deaf adults

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It long has been recognized that people with congenital, total blindness have mental representations that are functionally similar to visual images. Such findings have implications for cognitive psychology, education, and other fields. The present study provides the first parallel investigation of the possibility that people with congenital, profound deafness might have mental representations functionally similar to auditory images. A reconsideration of existing literature and a report on new studies demonstrate that auditory imagery can influence memory and concept knowledge and clearly underlies phonological processing during reading by deaf individuals. Findings suggest that there are mental representations that function like auditory images even in the absence of auditory experience. These results provide theoretical elaboration to models of mental representation and clarify several applied issues with regard to deafness and deaf education.

Visuospatial working memory components: the case of the blind

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The study of visuospatial imagery abilities in totally congenitally blind people may be useful for understanding the contribution of visual experience to imagery processes and representations. The present paper examines how the study of the blind can in particular help to understand the structure and functioning of visuospatial working memory. Data obtained in a series of experiments will be reviewed. Blind people like sighted people have better performance in visuospatial tasks than in verbal tasks simulating visual tasks, and both groups seem similarly disturbed by a concurrent visuospatial task. However, the blind performance is equal to the sighted people's performance only when a passive short-term store is involved, whereas it shows an impairment when active operations are required.

Results bring further evidence to the hypothesis that blind people can also generate visuospatial representations, but that their use in working memory is subjected to specific limitations.

ORAL PRESENTATIONS

Lexical and non-lexical spelling procedures in French-speaking normal and disabled readers

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The spelling procedures of normal and disabled children matched for reading level have been examined. Lexical procedures were explored asking the subjects to spell frequent and infrequent words containing non-dominant versions of inconsistent graphonemes (e.g., /s/ spelled "c" as in "cigarette", the dominant spelling for /s/ being "s"). Non-lexical rule-based procedures were analyzed in a pseudo-word spelling task including inconsistent phonemes presented in different phonological contexts (e.g., initial /s/ can be spelled "s" or "c" if the following vowel is /i/, but "c" is incorrect if the following vowel is /y/). Finally, frequent and infrequent words containing consistent context dependent graphonemes were considered (e.g., /g/ followed by "i" → "gu"). The frequency manipulation with these totally consistent items was aimed at establishing whether their spelling was based on orthographic representations of words or on the use of contextually determined rules.

At the lowest reading level, frequency effects were totally absent in both groups of children. Besides, some signs of taking the context into account to apply rules were observed in the normal but not in the disabled group. These results are compatible with the notion that spelling begins with a simplified set of rules probably learned through explicit classroom instruction. As reading ability progresses, both word frequency effects and contextual constraints to rule application increases. Those phenomena were weaker in disabled than in normal readers even though groups were matched for reading level. A tentative explanation supposes that word identification procedures differ in normal and in disabled readers. Disabled readers use partial cues that allow reading but do not supply the orthographic lexicon with complete representations of words. A slightly different but not incompatible explanation could be that disabled children presented a non-specific visual memory deficit that impairs to some extent the storing of orthographic representations. Finally, the paper considers some constraints of a spelling model involving complex interactions between lexical and non-lexical contextually bound rules with the inhibition of simpler rules.

Does realism in confidence judgements vary as a function of working in a pair or alone?

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This study compares the confidence judgements of individuals and pairs. It may seem reasonable to expect that the realism of subjects' confidence judgements should increase as an effect of their interaction in a pair condition. However, in a previous study by Allwood and Björhag (1990) no differences were found between individuals and pairs in the realism of

their confidence judgments of answers to general knowledge questions. The results showed that there was rarely any negotiation about the confidence level in the pair condition. Furthermore, for about 25% of the items there was very limited interaction when deciding on an answer to the knowledge question. The present study was designed to increase the interaction between the subjects in the pair-condition.

The main experiment in the present study involved 40 subjects in a within-subject design. All subjects first individually answered 60 general knowledge questions by choosing one of two answer alternatives. After each choice they rated their confidence for the answer on a scale ranging from 50% (guessing) to 100% (absolutely sure). The first half of the 60 questions constituted the control condition (condition 1) and for the second half they were asked to generate and write down an argument for the chosen answer (condition 2). This was done in order to increase the subjects' interaction in the following pair condition. After finishing the 60 items, 20 pairs were created from the 40 subjects participating in condition 1 and 2. In the pair condition (condition 3), subjects were asked to work together both when answering the questions and when giving the confidence ratings of their answers. One of the two subjects was first to read the question with its two answer alternatives. These instructions were partly given in order to increase the subjects' collaboration and partly to structure the interaction. The subjects' discussion was tape-recorded. The block of 30 questions answered in the pair condition was always identical with the block they had answered, individually, in condition 2. The three conditions were always given in the same order.

Each of the two individual conditions (condition 1 and 2) was compared with the pair condition. For each condition 1 and 2 the average of the two pair members' result represented their result in the condition. The result of this comparison showed no significant difference between the conditions for calibration and resolution. However, we found a significant decrease in overconfidence in the pair condition in both comparisons (condition 1 with 3 and condition 2 with 3). Moreover, proportion correct answers increased significantly for the pair condition. Likewise, the mean confidence increased in the pair condition although not significantly. We are currently analysing the protocols of the subjects' interaction in the pair condition. These results will be reported in our presentation.

In the main study, subjects answered the same questions twice. The effect of this was checked for in an ongoing control study where subjects individually answered the same question twice. The results of this control study will also be reported.

In conclusion, our study shows that subjects' overconfidence can be decreased in a pair condition if they are made to interact actively.

The role of knowledge of results in sensorimotor synchronization

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In synchronization tasks subjects are instructed to synchronize a motor response (e.g. taps) with a regular sequence of stimulus events (e.g. clicks). The relationships between the onset of the guiding signal and the onset of the response signal are then measured. Usually, a response pattern is found where the motor event precedes the sensory event by about 30–50ms — the so-called negative asynchrony. This observation suggests that afferent rather than efferent movement codes are superimposed on the afferent codes that result from the guiding signal. The movement-related afferent codes may result from tactile/kinesthetic feedback from the tapping movement. The different processing times involved in the code generation for these two central codes might therefore cause the observed asynchrony. The results from experiments with different experimental manipulations support basically this view (referring, e.g., to the limbs involved, nature of feedback and the timing of feedback involved; Aschersleben, 1994).

This paper addresses the question why in everyday life people are able to synchronize their movement with an external event exactly (e.g. playing tennis, making music in an orchestra), while they are unable to do so in our experiments. In four learning experiments we investigated the idea that knowledge of results (KR) — available in everyday life situations — causes people to learn to compensate for almost any processing time. To provide KR in our experiments, we informed the subject after each tap whether they had reached a defined criterion of synchrony. This criterion increased throughout the 10 experimental sessions. The results show that the asynchrony is clearly reduced under conditions with continuous KR. Therefore the results support the hypothesis that the absence of KR is one reason for the observed asynchrony in laboratory experiments.

Reference

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Perception of the order of succession between two auditory stimuli

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In synchronization tasks, the subject is asked to synchronize their movement (like beat of the hand or foot) with an isochronous auditory pattern. In most of the cases, the stimulus sequence consists of a sequence of metronome clicks at regular intervals, and the task is to produce beats (beat of the hand or foot) in synchrony. The behaviour generally observed is a

slight negative asynchrony (NA): the subject produces their beat before hearing the stimulus. Motor processes are generally considered as responsible for these NA. However, these NA are not of constant value: they vary with the nature of the stimuli used, the NA being shorter when the stimulus sequence contained syllables than when it contained metronome clicks (Auxiette, 1992). Therefore, it was suggested that it is the location of the reference point of synchronization in the stimulus itself that can explain the differences in the NA. This reference point could be the P-Centre, in the case of syllables. Thus, these results cannot be explained only in terms of motor processes. A perceptual component has to be taken into account. The disadvantage of synchronization experiments is that they do not permit us to separate the perceptual processes from processes linked to the production task, such as motor control and encoding of duration.

A perceptual experiment was then conducted, in which 5 adults took part. In this experiment, we examined the judgment of the order of succession of two different stimuli, a metronome click and a syllable. The frequency of the metronome click was 4600 Hz and its duration was 5 msec. Eight syllables were tested: FA, LA, MA, NA, RA, SA, VA and ZA. The subject heard the two stimuli three times, and their task was to indicate, by pressing one of two keys, whether the click preceded the syllable. A simple up-down procedure developed by Levitt (1971) was used, wherein the response given by the subject determined the asynchrony of the following stimuli.

The analysis of the results is currently under way. But the initial results showed that, despite large interindividual variability, subjects judge the click before the syllable when the click is physically in the syllable. These results are in agreement with the results obtained in the P-Centre experiments. The nature of processes involved in synchronization experiments is then rediscussed in the light of the results of the perception task.

The hot-handed gambler's fallacy

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Dostoyevsky (1866/1966) was the first to record what has now become widely known as the gambler's fallacy — the tendency to believe that, in roulette, a long run of a particular outcome (e.g. red) will be balanced by an increased tendency for the opposite outcome (e.g. black). Kahneman and Tversky (1972) offer an explanation of this fallacious belief in terms of the representativeness heuristic; despite their statistical inevitability, long runs of the same outcome are not representative of the expected output of a random device.

The hot hand fallacy was observed by Gilovich, Vallone and Tversky (1985) who noted that most people associated with the game of basket-ball believe that a player who has just scored several times in a row is now more likely to score — because he is "hot". However, when these authors examined the sequential dependencies between the successive scoring attempts of players they found that there was no such dependency; in fact, players who have had a run of successful scoring attempts are less likely to score next time.

We explored these apparently opposing biases in two experiments where subjects were either instructed to forecast the next event in a binary time series (red or blue), or to make bets in a simple binary version of roulette. Having made their prediction or bet, all subjects stated how confident they were that their bet/prediction was correct. They then received feedback.

In fact, the outcomes in both cases were randomly determined. We find that subjects' choices of bet/prediction are predictable from the presence of runs of blue or red — confirming the existence of the gambler's fallacy. However, we also find that subjective confidence associated with the bets/predictions varies with runs of success and failure. Subjects appear to believe that they are "hot" or "cold" — in spite of the fact that there were no serial dependencies in the outcomes that they were predicting. Our subjects were therefore simultaneously suffering from the hot hand fallacy and the gambler's fallacy; they expected runs of success or failure to continue but runs of red or blue to end — even though both sequences exhibit the same (zero) sequential dependency.

We explain these findings in terms of subjective beliefs about luck and chance. Wagenaar and Keren (1985) argued that these are not the same. Random binary outcomes are perceived as being due to chance; psychologically this implies that runs of outcomes are expected to end. By contrast, choices concerning these binary outcomes have positive or negative utility and are thereby governed by luck; psychologically this is perceived as going in 'streaks'.

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Pensioning off the homunculus

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The central executive represents a crucial, but poorly understood component of the concept of working memory. In the initial version, it could justifiably be criticised as little more than a homunculus that was assumed to perform the many tasks that were beyond the scope of the peripheral slave systems. I have attempted to tackle this problem piecemeal, by splitting off and attempting to understand specific executive processes, in the hope that the homunculus has less and less to do until eventually it can be declared redundant. The progress that we have made along this long and somewhat stony road will be described and illustrated with studies from neuropsychological patients, and from normal young and elderly subjects.

Cognitive skills and language interpretation

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There is substantial evidence that people differ in their cognitive capabilities. Individual differences in working memory capacity, comprehension and lexical access are widely

documented (Daneman and Carpenter, 1980, Gernsbacher, Varner and Faust, 1990; Cantor and Engle, 1993). However, very few studies have explored the way in which these cognitive skills change as a function of specific training procedures. An ecological approach is to investigate the cognitive capabilities of people that by the nature of their work have developed their cognitive skills. The present research was carried out at the language interpretation school at the University of Granada with the specific aim of assessing memory, attention and comprehension skills of professional interpreters and interpretation students at different levels of training.

Interpreters, first year students, second year students and control subjects performed a series of memory tasks (digit span, word span, free recall), attentional tasks (Stroop, dichotic listening), lexical related tasks (naming, lexical decision, categorization) and general comprehension tasks under different conditions. Results showed a superiority in interpreters' performance especially in tasks related with working memory capacity. Results are discussed in the context of cognitive skills theories as well as cognitive theories of interpretation.

Propositional reasoning with mental models: a comparison between experimental and artificial subjects

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We present a developmental theory of the processes underlying comprehension and reasoning with three connectives: conjunction, conditional and disjunction. In the mental model paradigm, we predict that the difficulty in mastering connectives depends upon both their representation and their utilization in different tasks.

We analyzed 100 subjects from five age groups, ranging from 3 years-old to adults, in three different experimental contexts: acting in compliance with a request, judging a state of affairs as true or false with respect to a premise, and drawing an inference from two premises.

The expected trend has been experimentally confirmed. A computer model has been devised, which simulates the performances of human subjects at different age levels, reproducing both correct responses and mistakes. Finally, we compare the results obtained by experimental subjects with the output of an artificial subject whose competence is determined by developmental criteria.

Sustained and transient attention states in stimulus detection performance

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To be detected in an uncertain spatial position a visual target must be captured by the attentional focus. Spatio-temporal properties of the attentional focus were studied in choice reaction time experiments, where the size of fixation frame and the delay between the frame's offset and the target stimulus' onset were used as the variables. The target was a small black

square which appeared in one of four potential positions along the horizontal meridian for 200 msec., with a delay of 0, 100, 200 or 500 msec. A large fixation frame covered all positions of the targets, and a small frame was located among the positions. The subject's task was to detect the laterality (left vs right) of the target. There were two presentation modes: blocked (all trials in the block had the same gap magnitude) or mixed (the trials in the block had randomised gap magnitudes). The results show that the subjects are able to sustain the spatial dimension of attentional focus without stimulus support. Also, the disengagement of attention from a large object takes more time than the disengagement from a small one. The time course of the gap effect was different for blocked vs mixed conditions that evoked a stereotyped or a more diffused attentional strategy.

On the relationship between encoding procedures and availability of information for subsequent use

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The nature of the memory traces installed by information to which human subjects are exposed and their availability for subsequent use may be determined (among other factors) by the manner by which this information is studied. In a series of experiments we have examined how manipulations of the level at which words were processed at study and at test, and selective allocation of attention at study influence their availability in direct and indirect tests of memory. Contrary to theories suggesting a dissociation between implicit and explicit memory mechanisms, we have found that the manipulation of the level of processing and of selective attention at study affects performance similarly in direct and indirect tests of memory. The similarity between the two measures was more conspicuous after 24 hours than at immediate testing. In addition, our data suggest a strong episodic component influencing the magnitude of the repetition effect. The implication of these findings on current models of human memory organization will be discussed.

Recalibration-by-pairing of perceived intermodal simultaneity

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"Recalibration by pairing" (Epstein, 1975) refers to a class of phenomena in which sensory data which "yield discrepant information about a distal property" become recalibrated in a way that reduces the discrepancy. The phenomenon has been studied mainly in cases of cross-modal conflict, like the well-known ventriloquism situation, in which the occurrence of visual events in synchrony with auditory ones, but in a moderately separate location, produces both an immediate bias in selective localization of the auditory data and a recalibration measurable through aftereffects.

The present study was designed to examine if a situation involving a discrepancy on the time dimension, instead of a spatial one, could produce similar effects. We used a test situation

inspired by Wundt's classical complication task. The subject estimated the location reached, at the time an auditory click occurred, by a spot moving along a graduated scale.

In Experiment 1 it was shown that when a discontinuity (the sudden appearance of a vertical bar perpendicular to the trajectory, which was generally experienced as a sort of explosion of the spot) occurred in the course of the spot shortly (40–160 msec.) before or after the click, it produced a strong attraction effect on spot location judgments. Further, it was shown that repeated exposure to transits with a constant click–bar discordance produced shifts in spot location judgments in the basic task. Such aftereffects were obtained irrespective of the fact that the adaptation trials involved quantitative click location estimations (Exp. 1) or judgments of whether the click occurred before or after the bar (Exp. 2). The possibility that the recalibration giving rise to the after-effects occurred in the visuo-spatial dimension was discarded by changing the direction of movement of the spot between adaptation and test trials (Exp. 3).

Planning strategies across ages

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Planning consists in the ability to organise behaviour to achieve some goals. It has been defined as a "mental simulation which envisages the circumstances and runs possible actions evaluating the consequences and selecting the optimal order for executing them" (Cohen 1988). The aim of the present study is to evaluate changes with age in planning abilities.

Three hundred subjects were tested, ranging in age from 11 to 96. All subjects were given a planning task. Subjects were presented with a map of a hypothetical town and asked to move around it, producing a plan for completing as many as possible of the errands proposed in the instructions, using the shortest way. The subjects' task was then sequencing errands, timing actions and logically ordering goals (Cohen, 1988; Hayes-Roth, Hayes-Roth, 1979). Some constraints were given to subjects mainly regarding time. Their performance was analysed emphasising both goals and efficiency of the plan produced.

The first measure did not show a relevant change with age, except when comparing the youngest and the oldest subjects. While the analysis of efficiency showed the use of less effective strategies in both children and the oldest subjects, the analysis of error types seems to underlie different mechanisms responsible for the failures.

An interpretation is suggested in terms of control processes. The monitoring process seems to be responsible for the differences detected, i.e. changes in the ability to verify the correct execution of the plan and to switch between different actions to inhibit one response in favour of another one.

Dynamic memory for object information in sequential behaviour

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Critical object information is perceived over time in dynamic conditions of continuous behaviour. The attentional system processes information for the purpose of coarse control of the organism system in motion. The same objects are viewed in different explicit and implicit perspectives including varying organism-object distances as ongoing behaviour proceeds. Memory for specific sub-places, places and layout units on an increasing space scale from "pencils on a table" to "houses in a layout" is a kind of memory which is based on serial systems of specific views in perception and imaging during behaviour time and which is continuously adapted to similar actions in the same or quite similar specific object situations.

Experimental conditions for the study of memory as a consequence of locomotion were arranged in a space consisting of two large, eye-level cubic objects with constant size and form but distinctive colours on eight vertical sides. Dynamic acquisition was defined as a complete walk in trained pace around the mini-layout. In one experiment, the walk was followed by a series of memory tasks functionally interrelated by a processing context defined by a perceptual exploration task located in the series. The series started with FC-recognition for reverse-side colour-object associations based on visible front-side colours as a task-inherent cueing source. Immediately afterwards, perceptual optimization was required in the task to maximize predicted colour change, relative to currently visible colours, and simultaneously minimize colour identification errors from the point that the task requested the subjects to select and mark (with a laser pointer). After a feedback move to the selected point, the same FC-recognition task was performed anew in conjunction with the task to remember (mark) the colours that were selected in the first FC-task (partial overlap of correct colours). Finally, the visible colours were identified (also FC). In a second experiment, the procedure was identical up to the first FC task but the latter was now formally a functional element in total acquisition which ended with the following prospective task. On the basis of a visible goal point (on the floor) the subject predicted reverse-side colours unique relative to currently visible colours (FC-task). The phase of total acquisition events was followed by a phase with observations of displacement interactions with the earlier mini-layouts. Subjects performed discrete walking moves in the task of finding the specific layout-view which obtained at the goal point in the first phase (perceptual view reinstatement). In what ways sequential memory for the mini-layout depended on interactions, goal attainment, accuracy of acquisition and prediction were examined on the basis of confidence ratings reported at behavioural starts and ends. Selected results and aspects of explication concerning this transition area between perception, memory, and behaviour will be presented.

Structural priming of pictures: angles and vertices facilitate object recognition

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We report three experiments designed to investigate the contribution of local features (angles or vertices and midsegments of edges), object parts and global shape information on object identification in a picture priming paradigm. Four types of incomplete forms derived from outline drawings of objects were used as primes: (1) forms with both angles and midsegments of edges present and aligned on the outline contour, (2) forms with angles and midsegments of edges present but non-aligned on the contour, (3) forms with only angles present and (4) forms with only midsegments of edges present. The target was an outline drawing of an object that subjects were required to name as rapidly as possible. Primes were presented at levels of luminance corresponding to identification thresholds, and both above and below threshold levels (determined in Experiment 1). Facilitation effects relative to a neutral (no prime) condition occurred at threshold and above threshold levels of luminance for primes with aligned elements, primes with only angles, and primes with only midsegments of edges present. Priming was less pronounced for the primes with non-aligned elements. In Experiment 3, with increased spacing between elements, the effects of primes with only midsegments of edges present disappeared while facilitation effects were found for primes with angles and vertices present. The results are consistent with Biederman's (1987) proposal that object recognition is mediated by the identification of object parts and that angles and vertices are involved in the determination of these parts and their specific arrangement.

Reference

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Recognition of people's names on the basis of partial information: A test of the plausible phonology hypothesis

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People's names are notoriously difficult to recall. A recent explanation of the difficulty, called the plausible phonology hypothesis, suggests that it is the large number of possible completions given a fragment of a name that makes the task so error-prone (Brennen, 1993). This is due to the fact that new exemplars of people's names are continuously encountered, even in adulthood. The hypothesis predicts that whenever people's names must be completed on the basis of partial information, they will be at a disadvantage relative to other words. In this paper the hypothesis is tested in two ways. Firstly, on a word fragment completion task, it is shown that people's names are less often completed than other words, even when the number of possible completions is controlled for. Secondly, subjects carried out a speeded word naming task, where words were either people's names or common names, and where the stimuli were either intact or perceptually degraded. In line with the hypothesis, there was no difference between proper names and common names for the intact conditions, whereas blurred proper names were read more slowly and less accurately than the blurred common names. The results generalize the scope of the plausible phonology hypothesis by showing that it applies to recognition of people's names as well as to recall.

Cognitive consequences of cardiac surgery: the role of particulate and/or gaseous emboli

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Most early studies report long-lasting cognitive impairment following cardiac surgery (CS) although recent research suggests a more complicated pattern with not all patients being impaired and not all aspects of cognitive functioning being affected. Research into the causes of impairment has concentrated upon patient characteristics, surgical and/or perfusion times, hypoxia, low arterial Pa CO₂ and low arterial perfusion pressure. Few studies have investigated the continuing presence of particulate and/or gaseous emboli in relation to the continuing presence of cognitive impairment.

A neuropsychological test battery was administered to CS patients post-operatively to ascertain cognitive function and Transcranial Doppler Sonography was applied to establish the presence/absence of particulate and/or gaseous emboli. The presence of particulate and/or gaseous emboli was found to be associated with impaired cognitive function. This finding was discussed in terms of models of diffuse brain damage and neuropsychological function.

Numerosity and orthographic confusability of derivational suffixes: effects on morphological processing

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In previous research, quantitative/distributional properties of prefixes were shown to affect the likelihood that they act as independent units of processing and representation (Laudanna, Burani and Cermele, in press). Do these properties play a role also for derivational suffixes?

In this research, we compared lexical decision latencies and accuracy to printed suffixed non-words (e.g. *livonista*) which were composed of a derivational suffix (e.g. *-ista*) combined with a non-root, i.e. a nonsense orthographic sequence (e.g. *livon*), with control non-words (e.g. *livonosto*) in which neither a suffix nor a real root were present. The suffixes varied along the dimensions of numerosity (i.e. the number of words in which a given suffix is included), and orthographic confusability of a suffix with existent homographic pseudo-suffixes in the language. Numerosity and orthographic confusability were calculated on three different data bases: i) on word-types in a dictionary; ii) on word-types included in a frequency count for Italian; iii) on word-tokens in the same frequency count. The prediction was that suffixes which occur in many words and which have fewer homographic pseudo-suffixes should behave more like lexical access units. Consequently, non-words, including these latter suffixes should require more time and generate more errors in being rejected as non-existent words than their matched controls.

Results showed that both these properties of suffixes (numerosity and orthographic confusability) affected subjects' performance, with numerosity, mainly when calculated on word-types, being the best predictor of subjects' latencies and errors. Specifically, a statistical measure for ranking suffix productivity, i.e. the number of word-types that occur only once in a language corpus, or hapaxes (Baayen, 1993) proved a good predictor of subjects' performance.

These data are accounted for by a model of lexical access in which lexical entries can be addressed through a morphemic access procedure that is sensitive to quantitative/distributional properties of affixes.

Phonological coding in test anxiety: phonological versus semantic interference during reading

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The role of phonological coding in reading comprehension as a function of test anxiety was examined. Groups of subjects high and low in test anxiety read texts followed by tests of comprehension. The texts were presented word-by-word at a fixed rate. Various concurrent tasks were performed while reading: none, articulatory suppression, unattended meaningful speech, and unattended non-word speech.

There were no differences in comprehension performance between high- and low-anxiety subjects with no concurrent task, and with concurrent meaningful speech. In contrast, the

former subjects had lower performance than the latter under concurrent articulatory suppression, and concurrent non-word speech. As there was also a decrement in performance for anxious subjects in the non-word speech condition (compared with the no concurrent task condition), it can be concluded that there was phonological interference only for the anxious subjects. In addition, as there was a performance decrement for both the high- and the low-anxiety subjects in the meaningful speech condition (compared with the no concurrent task condition), there was semantic interference for both groups of subjects. Therefore, there is phonological interference specifically associated with anxiety, but semantic interference occurs regardless of anxiety. The specific phonological interference in high anxiety subjects suggests that, compared with low-anxious, high-anxious individuals resort to more speech-based coding during reading, and are thus more vulnerable to disruptive effects on the phonological loop in working memory.

Word recognition across orthographies: semantic priming in naming and lexical decision

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The performance of English and Spanish subjects was examined in 4 experiments using naming and lexical decision tasks. In Experiment 1, English and Spanish subjects named or made lexical decisions to target words that were either associated with or unrelated to their preceding primes. Results showed similar priming effects for English and Spanish in the lexical decision task. However, in naming priming effects were obtained for English but not for Spanish. This pattern suggests that although English subjects normally use the lexical route in reading, the use of this route for Spanish subjects is task dependent. Experiment 2 to 4 explored whether it is possible to experimentally induce lexical and non-lexical strategies in both English and Spanish subjects. Experiments 2 and 3 tried to induce a lexical strategy in naming Spanish words by varying the instructions given to the subjects and the composition of the stimulus list. Results showed that although a change in instructions did not produce priming, priming effects were obtained when nonwords were eliminated from the experimental list. Experiment 4 tried to induce a nonlexical strategy in naming English words by including only regular words. However priming effects were also obtained indicating that the use of the lexical route in English is not dependent on word regularity. These findings suggest that although in English reading normally occurs lexically, in Spanish the selected reading route depends on the strategy induced by the reading conditions. This is consistent with double route frameworks in which the use of the lexical and nonlexical routes in different languages depends not only on the orthography involved but on the reading strategy induced by the experimental conditions.

Differences in length representation between right and left hemisphere.

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When normal dextrals have to mark the middle of a line, they make a smaller but significant leftward deviation of the subjective middle. It was suggested that this leftward bias was related to an overactivation of the right hemisphere in response to the spatial nature of the task. Such an overactivation of the right hemisphere might result in an enhancement of the left perceptual hemisphere, which would lead in its turn to a leftward deviation of the bisection. To test the hypothesis of an "enhancement" of the hemisphere contralateral to the most activated hemisphere, 45 normal dextrals performed an adaptation of the line bisection protocol. The subject is given a half-line (left half: protocol p1, or right half: protocol p2), and has to complete in order to obtain a whole line with two equal halves. The conjunction of the spatial nature of the task and of the presentation of the left half of the line in protocol p1 is supposed to activate the right hemisphere which in its turn would lead to an enhancement of the left half representation and to an over-construction of the right half. On the contrary in protocol p2, the reverse bias is expected, i.e. over-construction of the left half. Results show no significant bias when the subject has to infer the right half from the left one, whereas building the left half from the right one led to a significant under-construction. The enhancement and hemispheric activation hypotheses are discussed, but do not appear compatible with our results. Rather, it is suggested that there is a preferential direction for construction, possibly related to reading habits.

Onsets and rimes at the onset of reading

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Goswami and Bryant (1990) have forcefully argued that young children's sensitivity to rhyme relations plays a direct causal role in their acquisition of reading skill. One important argument stems from clue facilitation effects, which have been explored in depth by Goswami. When beginning readers are given one example (or clue) before being asked to read a word or a nonword, their oral reading performance improves, and more so if the target item shares the orthographic rime with the clue.

Our studies were designed to test whether the rime advantage also obtains in French. In a first experiment, first-graders were required to read pseudowords presented either in isolation or preceded by a clue word sharing the rime, the head (i.e. the initial consonant and vowel), or the initial and final consonant with the target. The results confirmed that even less advanced beginners use analogies, and an advantage of the rime condition was observed as in previous English/American studies. However, the advantage of the rime condition disappeared when analogy responses (all responses that were correct on the fraction of the orthographic string common to the clue and target) were counted rather than correct responses. This post-hoc

analysis suggests that the rime advantage does not reflect the prominence of the rime as an analogical unit but rather the fact that it is easier to blend the rime with the beginning consonant than to combine the head with the final consonant.

Two follow-up experiments aimed at testing the hypothesis that the use of analogy does not depend on the existence of a particular structural relation between the clue and the target, but rather on the degree of their similarity and the position of common elements. Taken together, the results show no indication that rime relations play any special role in the acquisition of reading.

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Time-monitoring strategies and prospective recall; some effects of ageing

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In most cases, prospective memory is concerned with the recall of an item (some action to perform at a given time) which is unrelated to the S's ongoing activity, and thus will not be triggered by some internal cue. In such cases, the S's time-watching behaviour may be of primary interest. In the present experiment, Ss were invited to view a TV-film, and, meanwhile, to turn sheets of paper at several, previously defined, moments. Response latencies were observed, along with the distribution of clock-watching over the time-period. Two groups were compared, whose mean ages were 22 and 66, respectively.

The overall time-monitoring strategy turned out to be expressible as follows: $c = 2 \exp(t-i)/p$, where c is the order number of the watch control and t the total time elapsed. According to this function, after some initial waiting time i , the controls occur at gradually narrower time intervals, each control taking place after a constant proportion p of the remaining time. While most Ss of both groups appeared to follow that kind of strategy, some of them developed different strategies. With one exception, these alternative strategies resulted in poorer prospective recall performances. Moreover, such less efficient time-monitoring behaviour occurred more often among the elderly.

The role of relational and distinctive processing in the concreteness effect with phonetic focal orientation tasks

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The effects of concreteness on memory have been studied in a great variety of conditions of semantic orientation, including item-specific tasks and relational tasks (e.g. Marschark and Hunt, 1989; Marschark and Surian, 1992), but there are few studies which have investigated this effect in non-semantic orientation tasks (e.g. Ruiz-Vargas and Cuevas, 1992). In part, this scarcity could be due to the assumption of the dual coding theory that image coding of concrete words is a consequence of a semantic processing (Paivio, 1971). However, some recent research (e.g. Ruiz-Vargas, Cuevas and Marschark, in preparation) appears to suggest that the concreteness could be, in part, the result of automatic semantic processing.

With the aim of analyzing the role of relational and distinctive processing, during both the encoding and the recall of information in non-semantic tasks, we carried out this experiment. In particular, our objective was to investigate the degree of generalization of the principal assumption deriving from the relational-distinctive framework (e.g. Hunt and Marschark, 1987; Marschark and Surian, 1989), with respect to the prediction and explanation of the concreteness effect when focal non-semantic processing is effected (Nelson, 1979). With this aim, we manipulated the concreteness of the words (concrete vs. abstract) at the within-subject level and the orientation task (relational vs. item-specific) and the recall task (free recall, extra-list semantic cued recall, extra-list phonetic cued recall, and recognition) at the between-subject level.

In accordance with Marschark and Surian (1992), the results showed that the concreteness effect weakened in item-specific tasks, and disappeared in free recall (in conditions in which an exhaustive relational processing had not been carried out). However, and contrary to the unidirectionality hypothesis, the concreteness effects emerged when the recall cues blocked access to the relational information (extra-list cued recall), or when the test directed the subject to the recall of item-specific information (e.g. recognition). These results call into question the degree of generalization of some assumptions of the relational-distinctive framework and, at the same time, suggest the necessity of clarifying the operative and conceptual definition of the distinctive construct (cf. Schmidt, 1991).

Semantic-like effects in judging physical properties

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The process of object recognition is normally very fast and efficient, in spite of the fact that different sources of information, and different levels of representation, need to be taken into account in order to perform it correctly. The different sources of information may interact with each other, or they may be processed independently. To address this issue, Boucart and Humphreys (1992) have devised a task in which subjects were required to match a target picture to one of two degraded alternatives, one corresponding to the target and one being a semantically related or unrelated distractor. Although their subjects were instructed to direct

attention to a geometric property that had no direct link to the object's identity (i.e., global shape orientation), their judgment was influenced by the semantic relation between prime and target. Thus, their empirical evidence showed that semantic and perceptual information interact at the very early stages of object recognition. However, the task employed may have magnified the role of semantic factors: the need to match two stimuli may have led subjects to use strategies based on semantic identification.

In our study, subjects were required to judge only one stimulus at a time. Stimuli consisted of line drawings of real objects and of animals plus the same number of nonsense filler forms. The stimuli were presented both in a "natural" format and in a "distorted" format. This latter was created by inverting the height/width ratio of natural stimuli. So, stimuli that in the "natural" format were vertically elongated (e.g. a giraffe) resulted in stimuli more horizontally extended than vertically extended (e.g. a compressed giraffe). The opposite was done for stimuli horizontally elongated in the "natural" format. Each item was presented for 150 msec. and was followed by a mask. Subjects were asked to judge the overall elongation of each stimulus, deciding if it was more vertically extended or more horizontally extended, by pressing one of two keys of the computer keyboard. If subjects perform the task without resort to semantic information, i.e. without automatically identifying real objects, their response time to "natural" and "distorted" stimuli should not differ. Also, no difference should be obtained for filler items.

The results can be summarized in the following way. For both experimental items and fillers, strong semantic-like effects emerge for vertically elongated, but not for horizontally elongated, stimuli. The pattern obtained indicates a possible interaction among physical properties of "natural" and "distorted" pictures, and will be discussed in terms of form, orientation, and surface information in object recognition.

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The processing of route descriptions

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Among the many kinds of linguistic descriptions related with space, route descriptions have a very special status. Contrary to descriptions of static scenes or objects, which are typically associated with a survey perspective, route descriptions require that the addressee adopts a series of successive points of view, which implies a strong dynamic component. Another feature of route descriptions is that they involve several discourse components (combining descriptive, prescriptive, and sometimes narrative-like segments). Finally, although the problem of discourse linearization is not crucial for the speaker or writer (since in general, steps along a route are described in the order of their appearance), a number of cognitive choices have to be made which require constant interaction between internal representations (such as cognitive maps) and the system responsible for producing appropriate linguistic outputs.

Based on a corpus of route descriptions collected in natural environments (university campus, districts of Paris, etc.), we have conducted detailed analysis of the components of this type of discourse, with specific assumptions on the cognitive operations reflected by the units analyzed. In a subsequent series of experiments, we investigated people's ability to generate route descriptions. Results show that the descriptions depend to some extent on speakers' cognitive abilities, in particular their capacities to visualize routes. Another set of experiments examined subjects' memory for route descriptions. The results suggest that different parts of a description elicit different modes of processing, with measurable impact on their memorability.

Updating representations of protagonists' emotional states

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Readers of narratives are able to represent the protagonists' emotions, even though these emotions are not explicitly described in the text (eg Gernsbacher, Goldsmith and Roberston, 1992, Gernsbacher and Roberston, 1992). Emotions — both in real life and in narratives — are usually transient states, episodically associated with characters. Consequently, as the interpersonal situation described by a text changes it is likely that the initial representation of a protagonist's emotion becomes less activated while a new emotional state is inferred by the reader. To put in another way, our hypothesis is that readers do update the representations of protagonists' emotional states as the narrative plot develops.

In Experiment 1 subjects read short stories in a sentence-by-sentence self-paced procedure. In one version of the task (maintenance condition) the protagonist's actions described in the first part of the story intended to stimulate readers to activate the representation of an emotional state (e.g., "proud"), and the second part of the story described additional actions compatible with the same emotion ("proud"). In the other version (change condition) the first part of the story attempted to activate an alternative emotion (e.g. "guilty"), whereas the second part of the story was identical to the previous version, biasing the same emotion ("proud"). A target sentence describing the protagonist's emotion (e.g., "Ann felt proud/guilty of her decision") was placed immediately after the first or the second part of the story, and was either consistent or inconsistent with the preceding biasing context. The reading times for the target sentence were slower when the emotion was inconsistent rather than consistent with the immediately preceding context, both in the maintenance and the change condition. The results suggest that subjects are able to track the protagonist's emotion state throughout the story, updating the representation when necessary (in the change condition).

An alternative explanation for the change condition, however, is that inferred emotions are always controlled by the local context. Put another way, the emotion knowledge activated by the second part of the story (proud) does not involve a real updating of the emotional model, because the representation initially activated (guilty) simply was dropped out from working memory as new sentences were read. Experiment 2 was designed to rule out this explanation. Subjects read versions of the stories with a first part that biased a given emotion (e.g. proud or guilty), followed by several neutral sentences (describing protagonist's routine actions) and, finally, by the target sentence. Reading times were faster for consistent rather than inconsistent targets, demonstrating that the representation of the emotion activated by the first

part of the story is kept in memory when the local context does not convey additional emotional clues.

The results support the notion that readers built articulate and updatable mental models of protagonists' emotions inferred from the described action. These mental models are related to the global coherence of the text, although they can be modified when the local context provides new information emotionally relevant.

Priming effects in automatic colour coding

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The hypothesis that priming effects in colour perception can be produced by automatic processes was tested in this experiment. Previous research in the literature shows inconclusive results in this regard.

In this experiment, prime stimuli consisted of a pair of coloured shapes (a circle and a square) presented either horizontally or vertically with respect to the centre of the screen. An arrow between the two figures was oriented toward one of the two shapes. The subjects' task at this stage was to direct their attention to the figure indicated by the arrow, in order to identify and memorize its shape. They were to ignore the colour of the two shapes. However, in order to prevent the subjects from developing explicit expectations, the colour of the two figures was always different, one red and the other green (the associations of the two shapes to each colour was counterbalanced across experimental trials). Prime stimuli (the two shapes and the arrow) were exposed for 250 msec. After a 500-msec. ISI, the target was presented. It consisted of a red or green triangle. The subjects' task was to respond to the target colour by pressing one of two response buttons. Target stimuli could be located either in the same position or in a different position with respect to the attended figure of the prime stimuli.

When the colour of the attended figure of the prime pair was the same as the colour of the target, a remarkable priming effect was obtained (73 msec.). This effect was probably produced by the automatic coding of colour, since the dimension of the prime stimuli the subjects had to pay attention to was shape not colour. Interestingly, priming effects were produced irrespective of the relation between the position of the attended prime and target stimuli. This result suggests that priming effects in colour perception are probably generated at a stimulus-centred level of representation, where an item is described in terms of a coordinate system in which the stimulus is defined not with reference to the portion of the retina to which it is projected but, instead, with reference to itself.

The effects of lateral interference and attention on visual search

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The slope of the function relating reaction time (RT) to the number of elements in a visual search display is generally taken as evidence for whether search occurred in a parallel or a

serial manner. Typically, search for a unique feature results in a flat search function whereas in absence search, i.e. search for the absence of a feature, and conjunction search, i.e. search for a conjunction of features, the RT linearly increases as a function of the number of display elements. Results like these are often taken as evidence for the notion that feature search can be performed in parallel whereas more complex search requires the involvement of a serial attentional scan. This notion is based on the assumption that increasing the number of elements, and consequently the display density, does not differentially affect target visibility in a feature compared to an absence or conjunction search task.

The present study aims to test the correctness of this assumption. In a visual search task subjects search for either a feature or the absence of a feature. The number of elements is independently varied from display density. The results are discussed in terms of possible implications for current theories on visual attention.

Using a dual task to investigate the role of autobiographical memory in problem-solving

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The present research aims to clarify the role that autobiographical memory plays in problem-solving. Initial work by Dritschel and colleagues (1994, in preparation) demonstrated that individuals employ specific past experiences as analogues in order to generate solutions to novel problems. Further, the problem-solving strategy appeared to be influenced by the degree of novelty of the problem. The more difficult a problem, the less likely it was for subjects to draw on specific past experiences as analogues. Instead increased problem difficulty was associated with a greater reliance on other strategies such as means-end heuristic processing.

The present study aimed at examining the effect upon the retrieval of autobiographical memory in problem-solving when the demands upon the cognitive system were increased. To achieve this aim, a dual task condition of rhythmic finger-tapping was incorporated into the problem-solving task. Our problem-solving set utilized six different problem sets, each consisting of four items (e.g., an everyday problem "How do you brush your teeth with a toothbrush" plus three script violations of this problem which varied in their level of difficulty). Our hypothesis was that as processing demands were increased with the dual task, there would be a decrease in retrieval of specific memories used as analogues. Subjects were required to perform a tapping task alone, the problem-solving task alone, and a dual task condition consisting of tapping and problem-solving concurrently.

As we found in our initial work, the results indicate that the novelty of the problem significantly affects the type of memories retrieved in both conditions. The dual task does not directly affect the type of memory retrieved. However, the task affects the subjects' ability to maintain a tapping rhythm as well as subjects' onset of images in the problem-solving task. An interaction was found between novelty of the problem and the type of task when general and knowledge-based responses were retrieved. In the dual task condition as opposed to the problem-solving alone condition, there was a greater tendency to draw on personal knowledge in the form of general memories as opposed to decontextualized knowledge.

Our findings lend support to the theory that autobiographical memory plays an important role in the problem-solving process. The results confirm the prediction that autobiographical memories will be retrieved as analogues in order to solve common and novel problems. Some important questions have been raised by the present research. The main question is why the system seems to be biased towards retrieving personal knowledge when the demands upon the cognitive system are increased. Future research needs to investigate and understand the use of personal knowledge in these circumstances. At such a point a comprehensive theory of the use of autobiographical memory in everyday problem-solving situations may be developed.

Locus and time course of context effects and typicality in sentence interpretation during reading

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Our general purpose is to evaluate the locus and time-course of top-down (concept-driven) processes in on-line reading. An experimental analysis of these processes in sentence interpretation during reading is proposed by means of infra-red eye-tracking. Stimuli were sentences that had a contextual lexeme as subject noun in the first part and a target lexeme as object noun in the second part, and the distance between both was varied. The target lexeme was either predicted by the lexical context or not. This was achieved by controlling typicality values for the context word. In addition, linguistic parameters such as lexical frequency and word length were controlled to evaluate the role of linguistic vs cognitive effects in the interpretation process during reading. These effects will be inferred from eye-movement parameters such as first fixation position and duration, and second fixation position and duration on the target word. Connected with Vitu and O'Regan's modelling of parafoveal preprocessing, the present experiment allows us to track the different stages and locus of top-down effects. These effects are discussed in relation to the hypothesis of modular vs connectionist modelling of comprehension in psycholinguistics.

Are older subjects necessarily worse in prospective memory tasks?

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In Experiment 1, subjects from three different age groups (15-25, 35-45, and beyond 60 years old) were required to phone once a day during five successive days. The youngest group showed more forgetting and used more internal retrieval cues than the two other groups. The findings were explained in terms of the overconfidence the youngest group of subjects have in their memory abilities, and in terms of their memory duties (i.e. calling) as embedded in their daily schedule of activities.

In Experiment 2, young and older subjects were requested to use either internal or external retrieval cues, or they were left free to choose the reminders they preferred. In all conditions, older subjects outperformed the younger subjects. There was not much difference between the

conditions where the use of internal or external reminders was imposed but the two conditions were better than the condition where the subjects were free to choose the reminder. Prospective memory was particularly bad when the young subjects freely chose internal reminders, confirming Experiment 1.

In Experiment 3, young and older subjects were asked to press on a space bar every three minutes whilst watching either an interesting or boring film. Older subjects were slower on the prospective memory task and they showed poorer (retrospective) recall of the movie content when the movie was interesting than when the movie was boring. With young subjects, the nature of the movie did not affect the speed of responding on the prospective memory task, and there was no significant difference in recalling the content of the movie. The findings are explained in terms of an age-decline in processing resources, emphasizing the importance of concurrent activities as an interfering factor in a prospective task.

An overall framework on processing differences between young and older subjects will be presented, emphasizing processing differences of young and older subjects in time- and event-based prospective memory.

Frequency and recognition of action-verbs

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An experiment was carried out to test whether the word-frequency effect and the enactment effect in recognition are based on automatic or controlled processes. Two groups of subjects learned a list of high and low frequency action-verbs. One group learned the list in a verbal task (standard instructions), the other group in a subject-performed task (they enacted the actions). Half of the list items were tested under interference, half without interference. Recognition performance was better for low than for high frequency verbs but only without interference. The enactment effect increased with interference. Hence, the frequency effect seems to be based on controlled processes, the enactment effect at least in part on automatic processes.

Morphological and orthographic analysis in word recognition contrasted

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Theoretical accounts of word recognition often minimize the role of the morpheme and attempt to explain effects of morphological structure as reflecting, instead, orthographic and phonological patterning of letter units, or semantic similarity in conjunction with shared orthographic and phonological structure. The present program of research compares and contrasts effects due to morphological similarity with effects due to orthographic and/or phonological similarity.

I intend to present some recent evidence for morphological processing from word recognition. In the first part, the effect on lexical decision to targets of primes that share morphological and orthographic similarity are compared. Both long and short lags between prime and target are examined as are effects of preserving and alternating modality. In one experiment, prime and target are both presented visually. In a second, primes are visually presented and targets are auditorily presented. In the second part, the effect of morphological relatedness over and above orthographic similarity is investigated. Patterns of interaction among orthographic neighbours with the same and with differing morphological structure are examined.

Masked form priming in picture and word naming

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A series of picture and word naming experiments are reported using the masked priming paradigm, with prime exposures brief enough (e.g. 29 msec.) to prevent prime identification. Experiment 1 demonstrates that the prior visual presentation of the same word prime facilitates both picture and word naming independently of target frequency. In Experiment 2, primes that are pseudohomophones of picture targets produced facilitatory effects compared to orthographic controls but these orthographically similar nonword primes did not facilitate picture naming compared to unrelated controls. On the other hand, word targets were primarily facilitated by orthographic prime-target overlap. In Experiment 3, we demonstrate that the prior visual presentation of a homophone of the picture target produced facilitatory effects relative to unrelated prime words. Moreover, this facilitation effect is practically the same size (in terms of percent facilitation) as when primes are nominally identical to or pseudohomophonic with the picture target. These results suggest that the priming effect in picture naming resulted from preactivation in memory of the phonological representations corresponding to the picture name, whereas for word naming, this priming effect resulted mainly from preactivation of sublexical orthographic representations. This marked dissociation in the priming effects obtained with picture and word targets is discussed in relation to different explanations of masked form priming effects in visual word recognition, and current models of picture and word naming.

Native language versus second language reading: where does the difference lie?

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Two on-line experiments examined bilingual subjects' reading strategies in their native language and in their second language.

Experiment 1 looked at the strategic use of animacy cues in the first and second language, by means of a self-paced reading task. The results did not strongly support the hypothesis that bilinguals rely upon animacy cues more when reading in their second language than when reading in their first language.

In Experiment 2, subjects' eye-movements were recorded while subjects read sentences presented in each of their two languages. Our intention was to determine whether lexical information from the bilinguals' native language would affect parsing in the second language. The results showed that, when reading in their second language, bilinguals behaved according to the lexical constraints of that language with only minimal interference from their native language. This was true even in cases where the bilinguals' native language presented conflicting lexical information. Note, however, that in the latter case, bilinguals hesitated momentarily when reading in their second language as compared to the performance of native readers.

Together, the results showed proficient second language reading, which differed little from native language performance and which was only minimally influenced by the bilinguals' native language.

Asymmetric integration of prior outcomes in risky decisions

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In prospect theory (Kahneman and Tversky, 1979; Tversky and Kahneman, 1991, 1992) which is a dominating descriptive theory of decisions under risk and uncertainty, unidimensional (e.g. monetary) outcomes are assumed to be coded as gains or losses relative to a reference point. An implication of this key assumption of the theory is that options are evaluated independently of outcomes of prior choices since they are assimilated to the reference point. This implication has been questioned in previous studies of sunk cost effects (e.g. Laughhunn and Payne, 1984). Need for affective control has been proposed as an explanation (Thaler and Johnson, 1990). According to the Renewable Resources (RR) model (Linville and Fischer, 1991), prior losses are integrated with current gains and prior gains with current losses. However, multiple losses and gains are segregated. In two experiments in which subjects chose to accept or not fictitious race-track bets, we found that only the evaluation of a possible loss were affected by a prior gain or loss. Such a principle of *loss saliency* governing integration is not compatible with the RR model which assumes that people maximize hedonic outcomes. In an additional experiment we made the prior outcomes uncertain (not yet known). The hypothesis was that hedonic maximization would be more likely to control integration under these conditions. However, the results were again more consistent with the principle of loss saliency. Both the predictions from the RR model and our results pose problems for prospect theory since they imply that subjects use several reference points in evaluating prospects.

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Speech segmentation in a non-native language

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Present approaches on speech segmentation focus on syllable-based (segmenting the continuous speech stream into syllable-sized units) versus stress-based (initiating lexical access at strong syllables) segmentation strategies. Which of these strategies prevails appears to depend on the subjects' native language. Evidence in support of syllable-based segmentation has been found for French (Mehler et al., 1981) and evidence for stress-based segmentation has been found for English (Cutler and Norris, 1988) and for Dutch (Vroomen, van Zon and de Gelder, submitted). The experiments reported here investigate whether French/Dutch bilinguals with French as their native language rely on their native syllabic strategy when listening to (stress-based) Dutch or, alternatively, whether they adopt a stress-based strategy.

In Experiment 1 subjects were induced to missegmentations of continuous speech by presenting speech fragments just above threshold. Like native speakers of Dutch, French/Dutch bilinguals erroneously insert word boundaries before strong syllables and delete them before weak syllables. Experiments 2 and 3 used a word-spotting task. Subjects were required to spot real Dutch CVCC words (e.g., melk, milk) or CVC words (e.g., bel, bell) embedded in bisyllabic pseudowords. The bilinguals made less errors in detecting the CVCC target when the second syllable of the pseudoword was weak rather than strong: 'melk' was detected more accurately in 'melkes' than in 'melkoos'. For CVC targets, the effect was reversed: 'bel' was detected more accurately in 'belkoos' than in 'belkes'. The former, though not the latter results are in line with predictions of stress-based segmentation. The results will be discussed in the light of alternative proposals.

The endorsement of the premises: assumption-based or belief-based reasoning

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Two experiments examined the effect on reasoning of the degree of belief in the premises.

In Experiment 1, 84 adult subjects had to evaluate their degree of confidence in the truth of conditional statements, and to evaluate the conclusion of Modus Ponens (MP) arguments using these statements as the major premise. The same seven-point response format was used for both tasks. In the inference task, 48% of the subjects accepted all the MP arguments even when they disagreed with their major premise. The other subjects considered that some or all of the conclusions were not certainly true. Moreover, they assigned a degree of belief to each conclusion which was highly correlated with the one they attributed to the major premise. Thus two modes of reasoning emerged, one which endorsed the truth of the premises irrespective of actual beliefs about them, and one which integrated the truth status given to the premises.

In Experiment 2, on the usual three-response format, 80 adults were invited to adopt one of these two approaches with four MP arguments, and then to shift to the other one with a new set of four MP arguments. With the appropriate instruction, belief-based reasoning was adopted by 98% of the subjects, and assumption-based reasoning by only 43%. Thus, the latter reasoning mode might correspond to a more flexible inferencing ability.

Judgment under uncertainty: expert-novice probabilistic reasoning within mathematical education

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Since Tversky and Kahneman's work on reasoning heuristics, it is a common result to find that subjects in general tend to predict by heuristics when solving probabilistic problems. Reasoning heuristics constitute a strategy that can lead to correct solutions depending on the type of judgement and the information involved. Although this heuristic is adaptative in many situations, it can also lead to biased responses. Experts are not immune to the use of reasoning heuristics, making their judgments sometimes undistinguishable from novices (Tversky and Kahneman, 1971; 1974).

The present study further explores expert-novice sensitivity to probability information when reasoning on problems within their field of expertise. In this study, we intend to analyze the differences between experts and novices by manipulating the influence of variables that affect representativeness but that are irrelevant for normative probability when dealing with sample size and base rate. Our objective is to identify the degree of influence that experience has over very representative but irrelevant information when experts and novices are confronted with reasoning problems in their domain of knowledge. We examined Mathematics teachers' and students' probabilistic reasoning when solving problems related to curricula and problems dealing with different statistical information presented together with representative but not critical data for solution.

The results showed that experts and novices presented significant differences in the proportion of correct responses to the different problems. Despite biased responses in some problem types, experts obtained a higher proportion of correct responses than novices. The results are discussed as reflecting data priority within a professional field. Experience within a domain of knowledge makes experts' heuristics conform to the normative model of probability. However, experts' use of heuristics can bias their reasoning when problems contain daily events.

Spatio-temporal resolution in the perception of warmth

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Recently, a prothesis for blind people has been proposed, based on the transmission of information by means of a matrix of spots differing in temperature (De Mey, De Baetselier, Vandierendonck, and Van der Goten, 1992). For such a prothesis to be useful, it is necessary that people are able to discriminate between two or more spatially separated spots of warmth. The present paper addresses the question whether people (1) are able to discriminate between one and two spatially distinct spots of warmth and (2) whether single stimuli can be spatially localised. In the research literature, no evidence is available about the sensation of warmth. Data will be presented from experiments in which subjects detected the presence of one or two stimuli and in which they localised the position of single warmth spots, by means of active feeling. The results are discussed with respect to the ability of humans to obtain information by means of thermoreception.

Reference

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A three-process model of lexical decision and word recognition

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A model of lexical decision (word/nonword discrimination) is described that accounts for the effects of orthographic neighbourhoods, frequency blocking, and nonword lexicality on all aspects of performance in the lexical decision task. The model postulated two processes for the generation of a "yes" response, and one process for the generation of a "no" response. The first process, thought to represent normal automatic word recognition, uses information about the most activated lexical representation and a noisy decision criterion that is not strategically variable. The second and third process use the information about total lexical activity and time from stimulus onset, as well as decision criteria that flexibly adjust to changes in stimulus material and task demands. The model is implemented using a localist connectionist network based on the semi-stochastic interactive activation model. It successfully simulates

the overall pattern of data in a variety of experiments that impose a considerable degree of constraint on models of word recognition (positive and negative response time means and distributions, percent error to word and nonword stimuli, and distributions of the false positive and negative response times.) The model unifies results obtained in the lexical decision and other word recognition tasks, and helps resolve a number of inconsistencies in the experimental literature that cannot be accommodated by other current models of visual word recognition.

Externalising performance in the selection task: reasoning as argumentation

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This paper reports three studies using an externalization technique to examine reasoning performance in the Wason selection task. The first study used a claim referring to coloured shapes whereas the other studies used claims referring to letters and numbers. The critical externalization procedure required subjects to carry out three steps: to envisage the nature of the counter-example to the claim (envisaging); to indicate which card or cards the counter-example could appear on (mapping) and then to ring which card or cards must be examined in order to prove the claim true or false (selection).

Correct selection performance is shown to be reliably associated with correct identification. More crucially, performance is markedly superior when subjects correctly map both potential counter-examples. However, there are cases where subjects map correctly but select incorrectly. It is argued that selection performance reflects an internal process of argumentation. Such a view proposes that reasons and selections have the same basis. An extension of the theory of mental models is proposed in which tokens correspond to arguments for action.

What illustrations to strengthen a non-spatial mental model of a text?

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Understanding a text is assumed to lead to the construction of a propositional representation of the text and of a mental model. As a mental model is analogical, drawings illustrating what the text is about can be viewed as possible expressions of a mental model, even though the text does not only describe spatial relations. In order to determine what should better be illustrated to strengthen the so-called non-spatial mental model, an experiment compared three types of presentation of four texts dealing with chemistry concepts. The texts were presented without illustration or with drawings illustrating either the elements mentioned in the sentence, i.e. the tokens of the model, or with drawings both illustrating the elements and the relations between them. To test the representation in the course of reading, both a question based on a paraphrase of the text and a question based on an elaborative inference

interrupted reading. To test the representation built, other paraphrase and inference questions were presented at the end of the presentation.

The results showed that (1) illustrations led to significantly better performance (accuracy and correct response times) than the text condition; (2) this effect was greater for inferences than for paraphrases, both during reading and after reading; (3) during reading, presenting illustrations of the relations led to similar performance as presenting illustrations of the tokens, whereas after reading relations led to significantly better performance than tokens. These results suggest that both types of illustrations can help to build a mental model of the text, but that illustrations of the relations could be a better device to retrieve the content of the model, once it has been constructed.

Taking advice: do people take account of their own expertise as well as that of their advisors?

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People took the role of agricultural inspectors who had to assess the seriousness of outbreaks of infection in cattle. In the first part of the experiment, they were trained to forecast the number of cattle deaths from information about the area of land infected and the virus responsible for the outbreak. (Number of deaths was actually determined from these variables by a simple algorithm devised by the experimenters.) People received 30, 100 or 240 trials training with feedback. In the second part of the experiment, they performed 72 test trials without feedback. There were three stages to each trial. First subjects made their own forecast. Second, they were told what someone else (their advisor) had forecast on an earlier inspection. They were also told how much training this advisor had received. (In fact, advisors' forecasts were computer-generated and their accuracy did not depend on the level of training that was specified.) We found that people modified their forecasts more when told that their advisors had received more training. Furthermore, these modifications were smaller when they had received more training themselves.

Why is doing better than thinking — for memory?

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More than a decade of research on action memory has unequivocally shown that enactment generally has a beneficial effect on memory. However, the reason for this facilitation is still unclear. It has been suggested that the facilitation might be due to the activation of a separate motor code system, increased item distinctiveness, reduced task difficulty, or increased task involvement. There also are other suggestions. Considered from a processing perspective, it is not known whether the enactment effect reflects encoding, retrieval, or both. Might it be storage? Might preparatory sets play a role?

In an attempt to approach the enactment effect from a new angle, experiments were carried out with variation in instructions, encoding, and retrieval. The observations suggest that subject expectations influence the effect of enactment on memory. The results of three experiments are discussed in terms of current theories of action memory.

On the time course of syntactic and thematic attachment

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Although there is considerable agreement on the concept of incrementality in human language processing, the exact time course of syntactic and thematic attachment is by no means undisputed. Whereas fully incremental syntactic attachment is assumed by proponents of certain two-stage models (Frazier and Rayner, 1982; Ferreira and Henderson, 1991), thematic attachment is supposed to be delayed, e.g. until the semantic head of a phrase is processed. For current lexicalist approaches (e.g. Abney, 1987, 1989; Pritchett, 1992) even syntactic attachment is supposed to be delayed until the lexical head of a phrase has been encountered.

In our experiments we investigate the exact time course of attachment processes by recording eye-movements of subjects reading garden-path sentences (subject-object asymmetries, and certain coordinations) which are disambiguated by case and/or thematic information. Grammatical case or thematic information can have an effect on processing only when the relevant phrase is attached to the phrase marker of the sentence. Thus, processing delays which are induced by these kinds of information allow us to establish the exact time course of attachment. An especially fine-grained analysis is possible by investigating a highly inflected language such as German.

Stimulus- and reaction-patterns in serial pattern learning

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In serial reaction time tasks, RT decreases faster with practice when the sequence of stimuli and reactions is structured than when the sequence is random. The experimenter usually introduced sequential structure in these tasks either by repeating a short sequence of trials continuously or by generating the sequence by an artificial grammar. The structure-specific decrease of RT indicates in any case that, during practice, knowledge of serial order has been developed. A recent issue is whether it is knowledge on the order of stimuli or knowledge on the order reactions which is developed. Experiments will be reported which were designed to specify the *relative* influence of regularities in stimulus- and reaction-order on serial pattern learning.

We presented continuously a fixed sequence of twelve letters in six consecutive blocks. There were six different letters which were to be responded to by pressing a button with the index-, middle-, and ring-finger of the right or left hand respectively as fast as possible. In the first, second, and last block a pseudo-random sequence was chosen where each letter followed each other letter with the same probability. In all the other blocks a structured sequence of the same letters was presented which imposes statistical constraints. Additionally, two factors were orthogonally varied between subjects: a) the pattern of *relations* between consecutive stimuli and b) the pattern of *relations* between consecutive reactions. A comparison of the performance in the "structured blocks" with the performance in the "pseudo-random blocks" allows us to assess the separate and joint influence of stimulus- and reaction-patterns on serial pattern learning.

The results suggest that both stimulus- and reaction-patterns contribute to the learning process. Pattern learning in serial reaction time tasks is presumably neither exclusively due to predictions of the next stimuli nor exclusively due to the formation of a motor skill, but rather a process where the order of stimuli and the order of reactions are regularly mapped to each other. A tentative learning structure is discussed which aims to improve the reliability of response outcome predictions as a function of initial conditions, and which can in principle account for the joint influence of stimulus- and reaction-patterns on serial pattern learning. From this perspective serial pattern learning is a by-product of learning to behave efficiently.

A theory of congruity effects: some tests with stroop and Garner's tasks

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Congruity effects take place when irrelevant aspects of the situation can elicit the same responses as the relevant attributes of the stimuli. I am trying to develop a theory of congruity effects based on the following two main hypotheses. The first hypothesis is that irrespective of whether the congruity relation is defined in terms of physical, linguistic, or conceptual attributes, congruity effects always arise at the response initiation stage of processing, not earlier. The second hypothesis is that congruity effects are consciously mediated. Unnoticed relations between the relevant and irrelevant aspects of the situation could not affect the voluntary decision to initiate a response on the basis of the state of the relevant aspect of a conscious mental content. Some tests of these hypotheses using stroop and Garner tasks will be presented.

Evidence for late stimulus-triggered attentional scanning in the selection of central targets from multi-letter strings

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As reported last year, the impact of (compatible or incompatible) flankers on the processing of a central target is asymmetric and material-dependent: With normal letter stimuli, the compatibility of left flankers is of greater relevance than that of right flankers. With pictures or inverted letters, however, the asymmetry disappears or even turns into a right-side asymmetry.

These asymmetries may reflect attentional scanning processes as in reading, scanning word-like stimulus strings from left to right (perhaps stopping at the central target), and inverted strings from right to left. The present study examined (a) whether these hypothetical scanning processes are automatically triggered by the stimulus or rather reflect the employment of a strategy to locate the target and (b) whether scanning precedes or rather results from full stimulus identification, hence, whether selection is early (e.g., form-triggered) or late (e.g., identity-triggered).

The results from three experiments show (a) that inverted flankers decrease the left-side asymmetry even if the target has a normal orientation, (b) that normally oriented and inverted letters produce left- and right-side asymmetries even if the orientation varies unpredictably from trial to trial, and (c) that the compatibility effect is smaller when flankers and target form a word vs. a nonword. That is, scanning seems to be automatically triggered by the fully analyzed stimulus configuration.

Learning the letters of the alphabet may give preschool children an insight into the phonemic structure of words

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There has long been a debate about how young children become aware of the phonemic structure of words. This study was carried out in order to examine the extent to which pre-readers are aware of phonemes in words, and to elucidate how this knowledge comes about. Preschool non-readers aged 4 carried out a battery of tasks designed to assess emergent reading ability, knowledge of the alphabet, and phonemic awareness skills. It was found that knowledge of the alphabet generally emerged before phonemic awareness ability; children who knew none or few letters of the alphabet were very unlikely to be able to segment or delete phonemes, whereas those who knew on average 8 letters of the alphabet showed awareness of phonemes in words. Furthermore, multiple regression analyses showed that knowledge of the alphabet was the only significant predictor of phonemic awareness skills. It was argued that for most preschool children explicit insight into the phonemic structure of words may stem from learning the letters of the alphabet.

Cognitive processes and dysfunctional eating attitudes

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The domain of emotion is now widely conceptualised in cognitive terms. A similar approach may be adopted to the domain of eating. In particular, the dysfunctional patterns of eating behaviour found in eating disorders may be related to particular patterns of cognitive activity. A series of experiments were carried out to investigate the relation between cognitive performance and attitudes to eating. The latter were assessed by means of the Eating Attitudes Test and the Eating Disorders Inventory. A number of different aspects of cognitive processing were studied including naming, semantic retrieval and image generation. Unusual eating attitudes were found to be linked to identifiable idiosyncrasies of cognitive processing in all three areas.

The decomposition of planning and scheduling: a cognitive task analysis

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In Clancey's task taxonomy (1985) planning (scheduling) is viewed as a system synthesis task, that is to say that there is an assembly of elements that has to be constructed. Opposite is a system analysis task in which a pre-existing element has to be identified, for example in diagnosis or classification. It is very well known that planning (scheduling) tasks cause a great deal of trouble. The task is complex, obscure, requires much cognitive effort and rarely leads to an optimal solution. Our aim is a) to build knowledge systems that support the execution of difficult tasks such as planning and scheduling in cognitive perspective and b) to re-use knowledge modules for several planning and scheduling situations, such as route planning, nurse scheduling or production planning.

Although planning is defined in the literature (Miller et al., Sacerdoti) as the determination of a sequence of actions, we narrow this definition down to a more operational one in which a scheduler (as a cognitive system) tunes different objects (staff, locations, time, etc.) into one another in relation to various goals and constraints.

To gain insight into the scheduling strategies we studied knowledge acquisition in four scheduling situations: nurse scheduling, construction scheduling, freight delivery planning and hospital admission planning. Four knowledge (or expert) systems have been built to support the scheduling tasks. Moreover, in a questionnaire, 50 schedulers and planners, all working in different planning situations, were asked for their cognitive strategies in making plans (or schedules).

It was found that planning (scheduling) consists of fixed and variable steps independent of the planning situation, that planning (scheduling) is a compound task consisting of several well defined sub-tasks, that the complexity of planning (scheduling) is caused by memory overload and that the difficulty of the problem-solving aspect in planning is related to the number and the running down of the involved and to be adjusted dimensions or object-types, such as staff and time in nurse scheduling, vehicles and locations in route planning and staff, locations and material in construction scheduling.

In our paper we will discuss a) the planning (or scheduling) model we developed, b) the sub-tasks we distinguished and c) the cognitive strategies we detected. In the perspective on problem solving we borrowed from Newell and Simon, we were able to show that understanding cognitive strategies is the foremost important step in task support by computers.

A phonological gateway to orthographic representations

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The issue of the intransigence for the 'misspelling effect' — where encounters with misspelled words have a detrimental effect on subsequent spelling performance — was addressed in three separate studies. While recent research has failed to localise the boundary

demarcations of the phenomenon, that is, conditions under which the encounter ceases to be effective, the current studies — one examining the role of phonological plausibility of the misspelling, and another highlighting the role of phonology within the context of a levels of processing approach — point to accuracy of phonological representation as a crucial factor.

A third investigation into the use of a phonological code during spelling by congenitally deaf subjects provides further converging evidence on the role of phonological representations in spelling.

The findings are considered in the context of models of access to orthographic elements of lexical representations in which phonology is prioritised and holds a controlling influence.

Acquisition of a complex cognitive skill

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Acquisition of cognitive skills is described in terms of speed up for solution time and of a decreasing rate of errors. Many activities in everyday life are performed fast and error free due to acquired skills. They require consistent learning conditions, i.e. solving tasks repeatedly for many times. There are several experimental paradigms, especially for simple tasks, where performance improvements resulting from practice under such conditions are shown. Among others, from models of skill acquisition one can infer that the improvement of performance is essentially based on practising the components of a task which brings about speedup (e.g., Anderson, 1993). This is also reflected in training studies where part-whole procedures are applied, i.e. where practice proceeds from training the task components to the whole task. The higher the number of opportunities for practising a task component, the more will performance improve for this component and thus performance for the task as a whole.

In the following experiment this assumption was examined more thoroughly. Ss solved complex tasks constituted by electronic components, i.e. digital logic gates (Carlson et al., 1989). Practice included 72 trials, where each trial required verifying the binary output of a connected set of gates. Each task was always composed of three components, i.e. connected logic gates. The frequency of occurrence of gates constituting the complex tasks was varied systematically. One gate appeared twice as often as the other two gates. When solving the complex tasks repeatedly, practice for one of the logic gates therefore was more extended compared to the other two gates, that were used in the series of complex tasks. The hypothesis was that given a complex task, those components of the task that occurred with higher frequency, and that were therefore practised more often, compared to those components with lower frequency would show higher speedup and lower error rate.

45 Ss were run under three experimental conditions. Under each condition always one of the three gates that were connected was used with higher frequency in the entire sequence of complex tasks that had to be solved. If practising a complex task is in fact based on practising its components one should expect shorter reaction times after extended practice for solving those task components where a higher number of opportunities was provided for practising. This was clearly not the case. The results do not support the assumption that after practice the reaction times and error rates for task components differ between task components, when tested separately. Logic gates that occurred twice as often as other components were not verified faster and with fewer errors. The empirical result raises research questions with

regard to the coordination of information-processing demands when acquiring complex cognitive skills. When given a complex task, the course of skill acquisition may follow a more serial order of practising the components of a complex task compared to a more holistic practising of the entire task. The results of this experiment are discussed on the background of models of skill acquisition and related experimental results.

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Repairs in sentence processing

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Our approach to repairs in sentence processing distinguishes reanalysis and repair as two distinct mechanisms for handling local inconsistencies between previously analysed structure and incoming items. Whereas reanalysis can be regarded as the selective search for a structural alternative to the one which fails at some point, a repair action is invoked when the structure built up from preceding items is regarded as less likely to be mistaken than features of the currently processed item. In this case, the currently processed item is internally replaced by a similar but different one that fits into the previously built structure, sometimes resulting in a totally different overall-interpretation of the sentence.

People are capable of comprehending inaccurate and deficient material in such an easy way as is known from every-day real-life communication situations. Obviously, a repair-skill must be a substantial part of the robust human sentence processing mechanism. If, however, people are capable of repairing some kind of globally ungrammatical material, it seems likely that these skills might also be applied only to local inconsistencies during processing, even if the entire utterance may turn out to be correct in the end. Although the potential existence of repair actions might cause fundamental problems to the interpretation of psycholinguistic experiments on parsing, the psycholinguistic literature on sentence processing, with only few exceptions, has constantly ignored the notion of repair in processing up to now. In our talk we will present results from a series of experiments on repair that are currently carried out in our lab. Subjects read sentences like (1–4).

1. Der hungrige Fuchs bemerkte den fetten Hahn.
The hungry fox [nom] noticed the fat rooster [acc].
2. Den hungrigen Fuchs bemerkte der fette Hahn.
The hungry fox [acc] noticed the fat rooster [nom].
“The fat rooster noticed the hungry fox.”
3. Die hungrige Fuchsin bemerkte der fette Hahn.

The hungry she-fox [nom, acc] noticed the fat rooster [nom].
"The fat rooster noticed the hungry she-fox."

4. Die hungrige Fuchsin bemerkte den fetten Hahn.

The hungry she-fox [nom, acc] noticed the fat rooster [acc].

Sentences with unambiguous object-subject-order (OS; 2, 3) were more often misunderstood than those with SO-order (1, 4). However, reading times at the disambiguating case-marked words suggest, that the subjects did not simply neglect case information but perform an active repair action. These results are further supported by data from recent eye-tracking experiments.

Integration of anomalous data in current explanations: a model-based theory of abductive reasoning

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An anomaly occurs whenever a new datum contradicts a person's existing explanation of a set of data. When this happens, the explanation must be changed to account for the new datum. Though general responses to anomalous data have been investigated (Chinn and Brewer, 1993) it is unclear how experience affects the interpretation of anomalies especially with regard to the entrenchment of an existing explanation. We investigated the degree with which the ability to change an existing theory (e.g. explaining evidences by a set of causes) depends on the amount of data explained by the theory and on the theory's likelihood compared to an alternative theory. We also studied how these effects change with practice.

Procedure: As a testbed, a simple game called Black Box was used in which the subject must locate 4 hidden atoms (causes) in a box by shooting light rays (data) into the box. In Black Box an anomaly occurs whenever the default explanation for a new datum is inconsistent with the existing explanation (the atoms hypothesized to explain the previously collected data). 10 undergraduate students of the University of Regensburg played a total of 180 games over 5 days (several training games and 11 test games every day). A 4 (level of practice) \times 3 (confirmatory evidence) \times 4 (relative probability) within-subjects design was used. In the test phase subjects were presented with cases containing a single anomaly. In all test cases, the existing explanation was incorrect and had to be modified to resolve the anomaly, though the subjects did not know this. Confirmatory evidence refers to the amount of evidence, measured in terms of how many data are explained by one explanation. Relative probability refers to the probability of the existing explanation for a datum *d* vs. the probability of an alternative explanation for *d*. This factor has 4 levels: equal, alternative explanation is less likely than the existing explanation (old), alternative is more likely (new), and new data absolutely contradicts the existing explanation (inconsistent).

Results. General progress of learning: Within the learning phase as well as within the test-games the general improvement for time per action along number of trials follows a power-law. Compared to a linear fit or an exponential fit a power-function proved to explain a maximum of variance ($r^2 = 0.63$). Correctness also improved with practice. On average, subjects correctly located 61% of the test case atoms on day 1 vs. 86% on day 5.

Confirmatory evidence: On average, subjects took less time (measured as time per action) to

solve games with 2 or 4 confirming data than games with 3. In cases with 4 confirmatory data, the mean of the number of atoms correctly located was significantly lower than the other variants, which were not distinguishable. There was no significant interaction between number of confirmatory data and level of training concerning the correctness of solutions. **Relative probability:** It took the longest time to solve tasks in which new data were logically inconsistent with the existing theory, followed by tasks in which the alternative explanation was more likely or as likely as the existing one. Games in which the old explanation was more likely were comparatively quick to play. Solution time decreased constantly from trial to trial without interacting with the type of anomaly. The mean of correct solutions was lowest with inconsistent situations, followed by equal and by new and old. Also, with respect to the number of correct solutions no interaction between the likelihood of an explanation and level of training could be found.

Conclusions: From the perspective of a general model of abductive reasoning these results suggest that a simple knowledge compilation theory cannot completely account for effects of experience on anomalous data interpretation. Such a theory could account for the speed-up effects, but not for improved correctness. We hypothesize that correctness improves as a result of satisficing search for alternative explanations. As alternatives are found they become more available, thus decreasing a person's belief in their original explanation. This is consistent with research in scientific reasoning that suggests that the availability of an alternative hypothesis affects a person's ability to reject their existing hypothesis. It is also consistent with the bias literature on availability.

Colour-colour interference: semantic ambiguity or a problem in selection-for-action?

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The naming of a target colour takes more time when it is accompanied by an incongruent distractor colour than when accompanied by an "neutral" colour or when presented in isolation. This Stroop-like interference effect has been attributed to an ambiguity that arises when two related representations are activated in semantic memory (Glaser and Glaser, 1982; 1989). In two experiments an alternative account is tested in which it is assumed that (a) target and distractor are identified in parallel without mutual interference, (b) the target is selected to control the naming response (selection-for-action), and (c) this selection process takes more time and is less accurate in the incongruent condition than in the control conditions. This account predicts that colour-colour interference will diminish or even disappear when selection-for-action is facilitated.

In Experiment 1 target selection is facilitated by presenting the target at the point of fixation. The distractor appeared right below that point. Under these conditions incongruent colours fail to induce interference, whereas incongruent colour words (presented at the same display position), do induce a massive interference effect.

In Experiment 2 a colour-colour variant of the Eriksen and Eriksen (1974) paradigm is used, in which a central target colour is flanked by incongruent distractor colours or is presented in isolation. The colour-colour interference obtained under these conditions strongly diminishes

when selection of the central target is facilitated by an additional exogenous selection cue, consisting of a change of the central target colour into white, 160 msec. after its onset.

The results of these experiments are taken to support a selection-for-action account of colour-colour interference.

Mental translation in space

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Investigations of same-different classification of visual patterns with respect to shape have shown strong and systematic effects of differences in size and orientation between the patterns to be compared. The results suggest that irrelevant variations in size or orientation are compensated by time-consuming normalization processes: mental transformations of size and orientation. A plausible conjecture is that irrelevant variation in spatial position between patterns to be compared with respect to shape are compensated by a time-consuming process of mental translation.

The results of an ongoing experiment that investigates this conjecture will be reported. On each trial of the experiment, the subject is presented with a briefly exposed pair of random patterns (decagons at a fixed level of visual eccentricity) terminated by a mask. The task is to determine whether the two patterns are identical except for spatial position. The probability of correct report is measured as a function of the onset asynchrony between the stimulus pair and the mask, and the way in which the function depends on the spatial distance between the stimuli within a pair is analyzed.

Orthographic structure and prefix processing

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The mental representation of prefixed words has been one of the main topics in the literature on lexical processes. In the present study the issue of prefix processing has been investigated by means of two lexical decision experiments on printed stimuli. In both the experiments we assessed the performance of subjects on prefixed non-words resulting from the illegal combination of a prefix and a real word in Italian. The prefixes included in the non-words varied along two dimensions: 1) length (in letters and/or syllables) and 2) quantitative relationship between the frequency of words including each prefix and the frequency of words in which the same orthographic sequence is present as a pseudoprefix.

The results showed a strong effect of both variables in determining the likelihood of prefix recognition with subsequent morphological decomposition of the stimulus. The results are compatible with models of lexical access in which lexical entries can be addressed through the activation of a morpheme access procedure.

Memory for descriptions of fictitious environments: some relevant variables

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Previous research (Perrig and Kintsch 1985; Taylor and Tversky 1992) on memory for verbal descriptions of fictitious environments has shown that people form multiple representations of the text: representations of the language of the text, that seem to be closer to gist than to exact wording, and representations of the situation that reflect the spatial relations described in the text. This level of representation has been called "mental model" by Johnson-Laird and "situation model" by Van Dijk and Kintsch (1983) and "spatial model" by Taylor and Tversky (1992). The "format" of situation models that originate from verbal descriptions of fictitious environments has been investigated by Perrig and Kintsch (1985) and Taylor and Tversky (1992) by varying the perspective ("Survey" and "Route") in which informationally equivalent descriptions of the same environments were written, and asking the subjects to verify both "Survey" and "Route" statements requiring spatial inferences. If the situation model is dependent on the perspective of the description, a "congruency" effect should emerge, consisting in a better performance when the perspective of the description and the perspective of the statements are congruent (Route-Route or Survey-Survey). Results and consequent interpretations of the two studies were conflicting. Congruency effects were found in the Perrig and Kintsch study and not in the Taylor and Tversky one. Since overall performance was higher in the Taylor and Tversky than in the Perrig and Kintsch study, one can hypothesise that the situation models that subjects form from verbal descriptions of fictitious environment are perspective-independent only when the environment is well-learned.

The aim of the present study is to reconsider the role of perspective on inferential reasoning, utilising simpler descriptions learned in different conditions. The hypothesis is that a single presentation (Expt. 1) or a short study time (Expt. 2) may induce mental representations that are perspective-dependent, while a longer study time (Expt. 3) may induce mental representations that are perspective-independent. Following Taylor and Tversky (1992), descriptions of two environments, a ZOO and a FARM CENTRE, containing nine landmarks each, were constructed in a Route and in a Survey version. Each description contained 12 Locative and 8 Non-Locative sentences. The two versions of each description were informationally equivalent, uniquely determined, consisted in 20 sentences (294 words) and had referential contiguity index of 0.74 (Ehrlich and Johnson-Laird, 1982). In each of the three experiments Route and Survey descriptions of the two environments were presented to two different groups of subjects (twelve subjects per group). Immediately after the presentation, both groups performed the same verification task, consisting in responding "True" or "False" to 24 inferential locative statements, 12 written in the "Survey" perspective (6 true and 6 false) and 12 written in the "Route" perspective (6 True and 6 False). In Experiment 1 the descriptions were presented on a computer screen, sentence by sentence, self-paced; in Experiment 2 subjects read each text, written on a sheet of paper for five minutes; in Experiment 3, subjects studied the two descriptions for ten minutes. Latency, accuracy and confidence rating for each inferential statement were recorded. A multivariate analysis of variance (MANOVA) on latency and accuracy as dependent variables was performed separately for each experiment. In Experiment 1 and 2 a congruency effect was

found for one environment only, the Farm Centre, and especially for the Survey statements. No congruency effects emerged in Experiment 3.

Altogether, the three experiments indicated that the influence of perspective on Inferential reasoning depends on different factors: study time, type of environments and perspective of inferential statements.

Identifying degraded stimuli in pure and mixed blocks: evidence for stimulus-driven shift costs

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Events are commonly responded to slower as they grow more variable among trials of a block. This result is often accounted for in terms of *strategic influence*: increased event uncertainty reduces the possibility of preparing for the processing demands of an event. The alternative account of *stimulus-driven influence* is often not considered: increased trial-to-trial fluctuations necessitate disengaging from previous processing demands to engage in current processing demands.

The present paper examines the primacy of either account in the domain of visual perception. Two types of degraded stimuli, noise-degraded and segment-deleted digits, were presented for speeded identification in pure and mixed blocks of trials. Using this design and stimuli, Los (submitted) reported *mix costs*, indicating that responding to either degraded stimulus quality was faster in pure blocks than in mixed blocks. The present experiments provided preknowledge about the quality of the forthcoming stimulus in mixed blocks, so as to enable subjects to prepare for the processing demands of a stimulus equally well in mixed blocks as in pure blocks. Consequently, a strategic account would predict the disappearance of mix costs. By contrast a stimulus-driven account would predict the persistence of mix costs, because preknowledge does not abolish the need to repeatedly shift from one type of processing to another for the benefit of the changing stimulus qualities in mixed blocks. The data supported the prediction of the stimulus-driven account. In addition, the mix costs were found to be concentrated in those trials where the stimulus quality was different from that of the immediately preceding trial. This indicates that mix costs are in essence *shift costs*, reflecting a fundamental inertia of the processing system to rapidly shift from one type of processing to another.

Cognitive predictors of speech understanding following a cochlea implant operation

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In a pre- and post-test design a group of deafened adults' cognitive and speech perception capabilities/strategies were examined two weeks before, and two weeks, six and twelve months after a cochlea implant operation. Pre-operative testing revealed that the deafened adults performed on a par with normal hearing controls on all cognitive and speech

perception tests, with one exception: the deafened adults showed a significantly lower level of accuracy on tasks demanding phonological processing (i.e., lexical decision tasks and rhyme-judgements). This difference was particularly prominent in those cases where the test items were either homophonous or orthographically similar to real words. Additional experimentation did not support the plausible alternative hypothesis that the results reflect a shift in information-processing strategy. This result was also correlated with the number of years that the individuals had been deaf and with performance on visual speechreading tasks. Post-operative testing showed that all subjects improved their speech perception capabilities with the implant compared to a pure visual condition (i.e., speechreading), but also that there was a large individual variation in the level of improvement. Furthermore, there was a significant relationship between level of improvement in speech understanding and performance on the rhyme-judgement and lexical-decision-making tasks, working memory span (i.e., reading span) and visual word decoding, across all test sessions. The results are discussed with respect to (a) how and what aspect of the internal speech is affected by deafness acquired post-lingually, (b) the role of internal speech in speech understanding, in visual speechreading and following a cochlea implant operation, and (c) pre-operative cognitive predictors of speech understanding with an implant.

Multiple conditionals: rules or models?

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Inferential problems based on several conditional assertions allow one to contrast the predictions of formal rule theories with those of the mental model theory. Solving problems, such as "If e, then a; if a, then b; if b, then c; if c, then d; what follows between a and d?", are a complex task from the standpoint of formal rules. They call for the application of several rules. In contrast, the task is relatively simple from the standpoint of the model theory, because the conclusion can be drawn from only a single explicit model of the premises. We tested the two theories by using a sample of problems for which they make opposite predictions. 20 Princeton University graduates were tested individually through a computer program that allowed us to measure reaction times. Each subject did 10 multiple-conditional problems based on 5 distinct sorts of problem. Content materials were always recipes for hypothetical dishes. We measured the accuracy of the conclusions, and two latencies, the response time and the reading time for each premise. The results showed an unexpected ceiling effect in the percentage of correct conclusions, but response latencies confirmed model theory. Responses to one-model problems were faster than those to multiple-model problems. Likewise, the time to read the fourth premise was less for one-model problems than for multiple-model problems.

Reaction-time estimates of stimulus specificity in visual discrimination and short-term memory

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Discrimination and short-term memory for the orientation and spatial frequency of sinusoidal luminance gratings were measured in a same-different task, with a variable time interval ($ISI = 0-10$ sec) between test and reference stimuli; accuracy and choice reaction times were recorded. In the spatial-frequency discrimination experiment the reference frequency was randomly varied from trial-to-trial and the test frequency was either the same or differed by $\pm 30\%$; in addition, the absolute and relative orientations of test and reference stimuli varied randomly between 0 and 90 deg. The orientation discrimination experiment was designed in a complementary fashion: the reference grating varied randomly in orientation, being compared to a test stimulus of the same orientation or differing by ± 10 deg; in addition, the test and reference stimuli varied in absolute and relative spatial frequencies by $0-2$ octaves.

The accuracy data indicated perfect or close-to-perfect storage of orientation and spatial frequency information in short-term memory, and confirmed previous findings that discriminations on one dimension are unaffected by stimulus manipulations along the second dimension. The RT data modified this picture: the RT for both spatial-frequency and orientation discrimination increased as a function of, respectively, the orientation and spatial-frequency differences of test and reference stimuli, and in both experiments choice RT, but not simple RT, increased as a function of ISI .

The results are consistent with a model where discrimination and short-term memory are based on early, sensory-based cortical representations where orientation and spatial frequency information is coded and organized in orientation columns and spatial frequency rows. If, as assumed by current models of visual cortex, functional similarity and distance are inversely related, search and read-out processes by which test and reference stimuli are compared would increase for widely different stimuli.

The time course of phonological encoding of phrases and sentences

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The production of an utterance involves the creation of several representations including at least one representation of the meaning and one of the form of the utterance (e.g., Levelt, 1989, Speaking). These representations are usually taken to be created incrementally, which implies that fragments of representations are passed on to lower level processors as soon as possible. Thus, speakers typically do not complete the semantic representation of an entire sentence before starting to generate its phonological form. Instead, phonological encoding begins as soon as the first part of the semantic representation has been completed. This incremental hypothesis is plausible, but not very specific. The study to be reported

investigates which part of the phonological representation is completed before utterance onset and how phonological encoding and articulation are coordinated in time.

To address these issues, a series of picture-word interference experiments was carried out. In these experiments, subjects saw pictures, which they described using NP-conjunctions ('the dog and the chair'), adjective-noun phrases ('the green chair'), or sentences ('the dog sits next to the chair'). Each picture was coupled with an auditory interfering word that could be phonologically related to one of the content words in the utterance or unrelated. Utterance onset latencies and utterance durations were measured.

For phrases and sentences, facilitation from phonologically related auditory words relative to unrelated ones was obtained only when the word was related to the first content word of the utterance, but not when it was related to a word in a later position. This suggests that prior to utterance onset only the first (phonological) word is phonologically encoded. The results are difficult to reconcile with recent claims that before utterance onset the first 'semantic unit' (usually the first NP; see Huitema, in press) or the first phonological phrase (Ferreira, 1991, *Journal of Memory and Language*) must be phonologically encoded.

The utterance onset latencies were shorter for sentences than for phrases. This unexpected finding is probably due to the fact that at the semantic level, not only the first phonological word, but the entire first (syntactic or phonological) phrase must be planned before utterance onset. Analyses of utterance durations support this hypothesis.

Action planning during the presentation of stimulus sequences: effects of compatible and incompatible stimuli

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Experimental designs requiring the simultaneous perception and reproduction of a stimulus sequence could help to clarify the relationships between perception and action. It is assumed that stimulus processing and action planning are based on identical codes and therefore are prone to interference, if there is a similarity between stimulus and response.

Five arrows were presented in 1-second intervals. The arrows pointed either to the left or to the right with equal probability. One of the five arrows was accompanied by a go signal at random. Ss then had to reproduce the sequence by pressing corresponding keys while the stimulus presentation continued. RT latencies and reaction intervals within a sequence were analyzed in five experiments.

Results showed increasing RT latencies the later the go signal was presented, i.e. the longer the sequence to be reproduced. This effect interacted with the compatibility between the arrow displayed with the go signal and the first reaction. Further, the results revealed that response onset asynchronies increased when stimuli were presented while the reaction was being carried out. This process also depends on the compatibility between the new appearing stimulus and the current segment of the reaction.

Processing deviant events in structured event sequences

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At the Elsinore meeting of the European Society for Cognitive Psychology we reported evidence in favour of the motor view of sequence learning. According to this view an internal model of the sequence of motor responses is generated in the course of processing structured event sequences, and it is used in an anticipatory way by predicting future responses from the sequence of preceding responses. This was shown in experiments where letters were presented, the sequence of which was either random or predictable. Occasionally, individual letters were inserted in the sequence of stimulus events which deviated from the regularities of the particular sequence. The experimental situation was arranged such that it was possible to generate deviations from the stimulus event regularities which did or did not violate the sequence of motor responses. Under these circumstances we observed reaction time costs with irregular stimulus events only when irregular stimulus events resulted in violations of the particular sequence of motor responses. This pattern of results was taken as evidence that subjects do not learn sequences of stimulus events but rather learn sequences of motor responses.

Here, we take a closer look at the nature of the reaction time costs observed with deviant motor response. For this purpose, we varied the type of motor response required to indicate the identity of a given stimulus event. Instead of pressing a particular response button subjects had to indicate the identity of a given target by pointing with a computer mouse to its position in a letter matrix. With this response total reaction time can be broken into three partial times: (i) the time from the display of the stimulus event until the beginning of the movement of the mouse (t_i), (ii) the movement time of the mouse (t_m), and (iii) the time from the end of the movement until a mouse button press (t_e) which terminated a particular response after having located the mouse symbol at the correct position of the target in the letter matrix.

Surprisingly, it turned out that the reaction time costs observed with irregular stimulus events that required deviant motor responses were due only to one of the three partial times: t_i and t_m were unaffected by deviant events whereas t_e was substantially longer with deviant motor responses as compared to regular responses. If it is justified to relate t_i to processes of stimulus identification and motor preparation, t_m to processes of motor execution, and t_e to processes of evaluating the effects of particular motor responses this pattern of results suggests that the effects of deviant events are due to irritations of operations which are concerned with processes of evaluating the effects of particular motor responses. To account for this observation mechanisms of motor planning and evaluation are discussed.

Reversing the Simon effect by manipulating task difficulty

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The Simon effect occurs when a nonspatial stimulus attribute indicates the position of the response. Even though the spatial position of the stimulus is not task relevant, it affects

response speed. We (Umiltà and Nicoletti, 1992; Nicoletti and Umiltà, 1994) proposed that attention orienting toward the imperative stimulus produces the stimulus spatial code, which in turn causes the Simon effect. This hypothesis predicts that the Simon effect should be found when attention moves toward the imperative stimulus, whereas a reverse Simon effect should be found when attention moves away from the imperative stimulus.

In Experiment 1, the subjects were required to perform a pattern discrimination task by pressing one of two keys, located to the left and right of the body midline. Two empty boxes, to the left and right of fixation, marked the possible stimulus positions. On each trial, a letter appeared for 100 msec. below the fixation mark, followed by a 500-msec. blank interval, and then the imperative stimulus was shown for 100 msec. One of the letters at fixation signaled a catch trial, in which the subject had to refrain from responding to the subsequent imperative stimulus. It was reasoned that attention would move from fixation to the imperative stimulus. A Simon effect of 26 msec. was found ($p < 0.01$). Compatible responses (390 and 378 msec. to left- and right-side stimuli, respectively) were faster than incompatible responses (409 and 407 msec. to left- and right-side stimuli, respectively).

Experiment 2 was identical to Experiment 1, except for the fact that the pattern discrimination was much more difficult. It was reasoned that the subjects would be in the process of moving attention back to fixation when the response was being selected. A reverse Simon effect of 24 msec. was found ($p < 0.01$). Compatible responses (587 and 576 msec. to left- and right-side stimuli, respectively) were slower than incompatible responses (565 and 546 msec. to left- and right-side stimuli, respectively).

In conclusion, the results support the hypothesis that the (irrelevant) spatial code of the stimulus depends on the direction of the attention movement.

Genetic associations with human memory

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In an effort to explore genetic components related to various forms of human memory, case-control studies of subjects aged 35–80 years have been undertaken. Memory performance was assessed by a series of episodic memory tasks and a series of semantic memory tasks. On the basis of aggregated data from these tasks, groups of high-performing and low-performing subjects were specified. Interesting dissociations in phenotypes and alleles of genetic markers of the complementary system in these two groups of subjects were observed. Several polymorphic candidate gene loci are in the process of being explored in relation to memory functioning.

Memory for labour pain

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A considerable number of recent research studies have been concerned with memory for pain. However, this research has focused on memory for the intensity of pain and on recall over relatively short periods of time. A study of long term (3–4 years) recall of pain was carried

out in which thirty-three women who assessed the nature and intensity of labour pain at the time of birth, repeated their assessments 3-4 years later using visual analogue and verbal descriptor rating scales. The accuracy of their recall of childbirth events was compared with records made at the time of birth. It was found that labour pain intensity was reliably recalled but accuracy of memory for its qualities was generally poor despite memory for childbirth events being excellent. These data will be discussed in relation to theories of memory.

Towards a more parsimonious theory of inferences

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How we control inferences during reading is still an open question. That we tend to minimise the inference processes seems very likely. A particular minimalist position on inferences has been proposed by McKoon and Ratcliff. According to this position two kinds of inferences are encoded automatically during reading: those that are based on easily available information and those that serve to establish local coherence.

In the present paper three issues will be discussed. One has to do with the control of inferences during reading. The two other issues deal with the process of making inferences, in particular with the question what it means to make an inference.

First, with respect to the control of inferences the dual character of the minimalist position by McKoon and Ratcliff will be discussed. On the basis of empirical research it will be shown that inferences that establish local coherence are not necessarily made during reading. A more parsimonious version of minimalism will be proposed in which only those inferences are made during reading that can be made on the basis of readily available information. Results of some experiments in the literature — in which local inferences are made on the basis of global information — should be reinterpreted in terms of locally available thematic information.

The second issue deals with automaticity of inferences. It is not the case that inferences that are made on the basis of available knowledge are automatic. They are made because the knowledge is available but they do require time. In an expert-novice paradigm it will be shown that experts make inferences that are based on available knowledge but that these inferences do require time. The question of the control of inferences should be distinguished from the question of the automaticity of inferences.

The third issue deals with the time course of the inference process, and in particular with the encoding of the inferred information over time. It will be argued — in agreement with e.g. McKoon and Ratcliff and Garnham — that it is too simplistic to consider the encoding of inferred information as a simple yes/no issue. Experimental evidence will be presented suggesting that inferred information may be stored over time in a different way than information that was explicit in the text.

The role of intentional retrieval in word fragment completion

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In priming tasks subjects are given the indirect instruction to respond with the first item that comes to mind, as opposed to directly thinking back to a prior study episode. Data from amnesic patients provide compelling evidence that conscious recollection is not a prerequisite for perceptual priming to occur. Whether recollection contributes to normal subjects' performance on priming tasks is less clear, however. It has been suggested that presence of levels-of-processing effects on priming provides a criterion for intentional retrieval (Bowers and Schacter, 1990). The main purposes of the experiment reported here was to investigate the extent to which normal subjects rely on intentional retrieval in primed word fragment completion, and to assess the usefulness of the "retrieval intentionality criterion".

The subjects were given either indirect or direct instructions, both shallow and deep study tasks, and a post-experimental questionnaire. Most of the subjects given indirect instructions reported that they became test aware but did not use an intentional strategy. There were small but significant levels effects for all aware subjects, irrespective of whether they reported having used an intentional or unintentional strategy, but no levels effect for the unaware subjects. About half of the subjects who were given a direct instruction reported using a pure intentional strategy, and they showed a strong levels effect. The rest of the subjects reported a mixed strategy (intentional plus unintentional), and for these subjects the levels effect was attenuated. To conclude, the results suggest that subjects who become aware are likely to show a levels effect whether they report intentional retrieval or not. An explanation of this conflict between levels effects and self-reports, as indexes of intentional retrieval, may be that the basis for levels effects in aware but unintentional subjects is different from that in intentional subjects (e.g., "involuntary reminding" as suggested by Richardson-Klavehn et al., in press).

Spatial cueing in vision: noise reduction or signal enhancement?

Hal Pashler and Ling-Po Shiu

Do we perceive a visual stimulus more efficiently or clearly when we know in advance where in the visual field it will be presented (and there are no other stimuli in the field)? Many well-known studies seem to answer the question affirmatively, finding that spatial cues enhance responses to stimuli in cued locations in (more-or-less) blank fields. We present new experiments using spatial cues in visual discrimination tasks including letter discrimination, word recognition and vernier acuity. The results argue against perceptual enhancement. While precues sometimes improved subjects' accuracy, this occurs only when sources of noise are present (such as seemingly innocuous masks over blank locations, as employed by earlier investigators). When speeded responses were required, valid cues led to faster responses, but analyses indicate this is mostly due to speed-accuracy tradeoff. In conclusion a wide variety of different cueing and uncertainty studies (including threshold experiments) will be reviewed

from a noise-reduction perspective; it will be argued that there is no good evidence for perceptual enhancement, and that if such enhancement exists, it must be tiny in magnitude.

Effects of syllable frequency, neighbourhood size and neighbourhood frequency on lexical access

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A major issue in reading is how orthographic similarity influences visual word recognition. Recent research on neighbourhood effects in visual word recognition has produced conflicting results. For instance, facilitatory effects of neighbourhood size (e.g., Andrews, 1992), but inhibitory effects of neighbourhood frequency (e.g., Grainger, 1990), and inhibitory effects of syllable frequency (e.g., Carreiras, Alvarez, and De Vega, 1993) have been observed.

The current experiments were performed by manipulating word frequency and syllable frequency, but selecting words that had no higher frequency neighbours, and holding constant the neighbourhood size among conditions.

The results of the first experiment, in which we used the lexical decision task, showed facilitatory effects of word frequency and inhibitory effects of syllable frequency. Similar results were obtained in the second experiment using the progressive demasking task. Some other experiments in which the frequency of neighbours or the size of the neighbourhood are manipulated while holding constant the syllable frequency are being performed. The results are interpreted in terms of activation and selection of lexical candidates in visual word recognition.

Lexical effects in reading pseudowords in shallow orthographies?

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Comparing the strategies used in processing different orthographies may be a productive way to test models of reading. Among the factors differing among languages, the degree of transparency between orthography and phonology has proved to be a significant dimension in how readers preferentially process printed material. A recent study by Sebastian-Galles (1991) has shown lexical effects in pseudoword naming in Spanish, a language with a shallow orthography. These effects have been taken as evidence questioning the existence of an independent, non-lexical route in reading based on grapheme-to-phoneme correspondence rules (cf. Seidenberg, 1992). Rather, such results are considered analogous to Glushko's (1979) inconsistency effect obtained in English, a language with a deep orthography.

Italian is quite similar to Spanish as far as the grapheme-to-phoneme correspondences are concerned, even if stress is generally not predictable. In this study, we tested the generality of Sebastian-Galles' results by trying to replicate in Italian the lexical effects in reading

pseudowords. The experimental material consisted of pseudowords derived from real words containing the graphemes g, c, and sc, whose pronunciation, while regular, is context-dependent. When followed by the vowels e or i, g is pronounced /dʒ/, c is pronounced /tʃ/, and sc is pronounced /ʃ/. When followed by the vowels a, o, or u, they are pronounced /g/, /k/, and /sk/, respectively. Two factors were manipulated: the frequency of the word from which pseudowords were derived (high and low frequency words), and the consistency of pronunciation. For this latter, two pseudowords were derived from each word. In one of the pseudowords, the target grapheme was pronounced in the same way as in the word (consistent pronunciation). In the other pseudoword, the target grapheme required the alternative pronunciation of the word (inconsistent pronunciation). For example, from the word *canguro* (kangaroo), both *cangaro* (consistent pseudoword) and *cangero* (inconsistent pseudoword) were derived. Subjects were required to read aloud lists of pseudowords containing, in addition to consistent and inconsistent stimuli, pseudowords without any of the target graphemes. Reaction times and errors were recorded.

No differences emerged between consistent and inconsistent stimuli. The results are discussed with reference to alternative models of reading.

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A model of the influence of spontaneous rhythms on learning

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It is well-known that human subjects can be characterized, according to the nature of their spontaneous rhythms, as belonging to two main categories: the one of subjects with binary and the other of the subjects with ternary rhythm. The problem of the influence of spontaneous rhythm on learning is an open question. In this regard previous experiments showed more sensibility to structure in subjects with ternary rhythm and more speed in learning and sensibility to signals in subjects with binary rhythm. In one of the most recent experiments subjects with ternary rhythm showed better ability in discriminating between the vocal or instrumental form of the same theme of atonal music.

To build a model of the behaviour of the subjects, we used a 3-layer feedforward neural network with a backpropagation learning rule. In the training phase the network received as inputs vocal or instrumental pieces (suitably digitalized) and it should learn to discriminate between these two types.

In the generalization phase the network received as inputs parts of the piece used in the experiment with human subjects and its behaviour was studied, measuring the classification errors. We used three different types of network: normal, with binary and with ternary spontaneous rhythm. The two latter were built in two ways: introducing a rhythmic modulation in the activating function of the hidden units and by introducing a rhythmic modulation in the learning law. The first way gave more interesting simulation results, showing a remarkable behavioural difference between the case of ternary rhythm and the others.

Conditional reasoning in two types of tasks

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We present four experiments in the domain of conditional reasoning. The tasks used were the four card selection task (Wason, 1966) and conditional syllogisms (modus ponens and modus tollens inference). We have six types of conditional sentences, depending on the content, which are used in both tasks. We have selected subjects 8, 11, 14 and ≥ 18 years old, and each subject was randomly assigned to only one task and one experiment. It was expected that some of the conditional sentences would improve subjects' results, because of the social meaning of certain conditional sentences used, as suggested by several experiments, for example those based on the pragmatic reasoning schemes theory (Cheng and Holyoak, 1985, 1989). It was also expected that the modus ponens inference would be easier than the modus tollens, as well as that the selection of the *p* card would be easier than the selection of the $\sim q$ card, as suggested by several authors (cf the mental models theory, Johnson-Laird, 1983; Johnson-Laird and Byrne 1991).

Results point to a substantial lack of success in the selection task, independent of the type of conditional sentences, and great success on the propositional task with syllogisms, the results with the modus ponens inference being significantly better than with modus tollens. These results are common to all age groups.

As we have no data to confirm the pragmatic scheme facilitation effect, results are interpreted based on mental models theory and on Evans' (1984, 1989) two-stage theory. We also defend a new type of answers classification, for the syllogism task, which gives us a better understanding of how subjects' reasoning depends on the conditional content.

The role of verbal encoding in the differential access of spatial dimensions

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When subjects are asked to retrieve objects placed in different directions in an imagined environment, a dimensional effect has been reported on RTs: up-down < front-back < right-left (Franklin and Tversky, 1990). This effect has been attributed to the nature of the underlying mental framework. However, it cannot be ruled out that the encoding of directional terms plays some role in this differential access. In order to minimize verbal

encoding a pointing procedure was created (Experiment 1). In the learning stage, subjects self-paced descriptive sentences of landmarks by means of the arrows of the computer keyboard, previously assigned to the four horizontal directions. In the test stage, subjects were given the names of landmarks and they had to point to their directions by means of the corresponding arrow keys. In Experiment 2 the materials and procedure were identical, except that both at the learning and at the test stage subjects named the verbal labels (front, back, right, left) to indicate the corresponding directions. In both experiments the reaction times and errors were collected.

The results showed that the differential accessibility of dimensions was reversed (front-back > right-left) when the pointing rather than the naming procedure was used for encoding and retrieving directions, challenging Franklin and Tversky's framework hypothesis. We discuss whether the differences between pointing and naming are due to different kinds of mental frameworks, or are mainly governed by subjects' policy in the distribution of working memory resources.

Influences of chronological-time distance in linear orders of autobiographical events

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This paper explores whether chronological information can be considered an integral part of the memory representation of autobiographical events. This was accomplished by applying a comparative-judgment paradigm known from studies on linear orders. Each subject in the present experiment generated a chronologically ordered list of six individual events. From these, all possible pairs of events were presented on a computer screen and the subject was asked to decide for each pair as quickly as possible which of the two events occurred earlier in his or her life. The judgement times revealed the typical distance effect: the further apart two events in the original list, the faster the reaction times. Additionally, the influence of the chronological-time distance (which is, of course, confounded with list distance) was assessed by computing its partial correlation with judgement time. This relation turned out to be substantial, while at the same time the partial correlation between list distance and judgement time dropped to zero. These findings strongly support the view that chronological information constitutes an integral feature of autobiographical memory. Thus, autobiographical events seem to behave rather differently to other linearly ordered items.

Implicit learning of a grammar with a recursive rule

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One of the psychological approaches in the study of language learning focuses on the process of learning grammatical rules when exposed to sentences of an artificial language (for a review, see Reber, 1989). The language used in the standard procedure consists of five letters, being the final terms, and a regular grammar (Reber, 1967). The experimental task is divided in two phases. First, subjects are exposed to a set of sentences of the artificial language.

Subsequently, they are presented with a set of partly correct and partly incorrect sentences, and asked to give grammaticality judgements. An extensive body of experimental research with this paradigm supports the finding that people are able to infer rules of a regular grammar. More importantly, they appear to learn these rules implicitly. I.e., when making grammaticality judgements, subjects behave in accordance with the grammar rules without being able to describe them explicitly.

Recently, the claim that people are able to process grammatical rules without awareness has been questioned, however. First, it is disputed that the rules inferred by language learners are indeed complex abstract grammatical rules. According to the critics, the learner's performance can be explained by assuming that they learn micro-rules, e.g., bigrams. Second, they claim that these micro-rules are accessible to consciousness (Perruchet and Pacteau, 1990; Shanks and St. John, in press). In the present experiment one recursive rule is added to the standard grammar originally used by Reber (1967), which transforms the grammar to a context-free grammar. This rule allows for self-embeddings of arbitrary depth. This variation allowed to test two hypotheses. First, it could be tested whether subjects are able to learn implicitly a grammar with recursion in the same way as they appeared able to learn rules of a regular grammar. Since recursion is a property of natural language grammars, this methodology allowed us to study the learnability of recursive grammatical rules resembling those occurring in natural languages. Second, if subjects can indeed learn grammars including these kinds of rules, this cannot be accounted for by supposing that they learn micro-rules like bigrams. Such a result would rather support the view that the grammatical rules inferred are indeed complex and abstract. This finding would eventually emphasise the importance of environmental factors in natural language learning. In the paper to be presented, we will discuss the experimental results and their implications for theories of implicit learning of grammatical rules.

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Constraints of object structure on descriptive strategies and response latency

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The purpose of this research was to show some of the rules governing the description of spatial entities. Especially, we examined to what extent the structure of an object places constraints on the order in which its parts are entered into a description. Materials were adapted from those used by Levelt (1982a) to explore regularities in descriptive strategies. They consisted of networks in which coloured circles were connected to each other by horizontal and vertical lines. But new variations on the network structure were introduced in order to explore several factors which were not systematically dealt with in the Levelt study. These modifications were expected to affect the probability of occurrence of descriptive strategies. Subjects (adults) were asked to describe networks presented visually. They had only one constraint: to start their description from a specific circle from which two branches went out in opposite directions. At this point, subjects had to make a choice as to which branch to describe first.

Results show that these variations increase the cognitive load associated with the processing of both branches and they result in the emergence of specific descriptive strategies. In addition to recording subjects' responses, we measured the time elapsing before the subjects started their description once they had been informed of which circle the description should start from. Data show that increasing the complexity of the networks results in increased response latency. Variations in response latency indeed reflect the cognitive load associated with the emergence of descriptive strategies.

Word-form encoding in speaking: segmental speech errors as failures of syllabary access

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Word-form encoding in speaking is the process by which the brain constructs a phonetic plan for a word. This involves the retrieval from memory of codes for the morphemic, metrical, and segmental properties of the word in order to derive an articulatory program. Elsewhere, I have advanced a computational model for this encoding process. Central to the model is the proposal by Levelt (1992) that morphemic representations are mapped onto stored syllable programs by temporarily grouping the morphemes' segments into phonological syllables, which are then used to address the programs in a syllabary. It has been shown by means of computer simulations that the model accounts, inter alia, for key empirical findings about the time course of word-form encoding in picture-word interference experiments, about the order of encoding inside and between the syllables of a word, and about word and syllable frequency. In the current paper, I demonstrate that the model can also fruitfully be applied to some of the basic empirical findings about segmental speech errors. In particular, computer simulations showed that the model captures, among other things, some of the basic findings

about the relative frequencies of the occurrence of the types of substitution errors (i.e., anticipations, perseverations, and exchanges) and their dependence on the speaking rate. In the existing models, segmental errors are explained as failures in the construction of a phonological representation for the utterance. By contrast, in the proposed model, such errors are due to indexing failures of the device that maps phonological representations onto a mental syllabary.

Problems of foundational analysis

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There seems to be a gap between philosophy of mind, metascience and practical empirical work in cognitive psychology. This grey zone concerns the conceptual analysis of the basic theoretical concepts, methods and argumentation. The standard way introducing concepts is to define and experimentally operationalize them. After a successful operationalization no further questions are required, because the empirical facts are seen as the core of the scientific practice. Unfortunately, this traditionally empiricistic practice neither encourages discussion about the conceptual basis and justification of cognitive psychology, nor the promotion of its conceptual level.

The ultimate ground of scientific action is always intuitive. All the methods and theoretical notions contain elements, which philosophers sometimes call pretheoretical. Scientists' cultural backgrounds, schooling, conceptions of human mind, skills etc. affect their practical scientific work and the way they do it. This means that consciously formulated theoretical concepts have in practice intuitive dimensions, which influence the interpretations of theoretical notions. These intuitive dimensions of concepts can be called conceptual postulates.

The intuitive dimensions of concepts are particularly important in a science like psychology, because the theory ladenness of the facts is so evident in it. Every experiment presupposes some theoretical background. It has its experimental presuppositions. The experiments make sense only if the instrumentation and design are theoretically justified. However, the inbuilt theoretical underpinnings are decisive for the type of facts the experiments bring about, and in this sense the experimental presuppositions are very decisive for the scope and significance of the experimental facts. Facts are answers to questions and the way the questions are posed influences the answers.

Conceptual postulates and experimental presuppositions typically belong to the pretheoretical intuitions behind cognitive knowledge. Unfortunately, very little attention is paid to these aspects of theoretical knowledge in cognitive psychology. It is easy to show that explication of the tacit assumptions behind the theoretical notions and experimental paradigms has greatly promoted progress in psychology. This is why, I argue for the thematization of a specific field of research called foundational analysis, to encourage discussion about the intuitive and pretheoretical foundations of cognitive psychology.

As a research field foundational analysis would be similar to cognitive simulation or psychometrics, in that it would adopt its method outside psychology to improve the discussion on psychological matters within psychology. Of course, the method of foundational analysis would be the one of philosophy and in a wider sense humanistic

research. Its goals would be similar to foundational analysis in mathematics and logic. This means the critical analysis and systematization of the theoretical notions and systems.

Thus foundational analysis means discussion about the justification and meaning of the theoretical concepts, methods and argumentation in cognitive psychology. It is critical to establish the foundations of cognitive psychology in an explicit and argued manner, instead of bare intuition.

The interaction between superficial and semantic structure in syllogistic reasoning: evidence from the figural effect

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The aim of this paper is to demonstrate the influence of semantic factors on the location of the terms in syllogistic conclusions. A well-established effect is that, depending on the superficial structure of the problem, subjects seem to prefer conclusions in one direction rather than another. Johnson-Laird and Steedman (1978) found that premises of the form A-B, B-C produced a strong preference for A-C conclusions, and these syllogisms were quite easy, while premises of the form B-A, C-B produced a preference for C-A conclusions and the corresponding syllogisms were very difficult. Semantic relations among concepts could also be asymmetric. For example, the inclusion relation is asymmetric, while the identity relation is symmetric.

An experiment is reported demonstrating that asymmetric relations could reverse the preferred direction when the superficial structure is complex (B-A, C-B). An explanation of this interaction between semantic and superficial factors, in terms of mental models, is provided.

Visual attention and saccadic eye movements: theoretical remarks

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Saccades of primates are usually goal-directed, depending on the task demands and the nature of the inspected scene. To realize this function brain processes are required that select the target location for the following saccade. Some authors have suggested that this is one of the jobs of visual attention. Currently, there are no detailed neuro-cognitive models how visual attention selects a certain saccade target (that is, its landing position). A few remarks should help to take steps towards such a model. First, relevant psychological and neuroscience data concerning the control of saccades will be presented and summarized. Next, a brief sketch will be given about the suggested functions and mechanisms of visual attentional processes in the primate brain. Finally, the analysis of saccade and visual attention control will be related and a few predictions spelled out.

Time course of elementary processes underlying visual selective attention: shape of hazard functions

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The shape of hazard functions of elementary processes underlying visual selective attention (cf. Shibuya, 1991; Shibuya and Bundesen, 1988) was investigated in detail. On each trial, the subject was presented with a brief exposure of a stimulus display consisting of a circle or a cross at fixation. A mask display was presented at the offset of the stimulus display. The exposure duration of the stimulus display was randomly varied between trials, from 0 up to 125 msec., with a step size of 4.17 msec. The subject was instructed to report whether the stimulus display showed a circle or a cross, if necessary by guessing. Guessing bias was estimated from those trials at which the exposure duration was 0 msec.

The analyses of the data showed that the hazard functions had an initial steep increase followed by a gradual decline. Implications of the results for the identifiability problem (the problem of distinguishing between serial and parallel processing models) are discussed.

Time courses of context effects in the picture-word task: experimental data and computer simulations

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In the picture-word task, subjects are asked to name a picture and to ignore an accompanying word. The time to name a picture increases when the word is semantically related to the picture, as compared to the situation with an unrelated word. So, the picture of a CAT is named more slowly when accompanied by the semantically related word *horse* than when accompanied by the unrelated word *house*. The effect is known as the semantic interference effect.

Naming times to the picture decrease when the accompanying word is orthographically related to the name of the picture, again as compared to the situation with an unrelated word. So, the picture of a CAT is named faster when accompanied by the orthographically related word *cap* than when accompanied by the unrelated word *house*. This effect is known as the orthographic facilitation effect.

The interaction of these effects can be studied by presenting words that are both semantically and orthographically related: For instance the picture of a CAT accompanied by the word *calf*.

The time courses of the semantic interference effect, the orthographic facilitation effect and the interaction of these effects were investigated in a picture-word task using a within-subjects design. We used five different Stimulus Onset Asynchronies (SOAs): -200 msec. (word first), -100 msec., 0 msec., +100 msec. (picture first), and +200 msec. The semantic interference effect was restricted to a small SOA range around zero. The orthographic facilitation effect spanned almost the whole SOA range used (-200 to +100 msec.). Finally, the interaction of these two effects was found to be significant, reaching its maximum when the

words were presented shortly before the pictures (SOA = -100 msec.). A theory that explains both effects and their interaction is described, and computer simulations that fit the data at a qualitative level are reported.

The activation of ambiguous words during spoken language comprehension

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The time-course of activation of the meanings of ambiguous words in the process of identification of these words during spoken language comprehension is investigated in a cross-modal lexical decision study. Polysyllabic ambiguous words (e.g., *present*) with a dominant (e.g., *donated object*) and a subordinate (e.g., *time*) meaning occurred in a sentential context that either strongly constrained one of their meanings, or imposed only weak constraints on it, as illustrated in the following example:

	Strong Context	Weak Context
Dominant Bias	The child couldn't wait until Christmas to unwrap the present	The child was delighted by the present
Subordinate Bias	The lady talks more about the years of her youth than about the present	Many people never worry and live only in the present

While the subjects are listening to one of the sentences, they make a lexical decision to a visual target word which is either related to one meaning of the ambiguity or is an unrelated control (e.g., GIFT- RICE; FUTURE-CENTER). The target appears at one of three different points, indicated by *: soon after the onset of the ambiguous word (e.g., pre*sent), at its isolation point (e.g., prese*nt), and at its offset (e.g., present*). The aim of the study is to elucidate whether and when context operates on the process of access to the meanings of an ambiguous word. The prediction is made that the nature of context — i.e., strong vs weak — interacts with dominance — i.e., more vs. less frequent meaning of the ambiguity — in determining the activation of the meanings of the ambiguous word during its process of identification. More specifically, while the dominant meaning is expected to be activated regardless of contextual bias, the activation of the subordinate meaning may depend on the context of occurrence of the ambiguous word.

Interference and inhibition in the production of complex sentences

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In our research we examined the role of interference processes in the production of complex sentences. According to Levelt's model the speech production unit (Levelt, 1989) can be conceptualized as a system of independent modules. This system includes a speech monitoring component responsible for the on-line control and repair of speech processes. While basic modules operate in a highly automatized manner the monitoring process is resource consuming.

In two experiments, 57 college students were presented 80 sets of three semantic concepts each. They were then asked to form a semantically correct and syntactically well-formed sentence from each set. The sets varied the order in which the concepts were presented. In a baseline condition the subjects could produce semantically and syntactically correct sentences without changing the order of the concepts. In two interference conditions the order of presentation would have led either to semantically or syntactically incorrect sentences. Hence, in order to produce a correct sentence subjects first had to rearrange the concepts. In a resource condition the order of presentation would have led to a syntactically and semantically incorrect sentence. In this condition, accordingly, the production of correct sentences demands the biggest number of restructuring operations compared to the other conditions.

Subjects produced significantly more errors in the interference conditions compared to the resource condition. This finding is in line with the view that in the interference conditions subjects had difficulties inhibiting inadequate responses that were suggested by the order in which the concepts in each set had been presented. According to Levelt's model, one of the main tasks of the speech monitoring component is to inhibit interfering information and conflicting action tendencies. Differences in the amount of syntactical and semantical errors support our view that monitoring processes operate at different levels of the speech production process.

The findings are discussed in the framework of a modular speech production model and the concept of inhibitory efficiency.

Skill-based automaticity: a theoretical framework

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Automatic processing of information can be either inborn or it may reflect skill acquisition. Two different mechanisms have been suggested to explain skill-based automaticity. On the one hand, it has been argued that automatization results in improvement of the mental computations required to perform a given task. Thus, according to this approach automatic and non-automatic processing differ only in the efficiency of mental computations. On the other hand, it has been suggested that automatization results in the development of a data base for memory retrieval, rather than an output of mental computations. We believe that both

mechanisms may be involved in skill automatization. A theoretical framework for skill-based automaticity based on this notion and on the notion of transfer of automatic performance is proposed. In particular we define a transfer space in terms of a set of Stimuli, a set of Representations and set of Algorithms, employed in the training and the transfer tasks. The original learning conditions and the conditions leading to transfer in the case of each skill-learning mechanism, are represented as points within this space. Thus, this conceptualization offers a distinction between the two mechanisms, in terms of the conditions that will show transfer in the case of each of the learning mechanisms. In addition, within this space, autonomous automatic processing may be seen as a special case of negative transfer.

Attentional asymmetries in English and Arabic readers

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How do reading habits influence attentional asymmetries? Does the right-to-left directional scanning of Arabic readers result in an attentional advantage for words presented in the left visual field, or is the right visual field advantage seen in English readers dominant regardless of reading habits? These questions were investigated with English and Arabic readers who performed a lexical decision task. Appearance of the letter-string was sometimes preceded by a locational cue that indicated whether it would appear in the left (LVF) or right visual field (RVF). Eye movements were recorded.

Both groups of readers made faster decisions to letter-strings appearing in the RVF, and showed an advantage for letter-strings preceded by a cue. Arabic readers made faster eye movements towards stimuli appearing in the RVF, and these earlier fixations upon the targets gave a greater opportunity for an increased number of fixations on the target. Both groups of readers gave less visual attention to RVF stimuli than to LVF stimuli (gaze durations). These results indicate a consistent RVF asymmetry in both groups of readers.

In a further study of the inspection habits of bilingual Arabic readers presented with sentences in English and Arabic, we report that Arabic sentences receive longer fixation durations relative to English, and fewer fixations, resulting in similar sentence reading times overall. The differences in inspection patterns can be related to morphological differences between these languages and to the RVF asymmetry in the perceptual fields of Arabic readers.

On learning to categorize archaeological objects

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In studies of category learning and category representation usually only two categories are involved. In the present study, subjects learned a five-category system of archaeological spearheads. The amount of processing effort needed in a two-category system is probably less than the effort needed to discriminate between five categories. More specifically, in a two-system categorization each feature helps to discriminate between the two categories or is irrelevant. With more categories, there are more possibilities to consider. The question, then,

is how acquisition methods based on simultaneous discrimination between all five categories compare to acquisition methods that spread the amount of learning over the trials.

Results of a study are reported that compared three different acquisition methods. A first method required learning of the five categories at once. The second method started with all stimuli categorised in two superordinate categories. During learning, these categories were progressively differentiated until all five categories were identified. In the third method, initially only two of the five categories were learned. Later on, the other categories were added one by one until all five categories could be identified.

Discussion of the results relates the findings to exemplar models and to knowledge-based models of categorization.

The influence of visuomotor factors on eye movements in reading

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Several studies have already shown that the oculomotor behaviour during reading is not only influenced by the on-going processing of the encountered words, but that it depends also on visuomotor factors. For instance, it has been reported that the probability of refixating a word as well as the gaze duration on this word depend strongly on the word's length and on the eye's initial fixation position in the word. In the same way, the probability of skipping a word depends on the word's length and on the position relative to this word where the eye is launched from.

In the present paper, I will present new results providing more evidence towards the idea that low level visual and oculomotor factors do strongly affect the way the eyes move during reading (i.e. the probability of refixating words and the probability of making a regressive saccade towards a previously fixated word). The necessity for controlling at least a posteriori the eventual effects of visuomotor factors when using eye movements as a tool to approach cognitive processes will be discussed.

On the processing of linguistically marked contrast relations

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Some devices in structuring discourse can be attributed not only a semantic but also a pragmatic function. These devices serve not only to convey a particular meaning but also reflect a particular involvement or intention by the speaker/writer. In this paper the conjunction 'but' will be discussed focusing on its pragmatic function in discourse. It will be demonstrated how this pragmatic function affects the on-line processes in understanding contrastive sentences.

The pragmatic effect of the conjunction 'but' is an asymmetric effect. The conjunct that follows 'but' dominates the conjunct that precedes 'but'. The second conjunct reflects the opinion of the writer more than the first conjunct. Readers indeed interpret contrastive sentences in that way. Accordingly, the second conjunct is likely to constitute the topic of the subsequent discourse. This pragmatic effect of 'but' will be demonstrated in several off-line judgment tasks.

In an on-line reading experiment it is investigated whether the asymmetry of 'but' affects the processes in interpreting contrastive sentences. If the second conjunct (the conjunct after 'but') dominates the first conjunct, is it then the case that concepts in the second conjunct are more available for the reader/listener than concepts of the first conjunct? The asymmetry effect of 'but' is investigated by comparing 'but' with the symmetric conjunction 'and'. The effect of another factor, negation, was investigated as well. Both factors will be demonstrated to affect the availability of information in an on-line probe recognition task.

On the semantic interpretation of events and the "Filled Interval Effect" in time estimation

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On some occasions, time seems to fly (such as when one is trying to solve a maths problem). On other occasions time just drags by (such as when one is awaiting someone who is late already). This phenomenon has been referred to as "the filled interval effect". It is generally explained by focusing on some quantifiable aspect of the information that is dealt with during the presentation of an interval (e.g. storage size, processing effort). Recently however, Jones and Boltz (1989) have pointed out that the temporal structure of events (e.g. of musical tunes), may give rise to temporal expectancies which can explain the subjectively perceived duration of a certain time interval. More specifically, it may be hypothesized that subjects make specific semantic interpretations of the series of events that occur during a time interval, and that this interpretation evokes the temporal expectancies that affect duration estimation.

The paper reports a study in which this hypothesis is further explored. Subjects had to estimate the duration of beep-sound sequences with different temporal structures. In addition, they were asked to give a semantic interpretation (e.g. a metaphor, a story) for each of these sequences. The findings of this experiment will be discussed with respect to (1) the hypothesis, and (2) to their implication for studies on time perception in which subjects estimate the duration of intervals filled with "meaningless" events.

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Frequency effects and lexical inhibition in spoken word recognition

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Among the major suggestions as to how discrete words are segmented in continuous speech, one focuses on sensitivity to prosodic structures (a prelexical procedure where segmentation is based on strong syllables, Cutler and Norris, 1988), while another concentrates on lexical knowledge (lexical inhibition as in TRACE, McClelland and Elman, 1986). The present study examined the separate or combined effects of these two segmentation procedures by employing a cross-modal repetition priming paradigm. Subjects heard Dutch CVCC words of high or low frequency (e.g., *melk* 'milk' or *kelk* 'chalice', respectively) which were embedded in bisyllabic pseudoword strings. The second syllable of this pseudoword was either weak (as in *melkem* or *kelkem*) or strong, and the cohort size of competitors starting with strong syllables was either small (*melkeum* and *kelkeum*) or large (*melkaam* and *kelkaam*). These auditory pseudowords served as primes for a visual target (MELK or KELK) to which a lexical decision was made.

As predicted by lexical inhibition, *kelkem* had the largest facilitatory effect on the low-frequency target KELK, *kelkeum* had an intermediate effect, and the facilitatory effect of *melkaam* was smallest. For high-frequency targets (MELK) there was no difference between the facilitatory effects of *melkem*, *melkeum* and *melkaam*. These results underscore the importance of lexical inhibition in spoken word recognition.

Detecting ghost phonemes: the "liaison enchaînée" in French

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In two experiments conducted with the generalised phoneme monitoring task, subjects were asked to respond to consonant targets included in a sentence context. Phoneme targets correspond to a "lexical initial consonant" and a "liaison consonant". The "liaison enchaînée" consists in the following double phenomenon: when 2 vowels are in contact at a word boundary, a latent consonant appears at the boundary between the two words and it is resyllabified at the attack of the second word (i.e. *un arbre* (a tree): *un* [ɛ̃] and *arbre* [aʁbʁə] but *un arbre* [ɛ̃naʁbʁə] when they appear together). The consequence of such a phenomenon is the lack of correspondence between syllable boundaries and word boundaries and the creation of a false beginning of word (**narbre* does not exist in French). Results showed that the liaison consonant induced many more errors and longer reaction times than lexical phonemes. If, as it is assumed by the dual code models, subjects need to access a word in order to recognize the phonemes of this word, they show a difficulty in detecting liaison consonants because these segments do not belong to any canonical representation of a word. Furthermore, RTs to liaison phonemes according to the prosodic context in which they were included: clitical group (*un navire* / *un avion* [ɛnaviʁ / ɛnavjɔ̃] a boat / a plane) and

phonological phrase (*un grand éléphant* / *un grand téléphone* [ɛgʁɑ̃tɛlɛfɑ̃ / ɛgʁɑ̃tɛlɛfɔ̃]). We noticed that the more cohesive the group is, the greater is the difference between the detection of liaison and initial consonants. These results suggest that subjects do not necessarily treat the words one by one in a strictly left-to-right parsing but rather use the phonotactic organisation of the speech stream to find word boundaries. Then, segmentation could be based on signal fragments larger than the word, which could be prosody-dependent.

Causes compete, effects collaborate: types of cue competition in predictive and diagnostic causal induction

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Several researchers have recently claimed that higher-order types of learning, such as categorization and causal induction, can be reduced to lower-order associative learning. These claims are based in part on reports of cue competition in higher-order learning, apparently analogous to "blocking" in classical conditioning. Experiments will be presented which cast doubt on both the associationistic ontology, which collapses predictive and diagnostic learning, and the most widely used associationistic learning rules. A new experimental design will be introduced that extends traditional blocking procedures. In this design a redundant cue was either paired with one or with two previously learned predictive cues. In the predictive learning conditions the cues represented causes, whereas in the diagnostic learning condition they represented effects. As predicted by causal-model theory, subjects proved sensitive to the causal status of cues and outcomes. Predictive and diagnostic learning involve structurally different competition processes.

POSTERS

Syntactic and semantic cues in plural anaphor resolution

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Two experiments were carried out to investigate the influence of superficial and semantic distance of the antecedents in the interpretation of plural pronominal anaphors. Subjects read sentences that contained three proper names (two feminine and one masculine), as potential antecedents followed by a plural pronoun "they" in its Spanish feminine form "ellas". Each sentence had three clauses, as it is shown below. The third sentence always contained the pronoun "ellas". E.g.: Eva y Sara compitieron en las pruebas de atletismo en Barcelona, Abel participo en judo en Las Palmas, Ellas se clasificaron para la final. The superficial distance was manipulated by placing the two feminine antecedents in two different clauses or in the same clause. The semantic distance was manipulated by describing the two feminine antecedents acting in the same or in two different locations of the physical space.

In the first experiment, a self-paced reading time task was used. Subjects read the third clause more quickly when the two feminine antecedents were superficially close than when they were superficially distant. However, the semantic manipulation did not produce any reliable differences. In the second experiment a continuation task was used. Subjects read the first two clauses as in the first experiment, and immediately after presenting the pronoun "ellas" they had to produce a sensible continuation. We measured the time from the presentation of the pronoun until the beginning of the utterance. The results showed that there was an interaction between superficial and semantic distance. The results are discussed in relation to mental model theory, taking into consideration the superficial and meaning-based levels of the representation.

The effect of heuristics training in statistical problem solving

Salvador Algarabel and Carmen Dasi

The use of efficient heuristics is one of the major differences between the expert and the non-expert approach to solving a problem. However, there is no agreement among researchers on the meaning of heuristics. On the one hand, researchers in artificial intelligence consider strategies so general as means-ends analysis as a useful strategy to solving problems but researchers on mathematical education think of heuristics as something more concrete and specific to a particular field. Taking into account this difference we present data comparing several groups of subjects of an introductory university statistics course trained under different kinds of conditions trying to clarify whether teaching of heuristics is useful for improvement of performance.

Syllable and visual word recognition in Spanish: evidence from the temporal separation technique

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Some recent experiments (Carreiras, Alvarez and de Vega, 1993) have shown that syllable frequency in Spanish influences reaction times and percentage of errors in Lexical Decision and Naming tasks. These results suggest that the syllable could act as a sublexical unit in visual word recognition. This paper examines the role of the first and the second syllable in visual word recognition of two-syllable words and nonwords. Three experiments were carried out using a Lexical Decision Task and the Temporal Separation Technique (Lima and Pollatsek, 1983; Sánchez-Casas, García-Albea and Bradley 1991). Word frequency, first syllable frequency and second syllable frequency were manipulated. The results showed reliable effects of first syllable frequency for words and second syllable frequency for nonwords. The implications of such findings for different models of visual word recognition are discussed.

Explicit and implicit retrieval in depressed patients: Predicting computer performance from mental representation

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A widely accepted assumption in cognitive psychology is that the mental representation of novices changes as they learn a new skill. More specifically, within the computer learning domain a great amount of research has been devoted to encourage the acquisition of "good" mental models in an attempt to facilitate learning (Mayer, 1988). However, very few studies have directly measured the "goodness of the mental model" and task performance. The purpose of the present study was to obtain direct indices of novices' mental models and relate those indices to actual performance. In the study, 24 novice subjects learned basic computer concepts and basic commands of the operating system MSDOS. Immediately after the learning phase subjects provided relatedness ratings of pairs of concepts and commands, and performed a procedural test in which the use of the different commands was required. Independently, relatedness ratings for the same set of concepts and commands were obtained from 3 expert subjects. Both novices' and experts' ratings were submitted to a weighted multidimensional procedure. Results showed that novices' weights on dimensions important to experts were predictive of novices' performance on the procedural test.

Event-related potentials during the detection of changes in a repetitive musical piece

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Event-related potentials (ERPs) to binaurally presented tone pips were elicited while 15 female subjects were listening to a musical theme in the vocal and instrumental forms. In order to maintain a constant level of attention, subjects were asked to press a button each time they detected a change in the repetitive and progressively deformed musical passage. ERPs were recorded from left and right scalp locations (T3 and T4 and from midway between C3 and T5 — Wernicke 1 — and between C4 and T6 — Wernicke 2). The aim of the study was to evaluate whether there is a relationship between the number of changes detected, the characteristics of ERPs, the type of stimulus (Vocal or Instrumental) and the order of presentation of the two forms of the musical piece. Results showed that subjects detected more changes in the instrumental trial when the vocal form was presented before the instrumental one. Analysis of variance on peak amplitudes and latencies of the N1, P2, N2, P3 ERP components yielded interesting inferences on cognitive processing with respect to the stimulus type and the order of administration.

Principal component analysis of event-related potentials during musical listening

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Event-related potentials (ERPs) were recorded from four scalp locations, two left (T3 and T5) and two right (T4 and T6), in 23 male subjects (age range 18–29) while they were listening to a piece of atonal music in an instrumental and a vocal performance. The values of peak amplitudes of the N100, P100 and P200 components to binaurally presented tone pips in four conditions (tone burst, vocal form of the musical piece, instrumental form of the same piece and a verbal message about musical talent) were analyzed extracting the first three principal components (PCs). The analysis of the PCs and of their correlations showed a clear distinction between bioelectrical responses to vocal and to instrumental musical inputs. In detail, as regards the N100 component, the first PC seemed to code prevalently responses to vocal musical inputs, while the second PC was influenced by the response to instrumental inputs and the third by the response to verbal messages. With respect to the P200 component, there was evidence of a contraposition between the bioelectrical response to vocal versus verbal inputs and with minor evidence versus instrumental inputs.

The effects of presentation mode on the accuracy of judgmental forecasting

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In the judgmental forecasting experiment reported here we varied the type of data display used (line graphs versus columns of numbers). This manipulation was motivated partly from practical considerations. Which mode produces the smallest errors? It also helps us to discriminate between the forecasting strategies used. For example, filtering by the peripheral visual system cannot be involved in forecasting from a column of numbers. We predicted on the basis of our previous experiments that judgmental forecasting would be performed using simple anchor-and-adjust heuristics. Such heuristics should work equally well for extrapolation of both graphic and numeric series in the absence of trend and autocorrelation. However, we anticipated that estimation of adjustments required due to trend and autocorrelation would be facilitated by graphic representations. Hence in these cases forecast error should be lower for graphic than numeric presentation.

An experimental group of 52 subjects was run. Each subject was required to make two forecasts for each of 21 graphic and 21 numeric series. Preliminary analyses suggest that mode of presentation has a significant effect on forecast accuracy and interacts with trend and autocorrelation. In particular, we find an opposite effect to the one that we expected: forecasts for numeric series were more accurate than those for graphic. Reasons for this finding, and other aspects of the data, will be presented. We will also report results from two recently completed experiments in which respectively presentation was alternated instead of blocked, and the range of the series was changed.

Dissociation between explicit and implicit memory: effects of age and levels of processing

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In this research, we study the dissociation between explicit and implicit memory for words in 3 groups of old adults (60–69; 70–79; 80–89). The levels of processing at encoding (semantic and phonological processing) and the memory tests for which the modalities only vary on the instructions (with the stem: cued recall or stem completion) are manipulated.

The experiment contains two phases: 1) encoding: half the subjects in the 3 groups achieve phonological processing and the other half the semantic; 2) memory test: half the subjects receive the cued recall test = with the stems, only complete those that were in the memorised list and the other half, the trigram completion test i.e. with the same stems, complete each with the first word that comes to mind.

The results show on the one hand, the significant effects of levels of processing (S>P) and memory test (E>I) but not of age, and, on the other hand, the significant interactions between age and memory tests. Furthermore, the separate analysis of explicit and implicit memory shows: 1) for explicit memory, one significant effect of age and levels of processing but no

interaction between these two, and 2) that no significant effect was obtained for age, levels of processing and their interaction in implicit memory.

Thus, with our results we can conclude that the explicit memory is sensitive to age and depth of processing but not implicit memory.

Ageing and the speed-accuracy trade off in a working memory task

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Previous results (Salthouse, 1985; 1992) suggest that longer response times in older subjects are, at least partly, imputable to a more cautious strategy as regards the speed-accuracy trade-off. Older subjects would have a greater emphasis on accuracy than younger ones. An experiment was designed to investigate this issue in a working memory task. Through instruction manipulation, we attempted to make older subjects operate at a less conservative response criterion, in order to examine whether they could equal young subjects' scores and response times.

30 young (mean age=23) and 30 older subjects (mean age=66) were submitted to an incongruous sentence detection task with a mnemonic preload. Instructions either incited subjects to emphasize accuracy or speed.

Results showed that older subjects were spontaneously more cautious than young subjects, with longer response times and better sentence verification scores. When incited to emphasize response speed, both age groups improved their response times, but older subjects remained slower than young ones. Moreover, older subjects obtained a better verification score than young subjects on non-incongruous sentences in the three conditions — free, speed and accuracy. This revealed their more cautious strategy. Yet, they obtained similar scores to young subjects' on incongruous sentence detection. It is argued that a more cautious strategy was actually used in older subjects, but that this strategy only partly accounted for their longer response times.

Thus, it seems that both response bias towards accuracy and slowing should be taken into consideration for explaining age-related differences in information processing.

Abstraction in implicit learning

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The issue of abstraction in implicit learning studies has been a controversial topic for some time. Reber's (1969, 1989, 1993) claim that abstraction is a basic feature of incidental learning has been contested by many authors (e.g. Brooks, 1978, Brook and Vokey 1991 etc). Experiments are reported here that demonstrate the transfer of knowledge across different perceptual representations of a concept in an incidental learning paradigm.

The studies indicate that for the stimuli used here, subjects' performance appears to be mediated by abstract representations, supportive of Reber's contention.

A comparison of serial position effects in conceptual implicit memory and explicit cued recall

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This study compared serial position effects in conceptual implicit and explicit memory. One hundred and forty-four subjects performed either a conceptual implicit memory test of name generation or an explicit test of cued recall. In both tests, common forenames were presented as cues to previously studied famous surnames. In order to capture any possible recency effects, forenames were presented in the reverse order to the order in which the surnames had been encoded, so that the first forename presented was the last surname encoded.

The two tests produced different serial position effects, the implicit test showing a forgetting function, the explicit test showing a serial position curve with significant primacy and recency effects. The results are discussed in relation to current research into serial position effects in perceptual implicit memory.

The use of literal and metaphorical language in person's description

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Standard models of language posit that literal language provides the semantic transparency of a message much more than figurative language. If so, why would a speaker prefer a metaphorical expression? Metaphors are often used to describe something new by reference to something familiar, but the scope of metaphor extends beyond this general function. Ortony (1980) claimed that metaphor can perform three distinct functions: 1. Expressing the inexpressible, i.e., metaphor as a means for expressing things that are literally inexpressible (e.g., sensory experience); 2. Providing a compact form of expression for complex ideas, i.e., metaphor as a means for predicating a bundle of properties that often cannot be explicitly specified. Corresponding literal expressions (if there are any) can be quite prolix by comparison. 3. Providing for vividness of expression, i.e., metaphor as a more vivid and image-evoking medium for expressing subjective experience, emotional states and so forth.

Metaphors are systematically used to describe persons. The aim of the present study is to investigate whether such preference for metaphorical language existed and the rationale whereby people used metaphors in describing persons. Experiment 1 was devised to test whether or not metaphors provided us with a more compact way to describe a person with respect to corresponding literal descriptions. Experiment 2 investigated whether people preferred metaphorical to literal descriptions when presented with stories describing a character. Experiment 3 tested whether subjects generated metaphorical or literal descriptions.

Results suggested that metaphors indeed give us a more compact way of predicating one or more properties and questioned the idea that any metaphorical term could be paraphrased by a corresponding literal term. When metaphors were presented out of context, subjects considered them as more informative than corresponding literal terms, but the level of agreement on what exactly a metaphor meant was quite unstable. When metaphors were presented in context, they were rated as adequate as literal descriptions; a higher agreement was also found on metaphors' meaning than in the out of context condition. When asked to complete a story, subjects consistently produced literal instead of metaphorical descriptions. This suggests that the appreciation and the generation of a metaphor can be differently motivated.

Accelerated metalinguistic (phonological) awareness in bilingual children (Italian/English)

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Pre-school children (mean age 4.8 years) in matched monoglot English and bilingual Italian-English kindergarten classes were given tests of (lexical and sublexical) metalinguistic awareness in English.

Bilingual school children were superior to monolingual children at a task of spoken morpheme deletion (RAINBOW → BOW). They were also superior at detecting the odd-one-out from sets of pictured words when detection was meaning-based and when it was initial-phoneme based. The advantage to the bilingual group persisted for morpheme-deletion and phonological sorting after partialling out performance on the meaning-based task.

Exposure to the second language (Italian) at a pre-literate stage may improve metalinguistic skills. In particular, speech-sound awareness, which is implicated in reading mastery, benefits from this support.

Evidence about the specificity of the stimulation necessary for the development of phonemic analysis ability

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A longitudinal study followed the design used by Lundberg et al. (1988) aimed at examining the effects of different metaphonological training programs on phonemic analysis ability acquisition among kindergarteners (mean age: 5 years 5 months).

Two training programs involving either phonemes or syllables were administered to different groups. A third group was trained on non-linguistic visual analysis.

Specific effects of training on phonemic analysis ability were disclosed. While a phonemes-to-supraphoneme generalization was found among the group trained with phonemes, the reverse did not happen among the group trained with syllables. These results support the idea

that processes involved in syllabic analysis of speech or in rhyme manipulation cannot be applied to its phonemic structure. In addition, training with non-linguistic visual analysis did not entail any progress in metaphonological ability, thus providing evidence that phonological awareness cannot be promoted by analysis abilities acquired in another domain.

Detection of elaborative inferences with naming: the specific contribution of test anxiety

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A naming task with a RSVP paradigm was used to examine whether test anxiety is associated with an on-line bias towards an ego-threatening interpretation of ambiguous sentences. High- and low-anxiety subjects read ambiguous sentences concerned with potential ego-threat, physical threat, or no threat, under evaluative stress conditions. Each ambiguous sentence was followed by a disambiguating sentence, which either confirmed or disconfirmed the threat implied by the ambiguous sentence. A control condition involved the presentation of the disambiguating sentences alone, without being primed by the ambiguous sentences. The sentences appeared word-by-word on a computer screen with a Rapid Serial Visual Presentation procedure. In the disambiguating sentences, naming times were collected for a target word which represented a threat or a non-threat event. The target word appeared with a 1250 msec. or with a 450 msec. delay (SOA).

Results indicated that, with the 1250 SOA, high-test-anxious subjects took less time to name the target word which confirmed the ego-threat implied by the ambiguous sentence than low-anxiety subjects, but there were no differences in naming target words which confirmed physical threats or non-threats as a function of anxiety. The facilitation effect on naming words confirming ego-threats is interpreted as an indication that test-anxious subjects are likely to draw specifically ego-threat inferences when reading ambiguous sentences predicting potential threats to self-esteem. Nevertheless, as the effect occurred only with the 1250 msec. SOA, but not in the 450 ms. SOA condition, it is suggested that the bias towards ego-threat interpretation is not automatic and completely on-line, but post-lexical and strategic.

Cooperativity in the categorical perception of speech: experiment and modelling

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The phenomenon of categorical perception has played an enormous role in the theory of speech perception (Harnard, 1987). One reason is that the emergence of symbols from the continuously changeable acoustic stream might be studied through this phenomenon. In other areas of perception, the discrete reorganization of percepts as stimulus parameters are varied continuously has been related to cooperativity. For instance, work on binocular fusion and on the perception of visual motion has revealed hysteresis effects (e.g. Chang and Julesz, 1984),

in which the organization of a percept depends not only on the current stimulus, but also on the previous organization of the percept.

We set out to ask, to what extent cooperativity could play a role in the categorical perception of speech. We studied voice onset time continua based on natural utterances in Portuguese and demonstrated clear categorical perception between voiced and unvoiced consonant-vowel items. To investigate cooperativity we borrowed a psychophysical paradigm from vision research (Hock et al., 1993) in which stimulus continua are presented in ascending or descending series. To minimize the extent to which hysteresis would result from the response component of an identification task, subjects were asked to respond only to the last item in a stimulus series. Different stimulus series ended at different points in the continuum. We find clear evidence for hysteresis in 20 subjects.

A theoretical model was formulated in which two detectors, one for each phoneme, are modelled by dynamical neurons which compete mutually. We show that in the classical identification paradigm with randomized stimulus order, categorical perception emerges. When ordered stimulus continua are presented to the model, hysteresis results. We investigated the role of time scales and noise level in determining the size of hysteresis. Moreover, we find that, in the ABX discrimination paradigm, cooperativity effects lead to systematic differences between the conditions ABA, ABB, BAA and BAB. We compare the model predictions to our experiments and discuss the conceptual implications for the formation of categories in speech perception and in cognition in general.

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Influence of prosody on speech perception

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Our research deals with the use of prosody in speech perception. The prosodic manifestations (temporal variations of speech rate, pitch and intensity), and particularly the stress patterning, allow the listener to focus her/his attention on some words rather than on others. We investigate emphatic stress, i.e. the prosodic prominence on a word or a group of words, used to denote the salience of specified segments of a verbal message. The acoustical manifestations on the stressed word and on its surrounding contexts are thus modified. Martin and his colleagues, and Cutler and her colleagues showed that stressed word processing is facilitated partly because of the prosodic context surrounding the stressed word: the listeners may use the prosodic pattern to anticipate the upcoming focus. Here, two experiments were conducted to investigate this phenomenon.

First, we manipulated the prosodic context of a stressed word, i.e. allowing or not the prediction of the upcoming emphatic stress, and we measured the phoneme-monitoring reaction times, the phoneme target being at the onset of the stressed word. The results suggest that only the prosodic variations on the stressed word facilitate its processing. The prosodic context of emphatic stress did not speed up the phoneme-detection latencies.

In order to investigate prosodic context processing with emphatic stress, we measured in the second experiment the time necessary to detect the initial phoneme of the last content word preceding the stressed word. Although the presence or absence of emphatic stress does not change the phoneme-monitoring reaction time, it influences the number of omissions. All these results suggest that listeners actively use speech prosodic information to anticipate the stress patterning, and that they adapt their strategy of perception and their attentional focus on the basis of this information. Nevertheless, these results also suggest that the phoneme-monitoring reaction times are not the only measures to consider for the study of on-line speech processing.

Inhibition at sublexical levels: orthographic and/or syllabic units in Spanish

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The positional syllable frequency is computed as the number of times such a syllable is in a specific position (first, second, third, ..., end) in the words of a language. When words composed of high and low frequency syllables are used in a lexical decision task, the results are rather unexpected. The subjects are slower to recognize the words composed of higher frequency syllables than those composed of lower frequency syllables (Carreiras, Alvarez and De Vega, 1993; Dominguez, Cuetos, De Vega, 1993). The data suggest that, when a syllable is processed, it produces the activation of a pool of "candidate" words at the lexical level. If the syllable is a high frequency one, the pool size is bigger than if it is a low frequency syllable. The parallel activation model of McClelland and Rumelhart (1981), assumes lateral inhibition between word detectors. Extending that model to our results, and assuming that syllables rather than letters are natural phonological units in Spanish, the most obvious consequence is that the activation of multiple lexical detectors in words composed of high frequency syllables will delay the identification of words in lexical decision.

In order to test directly whether the syllable is a functional unit between letters and words, and to explore the inhibition processes that presumably operate at the lexical level we use a priming task. The general procedure involved the serial presentation of pairs of words involving phonological similarity. Both words always shared the first two or three letters, but in one case the first syllable ended just at the same point for both the priming and the target word (same limit condition; e.g., forma-forjo, whereas in another case the syllable limit between priming and the target differed (different limit condition; e.g., forma-foro).

The results in these conditions are compared with two control conditions without relation (prime and target have not any letter in the same position: forma-lento and forma-cazo). The reaction times were significantly slower in the experimental pairs than in the control ones. In addition, responses were slower for pairs with the same syllable limit than for pairs which differed in syllable limit, although they shared the initial letters. These effects are discussed in

terms of the inhibitory processes triggered by a word (the priming word) to other phonologically competing words — including the target word — that share the initial letters and/or the initial syllable.

Five categories for the investigation of empirical relations among concepts

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The empirical relations among concepts are main determinants of tasks such as deductive reasoning. We propose five categorical relations that could be used for research on human reasoning (identity, inclusion, inverse-inclusion, intersection and exclusion). According to this proposal, five mathematical indexes were computed using first-order concepts (those corresponding to real world objects, e.g. bus), and second-order concepts (those defining personal states, personal features, e.g. aggressive). In the calculus of these indexes, we took into account the type of response and reading time for four questions for each pair of concepts. The results confirm the empirical plausibility of the five proposed relations.

Global versus local activation in lexical ambiguity

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Two experiments were carried out to explore the time course of the activation of ambiguous words' meanings. In the first experiment ambiguous words were presented twice in short texts with two different meanings in one condition, but in the other condition a synonym of the second meaning was presented, instead of the actual ambiguous word. Just after the second appearance of the ambiguous word or the synonym, subjects had to decide whether a string of letters was a word or a nonword. When it was a word, its meaning could be appropriate, inappropriate or neutral in relation to the meaning of the second presentation of the ambiguous word or the synonym. The activation of meanings was measured at two SOA intervals: 150 msec. and 500 msec.

The results showed that the meanings instantiated during the first presentation of the ambiguous words remain activated longer than the appropriate meanings of the second presentation of the ambiguous words. Similar results were obtained in another experiment which was identical to the previous one, apart from the fact that the sentence containing the synonym was replaced by a neutral sentence.

How initial fixation position influences visual word recognition: a comparison of French and Arabic

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The position the eye initially fixates in a written word influences the ease with which this word is recognized. Prior research has shown that the function relating ease of word recognition and initial fixation position in the word is not symmetric. Word recognition is generally superior when the initial fixation is left rather than right of the centre of the word. This asymmetry in the function relating initial fixation position to word identifiability could be due to a) hemispheric specialization, b) reading habits, or c) variations in lexical constraint. The present experiments tested these alternative explanations by comparing the effects of initial fixation position in prefixed and suffixed words in French and Arabic. The results show that, contrary to both the hemispheric specialization and reading habit hypotheses, the average initial fixation curves for Arabic are neither asymmetric to the left nor to the right but depend on the morphological structure of the stimuli, thus lending support to the lexical constraint hypothesis.

Explicit and implicit retrieval in depressed patients

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The memory performance of normal and clinically depressed subjects was assessed in an explicit memory test (free recall) and in two implicit memory tests (fragment completion and word production from semantic categories). After studying a list of words from various categories, normal subjects recalled more items than depressed subjects in the free recall test. Performance in implicit memory tasks was dependent on the type of test. There were no significant differences between the two groups in the fragment completion test. However, facilitation due to previous study was larger for normal than for depressed subjects in the word production test. The results are consistent with a distinction between data-driven and concept-driven retrieval processes.

Relationship between light increment and decrement and the inhibitions elicited by a visual cue on manual reaction time to a peripheral target

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Simple reaction time (RT) to a peripheral visual target is shortened when a non-informative cue is flashed at target location 100–150 msec. before target onset (early facilitation). Afterwards, RT to targets appearing at cue location is lengthened (inhibition of return). In the present study, we have investigated if these effects are related to the onset and/or to the offset

of a cue darker or lighter than background. Ten subjects were asked not to respond to a non-informative cue (S1) appearing on a computer screen 6° to the right or to the left of a fixation point (FP), but to respond, by pressing a key, to a target (S2) occurring at 4° from the FP in the same hemifield as S1 or in the opposite hemifield. There were two different types of sessions. In one, S1 and S2 were bright in a dark background and in the other, S1 and S2 were dark in a bright background. In each session, there were two types of trials. In ON trials, S2 appeared 100 or 800 msec. after the onset of S1 that remained on until the response to S2. In OFF trials, S1 onset occurred at the beginning of the trial and remained on for 700 msec., S2 appeared 100 or 800 msec. after the offset of S1. Our results showed that when S2 follows S1 onset by 100 msec., RT to S2 occurring in the same hemifield did not differ from RT when S1 and S2 were in opposite hemifield. In contrast, after 800 msec., S1 onset elicited an inhibition of its hemifield similar to those observed 100 msec. or 800 msec. after S1 offset. The same results were observed if the cue and target were lighter or darker than the background, showing that the ON and OFF inhibitions are related not to light increment or decrement but to figure-ground discrimination.

Transfer of coordination skills in nonlexical tasks

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Coordination refers to the amount of processing required to regulate and to maintain the information flow between processing steps (Baddeley, 1989; Mayr and Kliegl, 1993). Our aim was to prove that coordination skills in nonlexical tasks are constrained by the capacity to maintain the activation level of representations and that coordination skills can transfer to new task conditions. Two types of tasks are used in our research: a delayed matching task (e.g. Parr 1992) and a serial transformation task on checkerboard-like patterns (Bethell-Fox and Shepard, 1988; Hagendorf and Sa, 1993).

Results demonstrated that in accordance with our assumptions enhancing the activation level of representation of patterns reduces the coordination demand of the tasks (experiment 1). Amount of transfer between tasks of different coordination complexity (experiment 2) is in accordance with our expectation that coordination is dissociable from component tasks and can generalize to new patterns and new transformations (see also Charness and Campbell 1988; Frensch 1993).

The results are consistent with the assumption of separate skills for coordination of information exchange between processing steps. They provide further constraints for building models of working memory in understanding individual differences in cognitive tasks.

When is a number an anchor?

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In a prototypical anchoring experiment, the subject is asked questions to which she presumably does not know the exact response, like "What is the percentage of African states in the UN?". Then a fortune wheel is spun and stops at a predetermined number higher (high

anchor) or lower (low anchor) than the correct response and the subject has to indicate whether her numerical response is higher or lower than this (from her point of view) "randomly" obtained number. The then given numerical response tends to be higher (lower) with a high (low) anchor. This finding has been explained by the anchoring and adjustment heuristic. This heuristic has also been named by Fischhoff as an explanation in hindsight bias experiments. In these experiments, the subject's recollection of her former numerical response to a question like "How high is the Eiffel Tower?" tends to be nearer to the correct response than the first response if the subject meanwhile has been presented with the correct response.

In four experiments, two with an anchoring design and two with a hindsight bias design, we have studied the properties of the task which lead to the number (anchor or correct response) acting as an anchor from which the response is adjusted. Merely to present the anchor (the correct response) with the question and to ask the subject a) to recall it later, or b) to say whether it is higher or lower than another random number leads to no anchoring effect or hindsight bias whatsoever. In the anchoring design, the full size of the effect is reached only if the subject is asked to say whether her response is higher or lower than the "randomly" produced number. Similarly, in a hindsight bias design, asking the subject to say whether her response is higher or lower than the "randomly" produced number (which actually is the correct response) leads to the same amount of hindsight bias as telling her that this number is the correct response. The similarity of results corroborates Fischhoff's idea to explain hindsight bias by an anchoring and adjustment heuristic.

An expert/novice approach to offender profiling

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An investigative technique that could aid the police in their search for the perpetrators of crimes is offender profiling. Whilst different research groups adopt different approaches to profiling, the approach adopted by the American FBI focuses on more violent sexual crimes. Given the success reported by the FBI of many of their profiles, there is no doubt that sound deductions unquestionably underlie the decisions made, but unfortunately the explanations underlying them are seldom made explicit.

In the Netherlands there is one professional profiler who, as well as being an experienced detective in homicide cases, is also FBI-trained. He, together with a psychologist working at the National Criminal Intelligence Service, has been willing to collaborate in a project with us which is basically attempting to explore three questions:

- What are the processes involved in criminal personality profiling?
- Are there substantial differences (quantitative and/or qualitative) between the processes used by a professional profiler, an intelligent novice and an experienced detective?
- How do police investigative teams view the advice given by a professional profiler?

The way we have attempted to begin answering the first two questions is to carry out an exploratory, in-depth study using three subjects: a professional FBI-trained profiler; an experienced detective from the Rotterdam police force; and a colleague who is a psychologist used to reading police files but mainly for civil offences. We have been fortunate in being allowed to use all the documentation relating to a sexual murder which took place seven years ago but which still remains unsolved. All three subjects were given access to all the available information and were asked to 'think aloud' as they attempted to develop a profile of the

perpetrator. They were filmed as they worked through the files (which took each of them almost a full working week). Differences in problem solving styles were found and these will be illustrated by process models.

The time course of the activation of literal and indirect meanings in the comprehension of sarcastic utterances

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This study addresses the relationship between the literal and indirect interpretation of sarcastic utterances in Spanish. Our major concern was to find out to what extent the literal and indirect meanings of sarcastic utterances are simultaneously and immediately activated during comprehension. A priming procedure combined with a lexical decision task was employed in the three main experiments reported in our study. In the first two experiments, subjects read short sentences preceded by a sentence context which could bias them towards a literal or a sarcastic interpretation of the sentence. The communicative intention conveyed in the critical sentence (sarcastic vs non-sarcastic) was disclosed at its last word (i.e. an adjective). Immediately after the subject had read the sentence (Experiment 1), or with a time lag (ISI) of 500 milliseconds (Experiment 2), a target word appeared on the screen, to which the subject responded with a lexical decision. In some trials the target was related to the literal meaning of a nonsarcastic item, whereas in others it was related to the indirect meaning of a sarcastic item.

The results of both experiments show an advantage of the lexical decision times to targets related to sentences with a literal meaning over those with a sarcastic intent. These results may be interpreted by assuming that literal meaning is made available prior to the subject's derivation of an indirect interpretation of the sentence. However, it might also be the case that either meaning of a sarcastic expression is accessed by means of a different procedure. A third experiment, now under way, where only sarcastic utterances are being tested, was devised to test these possibilities. In this experiment, RTs to target words related either to the literal (context-free) or to the indirect (context-dependent) meaning are compared. The results of this last experiment will serve to clarify whether literal meaning is computed on-line in the recognition of the sarcastic intention of the speaker.

Recognition memory and awareness for famous and obscure musical themes

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In each of two experiments, subjects listened to a set of famous and obscure musical themes. In later recognition tests in which these themes were re-presented along with a set of similar themes, subjects had to identify the themes they had heard earlier in the experiment. In addition, for each theme that subjects so identified they reported whether they consciously recollected its earlier occurrence ("Remember") or knew that it had occurred earlier because it was familiar in the experimental context ("Know").

Subjects were much more likely to recognise the famous themes as having occurred earlier in the experiment and this effect appeared in "Remember" but not in "Know" responses. Moreover, whereas subjects made far more "Remember" than "Know" responses for the famous themes, they tended, if anything, to make more "Know" than "Remember" responses for the obscure themes. The results were attributed to the relative ease with which subjects could encode famous themes in an elaborative, associative fashion.

Temporal integration and segregation of brief visual patterns

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Temporal integration of non-lexical patterns was examined as a function of the duration of the second stimulus field, ST2. With very brief durations of the leading stimulus and inter-stimulus intervals (10ms), performance was found to be inversely related to ST2, suggesting that perceptual integration does not commence until the termination of the second stimulus, thereby questioning conventional notions of visual integration processes.

A second experiment probed this further by examining the role of duration of ST2 both within an integration task, where the response required first and second stimulus field information to be combined, and in a backward masking paradigm, where identification of the first stimulus field was the critical response.

The finding of a differential effect of ST2 for the two procedures reinforces the interpretation of the first experiment and argues for a new model involving integration and independent processing of visual information.

Listening to stabilised speech — when sound can turn to sand

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The Verbal Transformation illusion, in which words non-existent in the stimulus stream are heard under conditions of stabilised auditory input, has consistently been seen as a speech-specific phenomenon, arising from the unique nature of speech perception with its opaque mapping between physical signal and conscious realisation. This traditional view of the Transformation illusion was questioned in a series of studies exploring the precise nature and locus of the effect. The first extended investigation beyond the verbal domain, while others confronted and sought to distinguish between different theoretical positions on possible mechanisms underlying the phenomenon.

The findings have threefold implications. They speak, first, to the view that its constructive nature is one of the properties setting speech perception apart from other forms of auditory processing. Second, to the role of pre-established cognitive structures during listening, be

they semantic or in some other way cohesive forms of representation. Third, to a model of auditory perception with highly mobile criteria for various converging sources of evidence.

And, less directly, the points of resemblance between the experimentally-induced misperceptions and auditory hallucinations raise the possibility of the present analyses opening a new door on causes of perception divergence from reality in abnormal states.

The impact of context on constituent attachment in reading

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Current parsing models, such as the well-known Garden Path Model (Frazier, 1987), have recently been demonstrated to be empirically inadequate when confronted with results from subjects reading German ambiguous sentences. PP-attachment preferences could be shown to vary according to verb placement in main- and sub-clauses. The parametrized head attachment (PHA) principle (Konieczny, Hemforth, Scheepers and Strube, 1994) was proposed in order to provide a thorough account of ambiguity phenomena. However, the PHA model, as well as the Garden Path Model, performs a first analysis based purely on syntactic grounds, which can only later be revised by thematic information. Initial syntactic analysis models have been criticized by, among others, Crain and Steedman (1985), Altmann and Steedman (1989), who assume that some aspects of meaning and pragmatics can guide parsing in an at least weakly interactive manner. E.g., according to the principle of referential support (Altmann and Steedman, 1989), potentially noun-modifying constituents following a definite NP should not be attached to the NP, if the simple NP already provides the identification of a unique referent in the discourse model.

In the experiment presented here we investigated attachment preferences in German verb-second and verb-final constructions such as (1-4).

1. Horst erschoss den Hasen mit dem Gewehr.
Horst shot the rabbit with the gun.
2. Dass Horst den Hasen mit dem Gewehr erschoss, ...
That Horst the rabbit with the gun shot, ...
"That Horst shot the rabbit with the gun, ..."
3. Günter fesselte den Jäger mit dem Gewehr.
Günter fettered the hunter with the gun.
4. Dass Günter den Jäger mit dem Gewehr fesselte, ...
That Günter the hunter with the gun fettered, ...
"That Günter fettered the hunter with the gun, ..."

In all cases, the phrase "mit dem Gewehr" can be attached either to the direct object-NP as an attribute (noun-modifying), or to the VP specifying the instrument of the action (verb-modifying). World knowledge, however, forces the verb-modifying interpretation in sentences 1 and 2 and the noun-modifying interpretation in 3 and 4.

Each target sentence was presented after a short text which introduced either a single or two possible referents (e.g. one or two hunters, in 3, 4) of the object in the target sentence.

According to referential support the noun-modifying reading should be preferred in case of two possible referents, otherwise the verb-modifying one. On the other hand, PHA predicts verb modification in verb-second and noun modification in verb-end sentences.

Eye-movements were recorded in order to provide an on-line measure of processing complexity due to the predicted preferences.

S-R compatibility of orthogonal stimulus and response sets

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Mostly, effects of stimulus-response compatibility are examined in experimental designs where there is an overlap between the stimulus and the response dimension (e.g. spatial compatibility, Simon-Effect). For instance, subjects have to respond to a left or right stimulus by pressing a left or right key.

In this poster, experiments will be presented showing that

1. compatibility effects also occur if the stimulus and response set do not show a dimensional overlap (e.g. left/right stimulus vs. up/down response key)
2. compatibility effects of orthogonal S-R dimensions can be explained by the same cognitive mechanisms already suggested for the occurrence of S-R compatibility effects of non-orthogonal S-R dimensions (dimensional overlap model; Kornblum et al., 1990).

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Attention point offset and manual reaction times to visual stimuli: evidence for express manual responses

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The distribution of saccadic reaction times (SRT) using a gap-overlap paradigm in monkeys and men has shown the existence of three peaks of SRT according to the responses latency: Express Saccades (ES), Fast Regular Saccades (FRS) and Slow Regular Saccades (SRS). We studied the distribution of manual reaction times (MRT) using the gap-paradigm with intervals from 0 to 2000 msec. between the offset of an attention point and the onset of a visual stimulus. The subjects had to press a computer key as soon as they detected the stimulus. Our results showed that: a) MRT at gap durations of 100 and 200 msec. were shorter than MRT at gap duration of 0 msec.; and b) MRT increased gradually from gap duration of 200 until 2000 msec. The distribution of MRTs showed the existence of three peaks: the first one around 175, the second around 205 and the third around 235 msec. These results lead us to propose the existence of Express Manual Reaction Times (EMRT), Fast Regular MRT and Slow Regular

MRT, similar to what was found with SRT. These data suggest that the occurrence of express responses (ES and EMRT) depends on the state of attention (engaged or disengaged). These short latencies motor responses are obtained when the subject is in a disengaged state of attention, triggered by the AP offset.

Dual tasks and cognitive actions

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There is a substantial set of evidence which indicates that when two simple sensorimotor tasks are performed concurrently the response selection on the first task holds up the response selection on the second task, whereas perceptual processing in the second task does not wait for any aspect of the first task (Pashler and Johnston, 1989). This fundamental bottleneck in action selection revealed in dual task experiments seems to apply to selection of actions in a very broad sense, including internal operations that might be termed cognitive actions.

The present research investigated whether attentional shift responses are selected by the same system as that which selects motor responses. If that is so, attentional shift responses should be subject to postponement when a motor response has to be selected in a concurrent task. Pashler (1991) showed that shifting visual attention could be performed concurrently with selection of unrelated motor responses. These results suggest that if a single mechanism is responsible for the selection of motor responses, this mechanism is not necessary for control over the focus of visual attention.

On the other hand the distinction between "exogenous" and "endogenous" control of attentional orienting suggested by Posner (1980) has recently led to the view that attention is not a unitary mechanism but a complex modular structure (Posner and Petersen, 1990). Under this view, shifts in visual attention produced by a transient peripheral cue may be mediated by a mechanism different from that which mediates shifts produced by a central symbolic cue. Thus it seemed reasonable to study the relationship between response selection and attentional shift mechanisms when different types of cue were employed.

In our experiment subjects performed two tasks in every trial: a speeded manual response to a tone and a choice reaction time to a target letter that was previously cued according to a cost-benefit paradigm. Stimulus onset asynchrony (SOA) between tone and cue was varied while time interval between cue and target letter remained constant at a value such that attentional movement were optimized. Type of cue (central vs peripheral) was manipulated between groups.

Our results showed that attentional shifts in the visual task could be performed concurrently with the manual response to the tone only when a peripheral cue was used. However when a central cue was employed the two tasks clearly interfered with each other. These results are discussed within the framework of both Pashler's approach to the study of dual tasks and Posner view of attention.

Combinatorial reasoning in adults

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The purpose of the present study was to investigate the way subjects, throughout adulthood, solve two complex cognitive tasks. A total of 162 subjects participated: 27 in their twenties, 27 in the thirties, 27 in their forties, 27 in their fifties, 27 in their sixties, and 27 in their seventies. The study tested the hypothesis that the increasing difficulty in solving combinatorial tasks, throughout adulthood, may reflect cognitive processing difficulties in dealing with the problem content, rather than absence of underlying reasoning competencies. Two combinatorial tasks were administered — a combinatorial task with academic content and a combinatorial task with familiar content. Data show significant differences, throughout adulthood, in the way subjects solve the two combinatorial tasks.

"Gone with the wind": remembering actors but not characters of movies

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Memory for actors/actresses and characters of entertainment movies was examined in two studies. In study 1 subjects were asked either to recall or recognise the main character or actor of several movies. Actors were better recalled and recognised than characters and recognition was better than recall. In study 2 memory for main characters was explored for movies with follow-up (recall vs. recognition) and for movies that the subjects preferred (recall). The overall results showed that: a) memory for actors was always better than for characters; b) characters of movies with follow-up were recognised better than characters of other movies but no effect was found on recall; c) and characters of preferred movies were only recalled better than other characters if preferred movies in which the characters' name was part of the title and preferred movies with follow-up were included. Results are discussed in the context of person and script memory.

Assessment of events in counterfactual thinking

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The mental construction of alternatives to factual events is defined usually as "counterfactual thinking" and represents an important topic in the psychology of thought processes. Counterfactual thinking plays an important role in the assessment of causality of events and actions (Wells, Gavanski, 1989), in the analysis of human errors in different conditions (Wagenaar, Hudson, Reason, 1990), in the attribution of responsibility (Miller, Gunasegaram, 1990) and its study, as Kahneman and Miller (1986) maintained, tries "to identify the rules that determine which attributes of experience are immutable and which are allowed to vary in the construction of counterfactual alternatives to reality". People generate alternative scenarios in real-world situations attributing greater causal significance to the event which

had a highly available counterfactual mutation that might have undone the dramatic outcome. Kahneman and Tversky (1982) evidenced that exceptional events are selected more than normal events when subjects had to undo the outcome of a story. With the exceptionality, the causal event order represents the second factor influencing the mental construction of counterfactual alternatives. In fact, as Wells, Taylor, Turtle (1987) pointed out, in a causal chain the first event is more mutable than subsequent events.

In the present study, we try to go deeply into the nature of counterfactual thinking. To examine the effect of causal order of events, an experiment was carried out in which to 8 groups of graduate students (each of 13 subjects) a story with four events was presented. Subjects' task was to list five events, by using also events of the narrative sequence, so as to determine a different outcome to the story. The following factors were considered: a) two different types of outcome (negative and neutral); b) the exceptionality and normality of the event; c) the controllability (i.e., an action performed by an individual) and non-controllability of the event. Results showed a significant effect for controllability factor, but no main effect for the types of outcome and for exceptionality-normality factors was detected. Furthermore, an interactional effect between causal order of events and the type of events of the story was obtained. The findings were discussed according to the suggestions of Kahneman and Tversky (1982), of Wells, Taylor, Turtle (1987), and finally of Girotto, Legrenzi, Rizzo (1991).

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Linguistic Tuning vs. Garden Path: evidence from Spanish

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Two experiments were carried out to investigate the syntactic processing of ambiguous sentences in Spanish. We used sentences like (1) that contained a direct object (*el trabajo* —

the work —) immediately after the verb and (2) that did not contain a direct object immediately after the verb.

- 1a. *Se adjudicó el trabajo al arquitecto inglés con el permiso del alcalde.*
 The work was assigned to the English architect with the permission of the mayor.
- 1b. *Se adjudicó el trabajo el arquitecto inglés con el permiso del alcalde.*
 The English architect assigned himself the work with the permission of the mayor.
- 2a. *Se quitó de enmedio al pobre anciano porque molestaba.*
 The poor old man was got out of the way because he was a nuisance.
- 2b. *Se quitó de enmedio el pobre anciano porque molestaba.*
 The poor old man got himself out of the way because he was a nuisance.

The sentences were presented to the subjects with a stationary window technique (Exp.1) and with a moving window technique (Exp.2). Both types of sentences were disambiguated to the impersonal sense by the particle *al* (1a and 2a) or to the reflexive sense by the particle *el* (1b and 2b). The syntactic structure is similar for the sentences with and without direct object; but it changes depending on whether the sentences become impersonal or reflexive. According to the minimal attachment strategy proposed by the Garden Path theory (e.g., Frazier, 1987) the reading time of the disambiguating clause will depend on the complexity of the syntactic structure of the sentence. In contrast, according to the Linguistic Tuning hypothesis (Cuetos, Mitchell and Corley, 1993), the reading time of the disambiguating clause will depend on the number of times the reader found similar structures previously. The results of both experiments showed: first, for the sentences with direct object the reading times of the disambiguating clause were slower in the impersonal version than in the reflexive version; and second, for the sentences without direct object the reading times of the disambiguating clause were faster in the impersonal version than in the reflexive version. These results are difficultly explained by the Garden Path theory. However, given the outcome of a corpus analysis, they can be readily explained by the Linguistic Tuning hypothesis.

Components of peripheral cueing

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We manipulated the informative value of a peripheral cue used to indicate the target location, and the cue-target stimulus onset asynchrony (SOA) as a means of investigating the relationship between attentional capture by abrupt onset of the cue and the attentional effect produced by its informative value. Three experiments were run making use of variations of the cost-benefit paradigm (Posner, 1980). A visual identification task was used in which an "x" or an "o" could appear at 6 degree of eccentricity on either side of the fixation point.

In the first experiment a non-predictive peripheral cue was used and the SOA between cue and target was 50, 100, 150 and 200 msec. When the target appeared at the same position as the cue benefits began to emerge at 50, reached its highest value at 100 but disappeared by 200 msec. SOA.

In the second experiment a peripheral cue that was predictive 100 percent of the time was presented at fixation and the cue-target SOA values employed were the same as in the

previous experiment. Again benefits emerged at 50 msec. SOA but then they increased during the remaining SOA values.

In our third experiment a peripheral cue was employed and made predictive by instructing the subjects that, when it appeared, the target would be located at the opposite site 80 percent of the time. The values of SOA between cue and target were 50, 100, 200 and 500 msec. In the 100 msec. SOA condition there was indication of both benefits, when the target appeared at the location of the peripheral cue, and costs, when the target was presented at the location indicated by the peripheral cue. However in the 200 msec. SOA condition, benefits were found at both locations.

These results are discussed within the framework of Posner (Posner and Petersen, 1990) modular theory of attention.

Does the role of segments and syllable in the identification of spoken Portuguese words depend on stress position?

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Previous work using word illusions has shown that, in the identification of CVCV Portuguese words by Portuguese listeners, the initial consonant intervenes as a major unit. This result diverges from those obtained for French, which support instead an important role of the syllable. However, French and Portuguese differ, among other characteristics, by the position of stress. In the present study, we examined the contribution of the second syllable and of its segments to word illusions in Portuguese, using targets with stress at either the first or the second syllable. The last case is similar to French. However, the results indicated no significant contribution of the syllable, thus suggesting that the stress position cannot be the only variable determining the language difference mentioned above. The second consonant intervened in word illusions regardless of stress position. As far as the second vowel is concerned, its involvement seems to depend on stress position, being somewhat greater when the vowel belongs to the stressed syllable than to the unstressed syllable.

An analysis of the visual-orthographic processes of dysorthographic children

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Some dyslexic-dysorthographic children who have acquired a rather good level of reading comprehension tend to perform very poorly on spelling words which contain phonemes that could plausibly be represented by different legal orthographic patterns (Alegria and Mousty, in press). The present study was designed in order to compare these children on several component word-identification skills to another group of reading-disabled children who were matched on reading comprehension ability and who do not show the same marked dissociation between their reading and spelling skills. The results will be discussed in terms of the current notion that the problems of poor spellers may result from inadequate word

recognition processes, based on a "partial-cue strategy", during reading (Frith, 1985; Holmes and Ng, 1993). The possibility that poor spellers may have an additional difficulty in processing spatial order information in visual sequences will also be considered through the results of a visual matching experiment involving orthographic and non-orthographic stimuli.

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Interaction effects in parafoveal letter recognition revisited

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The recognizability of a visual stimulus is affected by visual acuity as well as by the presence of other stimuli in the visual field. In particular, the recognizability of a stimulus decreases as a function of its distance from fixation point. If, in addition, other stimuli are simultaneously presented in the visual field, even lower recognition scores are obtained. The strength of interaction between neighbouring elements increases as the distance between the two stimuli becomes smaller. In 1970 Bouma estimated the visual isolation of a single letter, presented at eccentricity E° , to be obtained when no other letter is presented within an area of roughly $0.5 \times E^\circ$ distance. Ever since, it has been thought that the retinal distance over which neighbouring elements interact increases with increasing eccentricity. The present study provides evidence that this conclusion is wrong: the retinal distance over which neighbouring letters interact is constant at all eccentricities. The strength of this interaction increases exponentially with decreasing distance between target and flankers. Given that independently of retinal eccentricity the region of interaction is of the same size, this interaction might take place at a higher processing level where position-specific, functional letter features are coded.

Lexical processing of ambiguous words: dominance or associative strength?

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Four experiments examined the effects of meaning frequency and prime-target relationship in the processing of isolated ambiguous words. Recent studies investigating word ambiguity in lexical decision have shown that at short SOAs dominant and subordinate meanings are accessed (e.g., Simpson and Burgess, 1985). However at long SOAs results are mixed. Simpson and Burgess (1985) reported experiments suggesting that only the dominant meaning was activated, whereas Bentin and Frost (1992) reported results suggesting that both

dominant and subordinate meanings were activated. A possible reason for this discrepancy is the lack of control of prime-to-target associative strength.

In the present experiments subjects made lexical decisions to target words that were associated to either the dominant (more frequent) or the subordinate (less frequent) meaning of homograph primes. In Experiment 1 individual prime-target strength was controlled and long SOAs were used. Results showed that both dominant and subordinate targets were equally primed. In Experiment 2 dominant targets also were more strongly associated to their prime than the subordinate ones and priming effects were present only for dominant targets. Experiment 3 and 4 replicated conditions of the first two experiments but at short SOAs and showed that dominance was independent of strength at short SOAs.

These results are discussed within a theoretical framework that includes two types of processes (automatic and strategic) in the lexical decision task. Which type of process is acting determines the way in which ambiguous words are processed.

Does extrinsic reward reduce the feeling of autonomy and intrinsic motivation?

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Cognitive evaluation theory claims that subjects' intrinsic motivation when performing tasks will often be undermined by the administration of a reward. According to Deci and Ryan (1985), intrinsic interest is undermined because people have a need to feel autonomous, and their feeling of autonomy is reduced by rewards. Several authors have reported failures of rewards to produce undermining of intrinsic interest. Deci and Ryan (1987) asserted, however, that when rewards are expected, salient and contingent on task engagement, they will most reliably result in undermining of intrinsic interest.

In two experiments, subjects were presented with rewards that were expected, salient and contingent on task engagement. Contrary to cognitive evaluation theory, rewards did not undermine subjects' motivation. Furthermore, rewarded subjects felt more autonomous than unrewarded subjects. Cognitive evaluation theory predicts the opposite.

We argue that all human action is motivated both by intrinsic and extrinsic factors, and discuss the theoretical and empirical status of cognitive evaluation theory.

Knowledge about reading and self-evaluation in reading disabled children

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The relationship between metacognition and reading disability has been widely investigated, but the main focus was on the control processes involved during reading. The present paper examines the other main aspect of metacognition, i.e. what the reading disabled child thinks about reading and about himself/herself as a reader. To this purpose two standardized

procedures, used in two different studies, are illustrated. In the first study, sixth- and eighth-grade good and poor reading comprehenders are matched in their answers to a structured Questionnaire concerning four main aspects of reading: two related to knowledge (goals, strategies) and two related to control processes (control and error detection, text sensitivity). Poor comprehenders' scores are significantly lower in all the four aspects. It is argued that a standard Questionnaire may miss some of the child's feelings about reading especially when self-evaluation and self-esteem are involved and an alternative semiprojective Questionnaire is presented. Results based on the use of this Questionnaire with good and poor readers are presented.

Simulation of dissociative effects on explicit/implicit memory

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Patients with anterograde amnesia show similar results as normal patients in implicit tasks, whereas they show poorer performance in recall/recognition tasks (Warrington and Weiskrantz, 1970). Also the level of processing used with the stimuli seems to affect only explicit tasks, not implicit tasks (Graf and Mandler, 1984).

Several simulations were carried out in order to simulate these kinds of experimental effects in the context of the explicit vs implicit memory distinction. A simple back-propagation neural network seems to simulate such kinds of data. Results are discussed in terms of the implicit vs explicit memory controversy.

ELAN-1, a connectionist model for implicit and explicit memory tasks

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A connectionist model, named ELAN-1 (ELaboration and Activation Network), for simulating implicit and explicit memory tasks is presented. The model is an initial implementation of a theoretical view concerning the implicit/explicit memory distinction. This theoretical view addresses the roles of different learning mechanisms (i.e., activation and elaboration) and study/test compatibility within a single modular, hierarchic, and distributed memory system. Unlike the system view, which assigns implicit and explicit memory tasks to essentially two different memory systems, in this view memory (implicit and explicit) is considered a function of the interaction of many specialized sub-systems (or modules). Accordingly, the architecture of the model is modular. It consists of two interacting representational (CALM) modules, one for item and the other for context information, and additional input and output modules. Processing in the model can be subdivided into within-module competition (i.e., inhibitory processing) and between-module interaction (i.e., excitatory processing). Implicit memory tasks can be simulated by presenting incomplete items as input. Here a single item is produced as output. Continuous presentation of context produces a sequence of items as output, which simulates an explicit free recall task.

An initial simulation with this model was concerned with the dissociative effect of word frequency on an implicit (word-stem-completion) and an explicit (free recall) task. Furthermore, by lesioning the model certain features of the (anterograde) amnesic syndrome could be successfully simulated. Overall, a reasonable qualitative fit between experimental and simulation data can be achieved with this (simple) model. Extensions and improvements to this model, which are for example concerned with a more realistic representation of inter-item associations, are suggested and preliminary simulations with the extended model are presented.

The psychological reality of the syllable structure: comparison of naming latencies to CVC versus CCV syllables

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This experiment was designed to shed some light on how the cognitive system represents syllables and use them in a naming task. It has been repeatedly proposed that syllables are represented by means of a hierarchical tree, whereby a syllable is decomposed in an initial consonant group and a rhyme, and the rhyme is further decomposed by a vowel group or peak and a final consonant group or coda. Moreover, some current language production models (Dell, 1986; MacKay, 1987) view this hierarchical structure as part of a spreading activation network.

This experiment examines the effects of structural complexity and usage frequency of syllables on vocal latencies. Consonant-vowel-consonant (CVC) and consonant-consonant-vowel (CCV) syllables allow a test between two levels of complexity of the left branch of the hypothesized tree. Three levels of usage frequency of syllables were selected and factorially crossed with structure. The results show that CVC syllables were named faster than CCV syllables, and that frequency has a negative relationship with latencies. Syllable frequency and structure did not interact. This pattern of results is interpreted as evidence for the psychological reality of syllable complex onsets. The way associative networks for language production represent syllables and the locus of frequency effects in them is discussed.

Unless reasoning

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Five experiments were carried out to investigate how people reason with "unless" as a conditional. An assertion such as "not-p unless q" has the same truth conditions as "if p then q", but we argue that it is represented differently, i.e. the initial mental models for these two connectives are not the same. Furthermore, we hypothesised that the initial mental models of the assertion "not-p unless q" would resemble the initial mental models of the assertion "p only if q".

The first 4 experiments, in which we controlled for possible effects of negations in the assertions, investigated and confirmed this hypothesis. However, we hypothesised also that a pragmatic component has an influence and would make, at least with abstract material, the assertion "not-p unless q" more difficult than the comparable assertion "p only if q". Again, this hypothesis was confirmed.

Resolving NP-attachment ambiguities in German: results from self-paced reading and eye-movement experiments

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The principles that guide the process of sentence comprehension are central to psychological investigations of human language processing. In order to prove such principles empirically, psycholinguistic experiments must be run investigating sentences for which processing difficulties are evidently caused by lexical, structural, or other ambiguities. In word-by-word self-paced reading experiments on NP-attachment ambiguities in German (1a,b) we found evidence for a preference to attach the structurally ambiguous NP [dem/des Professor(s)] to the preceding NP [der Doktorand] rather than to the VP.

- 1a. Das der Doktorand *dem* Professor Urlaub abgetrotzt hat, ...
That the student (from the) professor (male, dative) a vacation wrested, ...
- 1b. Das der Doktorand des Professors Urlaub gefordert hat, ...
That the student (of the) professor (male, genitive) a vacation demanded, ...

While these findings contradict Frazier's (1991) Garden Path theory, the predictions of the head attachment principle fit the data very well (Konieczny, Scheepers, Hemforth, and Strube, 1991). Head attachment states that whenever an attachment ambiguity occurs during the course of sentence processing, the critical constituent is to be attached — if possible — to a phrase with its head already read. Because a dative-case article hinders an attachment to the preceding NP, it should induce a time-consuming reanalysis, and this was in fact indicated by higher processing times.

In recent experiments we evaluated the results of the former experiment by collecting eye-movement data during reading the same set of materials. This method has important advantages over the self-paced reading task. First, the reading situation is more natural, because the subjects do not have to perform a secondary task, like pressing a button. Second, the eye-tracking method allows us to separate first analysis processes from reanalysis processes directly by examining forward-directed eye-movements and regressive eye-movements, respectively. We calculated several fixation measures to separate different processing stages for each word. These were compared with the respective processing times collected in the self-paced reading experiment.

Cognitive aspects of the procedure bias: the judgment-choice discrepancy

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Response-mode biases have been found when subjects are asked to express preferences between pairs of decision alternatives whose consequences are described by two attributes. In a choice task, subjects placed more weight on the predominant or prominent attribute than they did in a matching task in which they were required to make the two options equally attractive (Tversky, Sattath, and Slovic, 1988; Slovic, Griffin, and Tversky, 1990). Tversky et al. (1988) have developed a cognitive theory which states that this so-called prominence effect occurs because choice and matching tasks evoke different types of mental strategies. However, the prominence effect can also be explained by Montgomery's (1983) theory of restructuring. Here, human decision-making is seen as a problem-solving process, in which one alternative gradually is restructured until it is sufficient for a decision. According to this theory, a lexicographic rule primed by a qualitative response mode cannot adequately account for restructuring operations carried out on both attributes. In the present study, 36 subjects in three conditions were asked to make choices, acceptances, or ratings of pairs of alternatives that they had previously equated in value. All subjects were instructed to think-aloud. A prominence effect was uniformly obtained. Due to the uniformity of the effect, the three conditions were subdivided into two groups based on whether responses were in favour of the prominent alternative or not. The analysis of these clusters was in support of the restructuring explanation.

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Performance and validation of the RBMT (Rivermead Behavioural Memory Test) in a sample of Spanish brain-damaged

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The RBMT (Rivermead Behavioural Memory Test) is a short test of everyday memory problems used with a variety of diagnostic groups to answer different questions related with diagnostic and clinical rehabilitation of memory. In this study we have used the RBMT to assess

the performance of brain-injured patients in this test and to validate it using other established memory measures with a Spanish sample. This offers the possibility of a differential diagnostic in memory disorders for each category of brain-damaged.

Visual search and skewed symmetry

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Visual search tasks have been widely used to study attentional phenomena and, particularly, to isolate simple perceptual features that can be detected preattentively. Previous results suggest that skewed symmetric patterns (i.e. symmetric shapes rotated in three-dimensional space) cannot be preattentively detected. A set of experiments using visual search for volumetric shapes rotated in three-dimensional space explore this idea. The experiments were designed to test the assumption, made by recent theories, that detecting qualitative differences in non-accidental properties such as symmetry is an essential part of object recognition.

This experimental series checks whether this claim is right. The stimuli were volumetric shapes rotated in three-dimensional space with one of two possible cross sections: elliptic or rectangular. Each of the stimuli might either have a symmetric cross section (circle or square) or one of two different degrees of asymmetry (measured as the ratio between the two main axes). Several distractor-target pairs were used. In each pair distractor and target might differ in one of two possible ways: a) one of them had a symmetric cross section and the other an asymmetric one or b) both of them were asymmetric in different degrees. Some recent object-recognition theories would predict rapid search for a) and slow search for b). Previous results about skewed-asymmetry search would lead one to predict slow search throughout the experiments.

Results do not agree perfectly with either view: in most cases rapid search was impossible but, under certain circumstances, it could be obtained: rapid (preattentive) search was observed only when the distractor cross section was circular (symmetric) and the target cross section elliptic (asymmetric). Such a result suggests a complex relation between attentional effort, shape and symmetry detection which has not been so far theoretically accounted for.

Picture naming with subordinate and co-ordinate distractor words

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Many objects can be identified at different levels, reflecting the degree of specificity in naming (e.g., at the superordinate level — animal; at the basic level — dog; at the subordinate level — poodle). With some exceptions, objects are named most readily at the basic level. A relevant question concerns the activation of names at other levels when an object is named at a particular level. When subjects are instructed to name at a particular level, are names at different levels simultaneously activated, possibly leading to interference? Alternatively, the different names an object has may be represented as separate and distinct pathways, and may not lead to interference when naming at one level.

Four experiments using the picture-word interference task examine the relative interference of subordinate and co-ordinate distractor words when subjects are asked to name objects at the basic level. Compared with unrelated conditions, the naming times of objects (e.g., DOG) with co-ordinate distractor words (e.g., racoon) was slowed. The effect on basic level naming of a subordinate distractor word depended on the typicality of the distractor word. Words depicting typical subordinates (e.g., labrador) did not interfere with basic level naming. Distractor words depicting atypical subordinates (e.g., poodle) slowed basic level naming compared with unrelated conditions. The results are interpreted with respect to the pathways activated during picture naming.

Remembering frequency of occurrence: effects of material and intelligence level

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Hasher and Zacks' model (1979) defines several criteria for distinguishing automatic from effortful cognitive processes. Particularly, automatic processes show little change with age, do not benefit from practice, are not affected by competing task demand, show minimal if any individual differences, are not affected by the intentionality of the task and by effortful strategies.

The aim of our paper concerns the criteria pertaining individual differences and effortful encoding strategies. On these grounds we would like to see if recall of frequency of occurrence for different kinds of stimuli (words, pictures, odours and non-sense pictures) by Normal and Mentally Retarded children is an automatic process, as supposed by Hasher and Zacks.

Three groups of subjects participated in the experiment: 12 Normal children, students at primary school; 12 Mentally Retarded, matched to the normal on the basis of their mental age; and 12 Mentally Retarded, matched to the normal on the basis of their chronological age.

Subjects were exposed, in an incidental condition, to four lists of 12 concrete words, 12 pictures, 12 nonsense words and 12 odours. Four of these items appeared once in each list, four twice and the last four three times.

Subsequently subjects were presented the items (one after the other) with the request to say how many times they had seen them previously.

Data seem to be at odds with the model of Hasher and Zacks, being that the remembering of frequency of occurrence was affected by the level of intelligence and kind of stimuli.