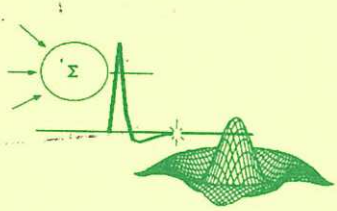
INTERUNIVERSITY CENTRE FOR RESEARCH ON COGNITIVE PROCESSING IN NATURAL AND ARTIFICIAL SYSTEMS



Università degli studi di Roma "La Sapienza"
Università degli studi di Roma Tor Vergata
III Università degli studi di Roma

ECONA

Sponsored events, on the occasion of the

VIII Conference of the European Society for Cognitive Psychology

Rome 23-27 September 1995

EDIZIONI KAPPA

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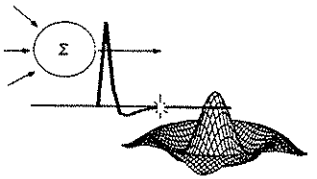

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Contents

ECONA lectures

ESCOP CONFERENCE (SEPTEMBER 26th, 1995)

INFANT NEUROPSYCHOLOGY, BRAIN IMAGING AND FIRST LANGUAGE ACQUISITION

Jacques Mehler

Laboratoire de Sciences Cognitives et Psycholinguistique
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Since the early 19th century a search for the cortical structures that mediate psychological functions has advanced without interruption. In the last twenty years the search has advanced thanks to two new research areas, namely, infant neuropsychology and brain imaging in general.

I am going to present evidence showing that at birth the human brain is structured to acquire language. Infants, shortly after birth can be shown to process language-like stimuli mostly with their left-hemisphere. Both behavioral and electrophysiological evidence support this contention. Likewise, PETscan studies help us demonstrate that the cortical structures that mediate language in the adult are mostly circumscribed to the left hemisphere. Some of these structures are not part of the standard neuropsychological teachings. Moreover, the specialized structures are mostly devoted to process ones maternal language. Languages there were acquired later in life use diffuse structures.

In brief, the language organ seems to be there in order to mediate the acquisition and use of the maternal language. Other languages can be then acquired by ones general intelligence.

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ESCOP CONFERENCE (SEPTEMBER 27th, 1995)

WHAT'S IN THE MIND? CONSTRAINTS ON MENTAL STRUCTURES

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The practice of building models of cognitive processes can be (and is routinely) led astray by various fields and fashions to which the biological and social science are particularly susceptible, and by the widespread practice (wich Alan Newell documented in his influential "Twenty Questions" paper) of attending to local paradigm-based experimental findings. Unless we take into account the most general and powerfull constraints that any explanatorily adequate model must meet, we can easily be lead into dead ends where our models are either not about the psychological phenomena we started out investigating, or more likely, we will develop models that have no possibility of scaling beyond the mere microcosms of the experimental paradigms on which they were developed. In this talk I will summarize what seem me to be some of these constraints or boundary conditions on theories of cognition and will show how they severely restrict the class of models that are acceptable. Then I will have some comments to make about whether the current trend to move towards neuroscience-based models (or as they are sometimes called "brain-like models") adhere to the most salient of these overarching constraints.

The general properties of cognition that I propose as forming the basis for the most powerfull constraints on cognitive theory are the following:

1) The Semantic determinants of most cognitive behavior. By this I mean that to capture regularities in cognitively-caused behavior (behavior determined by mental states, which excludes aspects of physical movements like falling, accelerating, growing and other such changes the extent of which remains a long-term empirical question) requires the use of semantic terms - terms referring to the contents of metal states - to what the states represent.

2) Closely related to this is the Cognitive Penetrability of most cognitive processes. By this I mean that almost any regularity can be sistematically altered in a quasi-rational way (or perhaps a more neutral way to say this is, in a content-dependent way) by imparting new information.

3) The productivity and systematicity of systems of mental representation. By this I

mean that systems of mental representation are structured so that even though they may not be capable of representing any possible state of affairs, it is nevertheless the case that IF they are capable of representing certain situations in the world (real or counterfictual) THEN they are thereby also capable of representing an entire set (usually unbounded) of other related situations; and

4) Because of an organism's ecological or social niche, only a small fraction of its behavioral repertoire is ever actually observed (or even realizable in principle in the course of its normal life). Nonetheless an adequate cognitive theory must account for the entire behavioral repertoire that is compatible with the organism's structure, which we call its cognitive CAPACITY, because it is this capacity that reveals the nature of mind.

Put in this sharp form the constraints may appear to begging the question and in fact presupposing one or another historical school of psychology And many of these premises certainly appear to be in conflict with one or another contenporary schools of psychology and psychobiology. But I will try to show that they have been and are currently implicit in virtually all studies of cognition, and moreover that they are indispensable if we are to ever have a general theory of the cognizing mind/brain. We may drop one or another of these constraints at the peril of developing a science which, however elegant and sophisticated it may be, will be impotent to account for behavior that is essentially cognitive and which therefore will be a science which has nothing to say about human nature (what kind of an organism or sytem is the human mind?). I take that to be the ultimate indictment of the entire enterprise of Cognitive Science.

In this talk I will provide illustrations of some of these constraints and what happens when they are ignored or violated, by drawing from my own experimental and theoretical work on studies of cognitive architecture, on studies of mental imagery, on proposals for new approaches to perception and to learning using Neural Nets.

CURRICULUM VITAE

Zenon Pylyshyn received a B.Eng. in Engineering-Physics from McGill University, an M.Sc. in Control Systems from the University of Saskatchewan, and a Ph.D. in Experimental Psychology from the University of Saskatchewan for research involving the application of information theory to studies of human short-term memory. Following his Ph.D. he spent two years as a Canada Council Senior fellow and then joined the faculty at the University of Western Ontario in London, where he remained until 1994 as Professor of Psychology and of Computer Science, as well as honorary professor in the departments of Philosophy and Electrical Engineering and Director of the UWO Centre for Cognitive Science. In 1994 he joined the faculty of Rutgers University as Board of Governors Professor of Cognitive Science and Director of the Rutgers Center for Cognitive Science.

Pylyshyn is recipient of numerous fellowships and awards. He received the

Donald O. Hebb Award of the Canadian Psychological Association in June 1990 for his contribution to psychology as a science. He is a Fellow if the Canadian Psychological Association and the American Association for Artificial Intelligence. He has been a Killam Fellow, a fellow of the Center for Advanced Study in the Behavioral Sciences and the MIT Center for Cognitive Sciewnce and is currently a Fellow of the Canadian Institute for Advanced Research (CIAR). He is past president of both the Society for Philosophy and Psychology, and of the Cognitive Science Society and national director of the Canadian Institute for Advanced Research program in Artificial Intelligence and Robotics.

Pylyshyn has published over 60 scientific articles and book chapters and is author of *Computation and Cognition: Toward a Foundation for Cognitive Science* (1984). He also edited and contributed to four books, including: *Perspectives on the Computer Revolution* (1988); *Computational Processes in Human Computer Revolution* (1988); *Computational Processes in Human Vision: An Interdisciplinary Perspective* (1988). He published *The Robot's Dilemma: The Frame Problem in Artificial Intelligence* (1987) and *Meaning and Cognitive Structure: Issues in the Computational Theory of Mind* (1986). As chairman of a panel on artificial intelligence under a grant from the National Science Foundation, Pylyshyn also helped to produce a major survey of the state-of-the-art in artificial intelligence which appeared in the book *What Can be Automated?* (1980).

For the past few years, Pylyshyn's personal research has dealt with two general areas. One is the theoretical analysis of the nature of the human computational system which enables humans to reason and perceive the world. This has led to a number of theoretical investigations of the "architecture of the mind". On the experimental side Pylyshyn has been concerned with exploring his so-called FINST theory dealing with human visual attention and the encoding of spatial information. This theory consists of a set of hypotheses about a mechanism by which the location of features in a visual display are preattentively indexed (i.e.,FINSTed) so that they can be referred to by subsequent cognitive processes. Several papers have been published on this theory and its experimental investigation, as well as its implications for understanding perceptual-motor coordination and for the design of human interfaces.

ESCOM WORKSHOP (SEPTEMBER 27th, 1995)

LE RÔLE DE LA RÉPÉTITION DANS LE DÉVELOPPEMENT DE LA COGNITION MUSICALE

Michel Imberty

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La tradition psychologique a toujours été de considérer les phénomènes de répétition ou les conduites répétitives comme des phénomènes de dégéné rescence ou des conduites à caractère compulsif sans intérêt autre que pathologique.

Or la répétition est le principe même de toute musique, la répétition impliquant non seulement l'opposition entre ce qui est répété (immédiatement ou à distance) et ce qui ne l'est pas, mais impliquant également la variation, répétition non à l'identique d'un modèle reconnaissable à travers une ornementation créative qui façonne l'unité de la forme musicale dans le temps en même temps que sa progression. Une psychologie cognitive de la musique, comme une psychologie de l'affect musical, ne peuvent ignorer la répétition comme fondement de la musique.

La répétition apparaît comme projet de maîtriser le temps: sans doute, a priori, aucun caractère temporel particulier n'apparaît dans la répétition; mais l'étude de toutes les formes de répétition, notamment dans les musiques où elle apparaît comme la plus rigoureuse, montre qu'elle dépasse la simple identité du répété: la qualité de l'instant qui s'ajoute à la répétition antérieure induit déjà la *variation*. Ce passage de la répétition à la variation est sensible dans les formes de musique où le rôle de l'exécutant est essentiel: la variation tient parfois à une intime modification du *tempo*, à une accentuation plus marquée, à une façon subtilement différente de faire attendre ou de précipiter les successions répétitives. L'exemple de Steve Reich est significatif: le "processus musical graduel" développe, par son mécanisme propre, la dérivation progressive, extrêmement lente, de la répétition de la cellule initiale.

La répétition crée donc en premier lieu l'attente du retour, l'attente de l'identique avec une marge suffisante d'incertitude pour qu'à chaque fois se glisse le sentiment que la répétition aurait pu ne pas être du tout, que l'avenir peut toujours être inconnu. La répétition crée donc une *tension* liée à une *attente* qui est ensuite suivie d'une détente plus ou moins marquée selon que la *variation* s'éloigne plus ou moins du modèle initial. Les "processus musicaux graduels" de Steve Reich sont donc des organisations temporelles musicales de l'attente, et des transmutations heureuses de l'attente.

Or la psychologie du développement, et spécialement la psychologie de la première enfance, met en évidence l'importance de cette structure fondamentale de

la répétition-variation. Ainsi D. Stern montre comment tout le début de la socialisation de l'enfant (entre 3 et 6 mois) est basé sur une organisation répétitive créée par la mère dans ses relations avec lui. Deux éléments permettent le développement de la socialisation, de l'affect et de la cognition dans de telles situations: d'une part, l'enfant apprend à s'adapter à un nombre toujours plus important de variations, mais d'autre part, il ne le peut que parce que la répétition est basée sur *un rythme régulier* qui rend prévisible et organise le temps. C'est sur cette régularité que se fonde l'alternance émotionelle de la tension et de la détente.

La répétition, en tant qu'elle structure le temps, structure aussi les expériences émotionelles du sujet, et c'est là l'une des sources les plus riches de l'expérience musicale future. Mais en même temps, la répétition n'acquiert de valeur positive que dans la mesure où elle engendre des variations acceptables, c'est à dire des variations qui permettent la reconnaissance des repères et l'identification du modèle initial. Il y a des limites au-delà desquelles la variation détruit l'effet de la répétition, instaure la perte et le chaos. C'est en ces limites que le rôle structurant de la répétition apparaît. C'est au delà de ces limites que commence l'expérience de l'angoisse et de l'attente impérieuse du retour à la répétition.

CURRICULUM VITAE

Président de l'Université de Paris X - Nanterre
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Directeur de Recherche en psycho-pédagogie de la musique à l'Université de Paris IV.
Conseiller scientifique auprès de la Società Italiana per l'Educazione Musicale
Professeur invité auprès des Universités de Bologne, Rome, Calabre, Grenade.
A publié 7 ouvrages et plus d'une centaine d'arlicles sur la psychogie de la musique, la psychanalyse et l'esthétique. Est plus spécialement spécialiste des problèmes du temps en musique.

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ESCOM WORKSHOP (SEPTEMBER 27th, 1995)

THE BODY-PLAY, THE SONORITY AND THE DEVELOPMENT OF THE MIND

Pina Boggi Cavallo, Antonio Iannaccone

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The Psychology of Music has explored various aspects of the musical experience (Boggi Cavallo, 1992), from neurophysiological to neuropsychological aspects, from musicological and musicotherapeutical to ethnological aspects, from perceptive to cognitive aspects, to find answers to many questions proposed by the study of this particular and exclusively human experience.

The significance of the experience of the sonority, movement and music for the development of cognitive competences of the individual remains in the shadow. The research has privileged the exploration of musical abilities (innate versus learned), their measurability, their potential of increase.

The possibility of exploring this aspect of the psychology of music was offered by the development of the newest theories about the mind and,more recently, by the development of the cognitivism (Gardner, 1983, 1993; Neisser, 1976; Bruner, 1992). Thanks to these, the link between a possible device of multiple intelligence and the egemony of the ermeneutic in the reproduction of the experiences gives to all channels of the symbolization of the reality the same dignity and the same productivity.

Our previous research (Boggi Cavallo, Iannaccone, Noschese, 1991) allows the preparation of an experimental longitudinal research to verify the hypothesis, according to the plurality of intelligences during a period of three years, supported with a program which is aimed to:

a) discovery of the self, sonour, rhythmical, motorial (first year) ;

b) knowledge and listening of the self, sonour, rhythmical, motorial (second year);

c) socialization and expression through sound: musical production (third year).

For each proposal the articulation of the activity was: free exploration, observation, articulation, verification. We administrated four times a group of selected tests to measure musical intelligence (Rhythms of Stamback, spontaneous production of rhythms, verbal rhythms, motorial rhythms), linguistic intelligence (repetition of a tale, (Andreani, 1992), kinesial/bodily intelligence (praxies of face, arms and legs. (Andreani, 1992), logical/mathematical intelligence (Piagetian

items). The overall number of pre-school children engaged in our program has been modified during the research, because not all of the babies remained at school during the afternoon, because of change of address of their family and because of absences caused by frequent pediatric illnesses. Finally, the reason linked to the necessity of rigorous comparison (experimental vs. control group) persuaded us to compare 12 subjects, 6 from experimental and 6 from control group.

Results, statistically treated with non-parametrical tests for small groups, confirm our hypothesis. The musical, sonorous and bodily experience, guided along a program, supports the development either of musical and kinesical abilities, either of cognitive and liguistic abilities, because non-verbal•communicative channels become egemonical. The experimental group has shown significant progresses in all abilities measured with regard to the control group, and demonstrates how the musical channels interact positively with the logical and linguistic development. The control group confirms the evolutive trend, in maturative terms, according to the cultural expectations, and shows how the main developmental channel is the verbal and linguistic one.

CURRICULUM VITAE

Pina Boggi Cavallo is Professor of Psychology at the University of Salerno.

CURRICULUM VITAE

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ESCOM WORKSHOP (SEPTEMBER 27th, 1995)

PERCEPTUAL APPROACHES TO THE ANALYSIS OF MUSICAL STRUCTURE

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Music presents special opportunities and challenges to cognitive psychology. It provides a wealth of complex and varied stimulus materials with an important scholarly tradition of theorizing and analysis. By its nature, however, music resists description, leading to the application of a diverse array of representational systems. These include formalisms from linguistics, applications of information and set-theory, and various geometrical and graphical representations. Psychological experiments can serve as a useful complement to these other approaches, yielding insights into how we perceive, remember, and organize music.

Psychological research on music has developed a wide variety of different methodologies. Some experiments measure psychoacoustic properties, such as consonance and dissonance, using tones without a musical context. Other experiments employ short musical materials that are written to isolate the effect of some particular property, such as harmonic conventions or scale structure. Other experiments investigate how an entire composition is perceived or performed. Although the experiments have tended to use music from the Western tonal-harmonic style, some have used music from other periods and cultures. Participants in experiments range from young infants to highly expert professional musicians.

The research to be described is a case study of a single piece of music, a movement of a piano sonata by Mozart. It draws on two different traditions of musical analysis. One describes music as giving rise to variations in tension over time. Music, particularly music of the Western tonal-harmonic style, is said to produce patterns of increasing and decreasing tension. At some points in time, the music is unstable, giving rise to a sense of tension and strong expectancies for continuation. At other points in time, the music reaches a point of stability, giving a release from tension and a sense that a point of conclusion has been reached. This aspect of music perception may be related to both kinesthetic and affective responses to music.

The research also draws on the tradition of drawing analogies between music and language. In particular, a tradition of music analysis draws parallels between music of this style and discourse. The music contains a number of conventional figures or motives, which are introduced, repeated, and developed. These are

compared with topics of conversation in discourse. More recently, specific similarities between units in music and discourse have been noted, with the suggestion that both reflect the operation of conscious experience.

The experiment employed listeners with a range of musical training. The music was reproduced from a professional performance and played without interruption. All listeners performed three tasks. One task investigated how the experience of tension varies over time; listeners continually adjusted a computer control to indicate the amount of tension heard throughout the piece. Another task determined how the music was heard as segmented; listeners responded when they heard the end of each section of the piece. The third task asked listeners to indicate when they identified a new musical idea. These three tasks were performed first with the entire piece, and then on smaller sections.

The results showed that listeners can make reliable and interpretable judgments of tension. The tension profiles exhibited reasonable agreement across individuals, with little effect of musical training, and a high degree of consistency across repetitions. The patterns could be traced to structural aspects of the piece, including harmony, melodic contour, dynamics, and large-scale musical form. Judgments of segmentation were also quite consistent across listeners and repetitions. Judgments of new ideas were less consistent, and showed the greatest effect of increased familiarity with the piece across repetitions. Nonetheless, all three aspects of perception were coordinated with one another to form a coherent cognitive representation.

CURRICULUM VITAE

Carol L. Krumhansl is Professor of Psychology at Cornell University in Ithaca, NY USA. Her research focuses on the psychology of music and appears in the monograph *Cognitive Foundations of Musical Pitch* (Oxford University Press, 1990) and numerous journal articles. Applying experimental methods to music, she has conducted research on a variety of topics, including tonal and harmonic organization in music, the experience of time, memory for music in twentieth-century and non-Western styles, infants' sensitivity to phrase structure in music, and the perception of musical timbre. She received her Ph.D. in Cognitive Psychology from Stanford University and the Early Career Award from the American Psychological Association. During the years 1983-84 and 1993-94 she was Fellow at the Center for Advanced Study in the Behavioral Sciences (Stanford, California), which sponsored a Special Project on Music Cognition in 1993-94. In 1987-88 she was a visiting scientist at I.R.C.A.M. (Paris, France). She is Associate Editor of Music Perception, a member of the Board of Directors of the Society of Music Perception and Cognition (SMPC), and a founding member of the European Society for the Cognitive Sciences of Music (ESCOM).

ESCOM WORKSHOP (SEPTEMBER 27th, 1995)

EXTRACTION D'INDICES ET SCHÉMATISATION DE LA FORME MUSICALE

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Il est généralement admis que l'organisation perceptive est basée sur la formation de groupes tels qu'ils ont été décrits par les lois de la Gestalt, processus qui évite la surcharge de la mémoire. Plusieurs études ont, par ailleurs, démontré comment ce type d'organisation s'applique à l'écoute de la musique. Cependant d'autres principes organisateurs doivent être pris en considération lorsqu'il s'agit de la perception de la musique en temps réel - l'écoute d'une oeuvre entière, par exemple. La mémorisation de groupes locaux s'enchaînant les uns aux autres, ne semble pas suffire lorsque les processus de mémorisation sont appelés à se poursuivre durant de longues plages temporelles.

Il y a environ une dizaine d'années, j'ai proposé les premières bases d'un modèle des processus cognitifs impliqués dans l'écoute d'une oeuvre musicale. Ce modèle considère l'écoute comme un processus de schématisation élaboré sur la base *d'indices extraits* pendant le déroulement de l'oeuvre. Au lieu de stocker chaque groupe en mémoire, l'auditeur est supposé sélectionner des *indices* saillants issus des groupes eux-mêmes. Ils contiennents les *invariants* du discours et sont le point de départ des processus de catégorisation qui établissent une comparaison entre entrées d'informations nouvelles et anciennes. Deux principes ont été définis dans le cadre de l'élaboration du modèle: les principes du MÊME et du DIFFÉRENTE. Les indices extraits sont les éléments conducteurs du fonctionnement de ces deux principes. Il a été observé, en effet, que l'agglomération en groupements formant de larges sections (ou périodes), de structures musicales pouvant être catégorisées comme similaires, se poursuit aussi longtemps qu'un même type d'invariant est reconnu. L'introduction d'une "différence" signalée par un indice chargé d'un potentiel contrastant suffisamment puissant, marque la fin du groupement. Une frontière est établie et un processus identique fonctionnera jusqu'à la fin de l'écoute: en fonction du principe du MÊME, un nouvel indice organisera la construction d'une nouvelle agglomération de structures, etc.

Selon Peirce, un indice est un signe bref contenant des attributs saillants, qui le lient à ce à quoi il se rapporte de manière à en provoquer la reconnaissance. Les

structures ou éléments musicaux susceptibles de jouer un rôle d'indice sont de divers ordres et dépendent de l'origine culturelle et historique de l'oeuvre. Par exemple, dans la musique occidentale, des structures locales - les motifs - dont l'identité se renforce par la répétition et la variation, n'apparaissent qu'à la fin du XVe siècle. Donc à partir de cette période et jusqu'à la fin de la pratique tonale, les indices seront plus généralement constitués de structures motiviques. Dans des périodes plus récentes, et dans d'autres cultures, bien d'autres types d'éléments musicaux pourront intervenir à ce titre.

Plusieurs procédures expérimentales ont été élaborées pour tester la validité du modèle.

La *procédure de segmentation* est appelée à montrer le rôle des indices dans la perception des grandes sections (ou périodes) de l'oeuvre. Ensuite la *procédure dite "Ligne mentale"* et la *procédure de "Relation entre paires de segments"* permettent d'observer le rôle que jouent les indices comme points de référence dans un schéma mental portant sur de longues périodes temporelles: une procédure complémentaire, *la procédure dite "Puzzle"*, a été introduite à titre de contre-exemple: les tâches demandées aux sujets dans cette procédure, mettent en évidence une aptitude assez maigre à organiser un déroulement musical sans l'aide d'indices mémorisés c'est-à-dire lorsqu'aucune audition préalable de la pièce n'a été donnée. Des *procédures de catégorisation* montrent enfin le rôle de l'indice dans des processus de *classification* et *d'évaluation de similarité* qui sont à la base des opérations de segmentation. Enfin la *procédure dite d'Empreinte* vise plus particulièrement l'effet cumulatif des répétitions et variations des indices au cours de l'audition. La notion *d'empreinte* est proche du concept de prototype et la procédure expérimentale proposée s'inspire des méthodologies pratiquées dans ce type de recherche.

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CURRICULUM VITAE

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ECONA Poster Session

"Perspectives on Italian Cognitivism"

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MEANING IN WORDS: A STUDY OF TEACHER-STUDENT INTERACTION ON THE COMPUTER

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The importance of meaning in words, and especially of the circumstances in which *speech acts* are produced, was first underlined in the studies of the philosophy of language in the 1960's and 70's. One of the language philosophers that dealt the most with this question was John L. Austin (1962): he proposed an analysis of the linguistic fact, identifying a class of utterances, the so-called *performatives*, which are actual *acts* performed in speech. Searle (1969), referring to the work of Austin, defined the basic unit of communication as a *speech act*, meaning an action performed while saying something. Within speech acts, two dimensions can be identified: what is the state or event or entity of social reality that the current speech act relates to; and how the speech act relates to or defines or constitutes that state or event of social reality.

In this sense, speech acts can be considered finite systems of discrete categories, rather than part of an infinite and indivisible continuum, and as such can be classified using a system of dialogue coding which includes the two above-mentioned dimensions (Ninio 1984, 1991).

Considering language acquisition, we can affirm that, since a child's language development grows out of interaction with the people who make up his/her environment, it is also important to study the behaviour of the adult and the rules that govern the adult's role in the course of his/her interaction with the child. Studies in this area confirm that the specific type of adult-child linguistic interaction that is gradually developed depends on the way in which the adult adapts him/herself to the child's level of competence; we can call this adaptation *adult pedagogic behaviour* (Bascetta, 1982).

What would happen to teacher-student interaction in the school context if a computer was introduced with the assumption that it is a powerful instrument capable of facilitating the teacher's pedagogical role? What effect would the relationship with the computer have on learning?

We used a linguistic computer education program in italian language called SEMELE (i.e. Elementary Semantics), conceived as an interactive linguistic adventure game : the child writes sentences on the computer which are then analyzed by the program (Albanese et al, 1991).

Until now we have studied these linguistic productions from the point of view of the sentence structure (Albanese et al, 1993). With the present work we intend to

study how the adult-child interaction ,which is the basis of the computer program's use, is structured in terms of speech-acts.Our hypothesis was that the interactive use of the computer game would facilitate the pedagogical role of the teacher, helping children's language development.

The children under examination, aged between 7 and 9 years,are observed during weekly computer sessions lasting 30 minutes while interacting with their teacher. Each session has been videotaped; the speech and gestures occurring between child and adult during the game have also been transcribed .

The occurring speech acts have been classified according to the Ninio and Weeler system (1986) as presented in the CHILDES Project (Mac Whinney, 1991). This system separates the component of *illocutionary force* from those aspects that deal with *types of interchange*. The classification methodology which we have used can lead to the use of these codes modified on the basis of Bascetta's analysis (1982) of communicative intentions and of our schemes.

The data are transcribed with a coding format named CHAT and interfaced with the CLAN programs, both from the CHILDES Project.

From these data, even though the study is in the preliminary phase, we can draw a profile of the teacher and of the children.

THE TEACHER requests, proposes, suggests actions (RP), congratulates (MK), asks why- questions (QN), and in general uses *illocutionary acts* in the "request-response", "marking", and "question-response" categories, and does so with all the children.

From the point of view of the *interchange categories*, she expresses approval (MRK), that she is willing to negotiate the initiation, continuation, and stopping - in general, all joint activity - (NIA), and that she is open to discussing anything in the related-to present (DRP).

THE CHILDREN, with regard to *illocutionary acts*, read the written text aloud (TX), they are involved in paying attention and responding to the suggestions and encouragement of the teacher.

From the point of view of the *interchange categories*, they dedicate a great deal of time discussing the related-to present (DRP), but they are definitely focused on the task (TXT).It seems that they rarely digress from the task, since they seldom engage in acts that involve "discussing a joint focus of attention" with the teacher (DJF).

THE INTERACTION was based on a *discussion* that the teacher started and the children pick up, while the *negotiation*, begun by the teacher, results in the performance of the task by the children. The child-teacher relationship can be classified as an *act of focused interaction*, which seems to characterize the whole teacher-child interaction during the computer sessions.

A UNIFIED THEORY OF FORMAL REASONING WITH MENTAL MODELS

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Present researches in cognitive psychology lack of unified theories, whereas microtheories increase. A first attempt to build a theory of the entire cognitive system was made by Newell (1990). Soar is the main product of Newell's theory where all cognitive tasks are phrase as problem solving. However, Pylyshyn (1991) points out that such a theory entails uniformity of cognitive architecture and uniformity of learning principle, neither of which is currently plausible.

As far as formal reasoning is concerned, we claim that there exists an intermediate level between Newell's conception of a unified theory of cognition and the microtheories developed as accounts of three major sub-areas of formal reasoning, that is syllogistic, relational and propositional reasoning. The development of microtheories reflects the difficulty to consider all the constraints that jointly affect and determine the reasoning process but, on the other hand, they fail to identify any general property of formal reasoning.

Rips (1994) has made an attempt to account for the computational procedures that describe the formal reasoning process, but adjusts his procedures on the data detected from human subjects performances and, so, his model is interesting only from an AI perspective.

We present a computational model of the general mechanism committed to reasoning with syllogisms, propositions and relations. The model, built following the claims of Mental Model Theory (Johnson-Laird, 1983), describes the reasoning process in terms of manipulation of mental models. A model is an analogical mental representation that reproduces the states of affairs that are perceived from the external world or verbally described by a natural language sentence.

Mental models are the inputs of the competential millstone that realizes the reasoning process. The millstone consists of two high-level procedures: integration and falsification of mental models.

The integration of two mental models identifies the common parts, in terms of tokens and relations, and builds a new model where the common parts have been merged in a single component. The remaining relations that were connected to this component in the original models are replicated in a new model. The model that result from integration describes new relations that were implicit in the two original models and that form the response of the reasoning process.

The falsification of mental models is the search for further integrated models. It consists in the integration of the premises through the merging of different components, or in the manipulation of the arrangement of elements in the model obtained previously. Falsification possibly produces new integrated models.

The response of the reasoning process must be consistent with all the models produced by the millstone. Another function, the reader of results, extracts the responses from the models, according to the global task in which the reasoning process is embedded. We have investigated three tasks: producing an inference, giving truth-value judgments, deciding whether to execute an action. We have found that the computational model provides a finer ranking of the difficulty of the trials with respect to other models in the literature.

Moreover, we have analyzed the reasoning process from a developmental perspective: subjects are assumed to possess the competence in formal reasoning at any age, but performance is affected by two limiting factors, the capacity of the working memory and the degree of mastering of the basic abilities involved in the competential millstone (Bara, Bucciarelli, Johnson-Laird, 1995). Not only correct responses, but also different kinds of erroneous performances are predicted by the theory and reproduced by the computational model. As working memory capacity and the mastering increase with the age, the percentages of erroneous responses display a decreasing trend.

"MAKING FACES". YOUNG CHILDREN'S STRATEGIES FOR REPRESENTING THE HUMAN FACE

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AIMS - The general aim of this research was to explore how children acquire the ability of drawing the various details that make up a human face and, if necessary, to change their shape (Face Drawing Ability = FDA). In fact, even if there are numerous studies about how children of various ages represent and draw the human figure, little research has been conducted about the pictorial representation of faces. Yet the face is, pictorially speaking, an especially interesting object: while it shares with the rest of the body the characteristic of being made of constant, easy to recognize elements, at the same time some of these elements are highly variable in their appearance (open-shut eyes; smiling-frowining mouth, etc.). This latter fact significantly enlarges the number of pictorial equivalents to be discovered by the child. We wanted to determine at which age and how children acquire the ability of modifying (intentionally) the pictorial equivalents of a single part of the face, the eye, in order to correspond to a change in a model, shown and/or described.

THEORETICAL BASES - Two of the existing theories about pictorial

representation, Willats' and Karmiloff-Smith's, can help us to make some provisions about how FDA develops. Willats (1985, 1987) indicates a developmental progression in the choice of the denotation systems, that are necessary to create a correspondence between the objects represented and the parts of the drawings. Karmiloff-Smith (1992) says that children move from rigid representational procedures towards flexible uses of knowledge. Both theories point to a developmental progression from simple, "conservative" representation to more varying and potentially innovative depictions.

HYPOTHESIS - Young children, already able to draw a face including at least the eyes and the mouth, should initially be confined to a rigid repetition of the same pattern of equivalents (level 1); successively, children should be able to use different pictorial equivalents for the same part of the face according to its different appearance (open or closed eyes), but only in separate faces (level 2); finally (level 3) children should mix in the same face different ways of representing an element (winking face). This progression corresponds to an increasing flexibility in children's representation of faces.

SUBJECTS - 32 children, more or less equally divided among boys and girls; 16 from 3.3 to 3.11 years-old, mean age 3.7; 16 from 4.0 to 4.12 years-old, mean age 4.7.

MATERIALS - Sheets (21 x 30 cm) each with 1 predrawn circle, diameter cm.13.A tray with 9 small piles (randomly distributed) of different "pictorial equivalents" i.e. pieces of thin cardboard to be used as eyes, mouth etc.

PROCEDURE - *Base-line*. Each child was requested to complete a face using the pieces at his/her own will, and subsequently to make (a) another face as identical as possible to the first and (b) yet another face as much different as possible (the first face drawn remains in sight of the subject). *Experimental task*. Each child was requested to make a face with "wide open eyes" (Face 1) and a face with "eyes shut" (Face 2) and "a winking face", with one eye open and one eye shut (Face 3).

MEASURES - According to their baseline performance, children were divided in three groups: INCONSISTENT (children who vary the face elements also when they are requested to make identical faces); RIGID (children that are not able to change); FLEXIBLE (children who are change only when requested to do so). The percentage of appropriate changes of the eyes between Face 1, Face 2 and Face 3 made by the children of these three groups was subsequently calculated.

RESULTS - At the base-line, only slightly above half of the sample was both able to keep constant and to vary when requested the features of the represented faces. In the experimental task, the subjects' performances raised well above the chance-level. For the younger children the first part of the task (changes from Face 1 to Face 2) appeared to be easier than the next, probably because the children's attention was concentrated on similar element to be varied during successive executions; these same children, instead, were unable to change only one eye in the same face. The opposite happened with the older chidren, who proved to be more endowed with representative flexibility, being more receptive to the task, more able to follow the experimenter instructions, and less tied to "canonical" representations.

INTERACTION BETWEEN COGNITIVE ABILITY AND DEGREE OF INVOLVEMENT AS A DETERMINANT OF THE ABILITY TO LIE

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Lies are a good example of a Theory of Mind, in that they reveal the possibility to attribute mental states to other people and to manipulate their mental states with the aim to modify behavior (Chandler, 1994). The ability to tell lies implies the coexistece in children's minds of the mental representation of both the factual and the representational levels. Understanding and telling lies, although requiring different cognitive skills, share the necessity of conceiving the possibility of false representations. The progressive development of a Theory of Mind in young children is the result of a complex interaction of cognitive, emotional and social factors (Dunn, 1988; 1991). Up to now, most research has focused its interest on cognitive factors. We hypothesized that children can manipulate mental states long before the age of four, and that this ability can be revealed only when children are involved in challenging situations in which the best strategy is to manipulate beliefs, instead of behavior, although this latter strategy is more common in very young children. Two to three year-old children were asked to prevent the experimenter to get a toy. In Experiment 1 for each child we used the preferred child's toy; in Experiment 2 the toy had no particular affective value for the child. Results showed that in Experiment 1 children used idiosyncratic hiding strategies and tried to misinform the experimenter about the toy's location. When the object was neutral, as in Experiment 2, children did not try to hide the object, neither they made any attempt to deceive the experimenter. These results demonstrate that affective and emotional factors favor the adoption of deceptive strategies in very young children. Similar results were obtained in another study where spontaneous deceptive behavior of very young children was documented within the family context. At the age of two most of the children actively tried to deceive to pursue interesting goals. Overall, results indicate that even at the age of two children have an initial representation of mental states, and show the ability to act on mental states in order to modify others' behaviors.

SPATIAL MODELS DERIVED FROM VERBAL DESCRIPTIONS OF FICTITIOUS ENVIRONMENTS: THE INFLUENCE OF STUDY TIME AND INDIVIDUAL DIFFERENCES IN VISUO-SPATIAL ABILITY

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According to Siegel and White, there are, roughly, two kinds of spatial knowledge: *route* and *survey* knowledge. *Route* knowledge provides a path for going from a starting point location to a final destination. It consists of a sequence of direction actions accompanied by an indication of the length of each segment to cover. *Survey* knowledge, instead, allows to know the relationship between object location by means of canonical directions (N, S, E and W) and Euclidean distances of one landmark referred to another. These two kind of knowledge are, usually, acquired through real navigation (*route* knowledge) and study of maps or low height flight (*survey* knowledge).

Anyhow it is a common experience to acquire spatial knowledge from language. For instance, when we ask for route directions, or when we read a guide planning a travel. In this case language is used, instead of, or complementary to, maps.

Usually people process text with a view to extract its content and in doing so, form multiple representations of it: a representation of the *language* of the text, and a representation of the *situation* that includes 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. The format of mental models derived from verbal descriptions of fictitious environments has been investigated varying the perspective (*survey* and *route*) in which informationally equivalent descriptions of the same environments were written, and asking subjects to verify both *survey* and *route* statements requiring spatial inferences. The procedure provided two groups of subjects, who scored below and who scored above the median of the scores to the Revised Minnesota Paper Form Board -a visuo-spatial test- equally devided in the different experimental conditions. All subjects were admitted to two different experimental sessions. In the first they read descriptions from the computer screen one time only, in the second one they read descriptions three times. After both the experimental sessions, subjects had to verify inferential statements written in *route* and *survey* perspectives regardless of the perspective of the description they read.

The aim of the present study was to consider the role of study time and the influence of visuo-spatial ability on mental representation derived from spatial descriptions, in a sentence by sentence text presentation condition. The results showed that significant congruency effects -that is, a performance facilitation when

descriptions and inferential statements were written in the same perspective- emerged only for *survey* perspective both after one and three presentations of the text. Our opinion is that memory representations derived from *route* and *survey* perspectives preserved some of the characteristics of the text perspective, but the *survey* congruency condition is more facilitating than the *route* one. This is probably due to the hypothetical differences between *survey* and *route* representations. When subjects reading *route* descriptions are requested to verify *route* statements they have continuously to assume new or changing positions within their mental representation. Analogously, when they were asked to verify *survey* statements they had to assume a new position with respect to the one described. In contrast, subjects that read *survey* descriptions and verified *survey* statements did not have to perform any readjustment within their mental representation; while the same subjects that verified *route* statements needed to change their point of view, leading to a significantly worse performance.

In addition, subjects with high visuo-spatial ability performed better than subjects with low visuo-spatial ability when they read *survey* texts. No difference emerged when they read *route* texts.

This pattern of results indicated that: 1) *route* and *survey* descriptions of environments led to different mental representations; 2) study time affected level of performance but did not modify the format of mental representations; 3) individual differences should be taken into account when studying the influence of perspective on mental representation.

COLOUR PERCEPTION, COLOUR NAMES: A MATHEMATICAL OR STATISTICAL PROBLEM?

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According to modern theories, colour perception in human beings is based upon the existence of three kinds of retinal receptors (cones) whose responses to monochromatic light are centered on long L, medium M and short S wavelengths, with a partial overlap. The second step in the neural pathway to visual cortex takes place in a second layer of cells, where the excitatory or inhibitory connections with cones give rise to two opponent mechanism, called red-green and yellow-blue, plus a third one related to the overall light intensity. In this way the 3-d space of chromatic perceptions is divided in one luminosity dimension and a 2-d variety of strictly chromatic character: all (perceptually) possible colours (hues and saturations), including neutral, are represented by points contained in a closed region, whose boundaries are the curve of pure monochromatic lights and the line of saturated purples, namely mixtures of blue and red. Why these two particular

opponent mechanisms and not others (conceptually possible, like red-blue and green-purple)? What determines the number and location of basic colours? I want to propose answers to these questions taking into account in first place anatomical facts, and as a second possibility, statistical facts, with a reasoning based on mathematical grounds. The three kinds of cones are not equally represented on the retina: the majority of cones is of type L and M, whereas only few are of S type. Therefore when the center of a cell receptive field is dominated by L(M) cones, the surround is more likely dominated by M(L) cones, with only a few S cones distributed among center and surround. On the other hand, statistical fluctuations in cone distribution may concentrate S cones on a center, but in that case the surround contains (statistically) a mixture of L and M cones. The two resulting opponent mechanisms are red-green and yellow-blue, but it is not impossible that the remaining 4 possible mechanisms exist in quantities so scarce to excape experimental observation. Another asymmetry concerns the overlap of cones responses, which is large between L and M, moderate between M and S, and small between L and S: the 3x3 correlation matrix produced by unbiased ensemble of chromatic stimuli has as eigenvectors (principal components) a first vector whose components are all positive, a second one with L and M components of opposite sign and small S component, a third one where the S component is important and of opposite sign to both L and M ones. If these components can be interpreted as weights of input cells on cells of a second layer, the actual organization of luminosity and colour detection is readily explained.

The chromatic plane can be symmetrically divided into six colour-labeled regions (red, yellow, green, turquoise, blue, purple) and one neutral region (grey), whose boundaries can be easily defined from a geometrical point of view, but perceptually their distinction is not so clear cut. Another symmetrical division is suggested by the opponent mechanisms: red, green, yellow, blue. Thomgs are different from the linguistic point of view: in many cultures orange and violet are as important as other colours, in others some (fundamental) colours do not even deserve a name. Statistical relevance of chromatic stimuli may be in part responsible for different numbers of regions; I think that the blue of the sky, the green of leaves, the red of blood, filtering daylight at each flutter of eyelids can justify the priority of these three colours. Another way to explain the sixfold division is to consider the nonlinearity of cells response to stimuli: the amount of pigment transformed is proportional to light intensity, whereas the conversion into electric signals and the subsequent response of the opponent cells of the second layer are not linear, but better described by a sigmoid function, with a threshold and a saturation level. Therefore even a homogeneous distribution of chromatic stimuli gives rise to an inhomogeneous distribution onto the perceptive chromatic plane: for low light intensities the density is higher in the centers of red, green and blue regions, whereas high light intensities produce higher densities in the yellow, turquoise and purple regions. In this way, either through the non-linearity argument or with the actual statistical inhomogeneity of stimuli it is easier to define boundaries between chromatic regions as valleys in the density distribution.

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TOPOLOGICAL STRUCTURE OF AUDITORY MUSICAL SPACE

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When people are asked to judge the distance between two simple sounds, the answers may vary according to different levels of musical culture or training, indicating that the notion of distance, in auditory space, is at least ambiguous: sounds one or more octave apart are very distant in terms e.g. of finger position on a keyboard, but very close from the musical point of view, sharing the same name; on the other hand sounds whose frequency ratio is very close to 1, so that the finger positions are almost the same, can be judged terribly distant i (i.e. completely out of tune) when the criterium is musical in nature. A mathematical evaluation of the distance between sounds can be defined through the overlap between the spectral representations of the two sounds, taking into account both the overtones distribution and the natural width of proper frequencies: in this way a satisfactory affinity criterium is obtained, but not an indication of a topological structure more complex than the "natural" one of the one-dimensional frequency ordering. We have faced this problem with a Kohonen type self-organizing neural network: input units, simulating auditory cortex neurons, were 120 resonators distributed over 5 octaves and tuned to frequencies 1/4 tone apart; output units, in number of 40x40, were displayed on the 2-d surface of a thorus: these small numbers (compared with the actual number of neurons in the auditory cortex: 400 per octave for 9 octaves) were chosen only for an economy in computing time. Training vectors were (computer simulated) sounds with 8 harmonic overtones whose fundamental pitches were randomly distributed over the 24 frequencies per octave. The only adjustable parameter was the line width W, running from a minimal value, barely allowing overlap between adjacent input units, to a maximal value producing simultaneous excitation of several units.

In the course of a preliminary run, sounds one octave apart were sistematically represented by contiguous "bubbles", namely areas surrounding the winning units; we have therefore eliminated the octave relation by a compactification of the frequency 1-d space which becomes a circle (closed topology) from the natural infinite line (open topology). The surviving 24 sounds generated bubbles whose ordering on the surface of the thorus depended on the line width: for large values of W (simulating a listener without musical training) the

dominant contiguity among bubbles corresponded to adjacent frequencies (interval of a quarter of tone), followed by the interval of fifth; for small values of W on the contrary (simulating good musical ear) the dominant contiguity corresponded to the fifth, followed by other consonant musical intervals, and only occasionally there was contact between bubbles 1/4 tone apart; for intermediate values of W the two competing principal contiguities coexisted, suggesting that auditory space can be represented at least in 3 dimensions, the first one corresponding to a gross height level (the octave), the second one to the (musical) organization of 12 pitches in the so called fifth circle which, in the tempered system, is an approximation of the infinite succession of exact fifths, and the third to the fine tuning running from one pitch to the adjacent semitone. The first two cohordinates are discrete, whereas the third is mathematically continuous, but neurologically represented by discrete and very close values. Thus the whole auditory space appears as a 3-d lattice, in which, according to network parameters, the relative importance of the three directions (principal axes in a cristallographic language) may change, generating what can be defined a topological transition.

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ENHANCED AND INVERTED BINOCULAR STEREOVISION

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The enhancement (reduction) of sensitivity in binocular stereovision can be obtained by raising (lowering) the interocular separation d, with a corresponding magnification (reduction), as in prismatic binoculars, or without, by means of two pairs of parallel mirrors. The same result can be obtained varying the separation among pairs of stereoscopic pictures. Real objects observed under these conditions appear to be closer (farther) than their actual distance and smaller (larger) than their actual size, if the effective interocular distance d is larger (smaller) than the average value of 6.5cm, the sensitivity to distance variations increases with the interocular distance. Introducing the binocular angle of convergence j = arctg (cos q ◊ Errore) and the minimum noticeable disparity djmin we obtain dr/r= (djmin ◊ r)/(d ◊ cos q)= djmin/j showing that the minimal noticeable value in the relative distance difference is inversely proportional to the interocular separation.

A similar perceptual result can be obtained by relative transverse motion with velocity v between the observer and objects: the effect is more evident in binocular than in monocular vision, suggesting that it is only partially due to motion-induced distorsions. A possible explanation is based on the hypothesis that the transverse optical flow causes a delay t in the trasmission of signals from the retina of the following eye to the visual cortex, in such a way that the simultaneity on the striate cortex, where disparity sensitive cells work, corresponds to events separated by t in the two retinas: during this time interval the preceding eye has travelled a distance vt so that the effective interocular distance is d+vt; even observing on the screen or on a TV set a scene taken with a single moving camera the effect is noticeable: the only difference concerns the effective interocular distance, which is just vt, since in that case d=0.

By similar means stereovision can be inverted, exchanging left and right eye positions, either by pair inversion of steroscopic pictures, or by means of a parallactic inverter, with which real scenarios can be observed with a reasonably wide field of view. In both cases the effective interocular distance can be considered negative, since the convergence angle grows with the distance, a behaviour opposite to what happens in normal conditions of observation.

The perceptual result is not merely the distance inversion (very close objects seem to be at infinity, far away ones appear within hand reach) but also a shape distorsion, since concave surfaces appear as convex and viceversa; straight lines and plane surfaces acquire curvature, so that the whole metric structure of the visual space is modified. The contradiction between the 3-d perception of objects and the knowledge of their actual shape is more evident when motion is added to the inversion, since motion-induced distorsions provide almost tactile sensations of actual shapes.

When the velocity becomes larger than a critical value, distance inversions and metric distortions disappear. This result can be interpreted in two different ways: physically the effective distance starts from a negative value -d to which vt is added, so that when v is larger than d/t the effective distance becomes again positive and the vision is normal; psychologically the contradiction between two space perceptions is resolved by the brain in favour of the strongest, namely the inverted one at low velocity, the normal (motion-induced) at high velocity. The two interpretations may coexist, and the first one is compatible with the results of an experiment we recently set up with a parallactic inverter:the effective (negative) interocular distance was of the order of 30 cm, and the critical velocity was qualitatively evaluated to be around 50Km/h: this gives for t a preliminary value of 0.02 sec, which is also acceptable from aneurological point of view.

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EMOTIONS AND VISUALLY IMPAIRED PEOPLE

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The emotional experiences of the blind have been studied mainly from the point of view of expression, to assess their ability to codify the facial expressions of primary emotions, the aim being to clarify whether emotional behaviour is innate or learned. The findings indicate that blind people's capacity to express their emotions is very similar to that of the sighted in their early stages of development. The differences between the two categories become larger with age, especially in relation to what are termed secondary, or social, emotions. For these emotions, in fact, learning linked to experience of non-verbal communication mediated by sight plays a large role. None of these investigations have looked into the content and specific features of emotional and affective experience. We study the emotional experience of the blind using a direct approach, by analysing the emotional contents of their daily lives. Our aim was to clarify whether a state of visual deprivation affects the way in which daily situations are appraised emotionally, taking account of the fact that seeing people gain most of their information on their surroundings through sight. The research looked more at the first aspect of emotional experience (receipt of information). It aims to assess how sensorial deprivation influences a person's apraisal of emotional antecedents, the responses activated and how all these processes are represented in memory. We think that quality and quantity of information acquired by a subject influence in a significant way his emotional experience. Bearing in mind the findings mentioned earlier and those of a previous study by our group on experience of primary emotions by blinds, we advanced hypotheses: 1) the modalities of representing antecedents and consequents of certain primary emotions differ in relation to the degree of visual impairment; 2) the emotions characterizing blind person's everyday life differ, to some extent, from those of the sighted. We studied 59 subjects divided into three groups: the first of 19 people, congenitally blind, the second of 21 with seriously damaged vision (less than 1/10, with a limited field of vision), and the third of 20 normal seeing adults. All the subjects were asked to narrate episodes from their everyday life in the last six months that had given rise to some type of emotional experience. At the end of their tale, there were asked to specify 1) how long ago the episode had happened; 2) how long the emotion had lasted; 3) any reactions which accompained each emotion; 4) how to label the emotion felt by one word. This procedure was repeated four times, without giving the subjects any time limit, so each person recounted four different episodes. The episodes and their contents were analysed and then grouped under 21 situation categories, obtained from a method of progressive generalization on several levels, reaching a formulation of summary

categories of meaning of the texts analysed.

The emotional experiences marking the everyday lives of the three groups of subjects differ considerably. The blind group and those with poor sight are much closer to each other than they are to sighted people. The differences between the groups are less in relation to the general mood, i.e. to whether positive or negative emotions prevail, since this was similar, than to the different categories of emotions mentioned as occurring most frequently. The sighted are more familiar with anger, while the blind and poor-sighted experience more sadness and fear; joy appears with equal frequency in all groups. The theory of evaluative controls of the stimulus, formulated by Scherer in 1984, states that emotions on the whole are the result of five systems of apraising stimuli: novelty, pleasurableness, relevance and coherence with the subject's aims, potential for adaptation and control, coherence with norms. Using this model we may try and establish the peculiarities of cognitive assessment of emotional experience by the blind.

COMPUTER ASSISTED REHABILITATION FOR CHILDREN WITH READING AND WRITING DISABILITIES

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Recent studies on subjects with learning disabilities stressed the role of computer aided course on the cognitive rehabilitation. In fact the computer generates high attention levels in the children and facilitates the learning processes, with little contribution of teachers.

The aim of this report is to describe the experimentation conducted during three years of research activity with a software for reading and writing rehabilitation in children.

The software, projected and realised on Macintosh Computers at the Department of Psychology of the University "La Sapienza" of Rome, has now a new version realised for PC Windows (**). The software is composed of some tasks to train the phonological and visual strategies described in (Coltheart, 1978; Ellis, 1982) "two ways" reading and writing cognitive models.

The first research made on (Scalisi, D'Amico, Renzi, Longoni, 1993) a seven years old child named Francesca who showed a specific reading disability, was able to read only isolated letters but no words or phrases.

On the first phase of intervention we tried to reinforce the phonological representation by a phonological awareness training; at the end the child was able to read the 91% and write 95% of the words composing the training material, but still showed reading and writing deficits. In the second phase we submitted our software

to the child, to train the visual access to the lexicon. After this phase the child improved significantly in reading and writing speed and accuracy, as well as in reading comprehension. Our hypothesis was that Francesca had an impairment on phonological reading and writing process, but not on the direct one; in fact the stimulation by the computer to the visual access realised with the constant association of words with pictures and sounds, gave her an alternative strategy to the phonological (and deficitary) way, the only thing she had learnt from the teacher.

The second research involved a normal group of Primary School children. Before starting the training phase we evaluated the group (105 children between 6 and 7 years old) on IQ and (Sartori, Job, Tressoldi, 1992; Tressoldi, Cornoldi, 1991; Cornoldi, Colpo e il gruppo M.T., 1981; Tressoldi, Cornoldi. ,1991) reading and writing level.

Then we divided the group into two balanced subgroups. The experimental group was submitted to a training (twice a week) with our didactic software, while the control group was submitted to a computer training on arithmetic and visuospatial tasks. At the end of the school year the reading and writing level of the entire group of children was re-examined; a MANOVA analysis was performed on the independent factors "GROUP" (experimental and control) and "TIME" (pre-test and post-test), the dependent variables being the score obtained by children at the reading and writing tests. A quite significant interaction TIME x GROUP was obtained ($p = 0.09$) in the multivariate analysis. The univariate analyses showed that the experimental group improved more than the control one for the dependent variable "Reading comprehension" ($p < 0,05$). We consider this result as prove of our didactic software efficiency. In fact we remarked that the association among sound, text and picture, promote the access to semantic system and facilitate the comprehension's processes.

The last experimentation (in progress) is been performed on 18 children at the second year of Primary School who have been pointed out by teachers for reading and writing difficulties. We used the following design:

O1 T+ O2 T- O3 T+ O4 T- 05 T+ O6

>----------->

TIME

in which there are 6 observation phases (O) and 6 training phases (T). In the "T+" periods the computer aided training on reading and writing was administered to the children, in the "T-" ones it was suspended.

The "T" phases consisted of about 40 - 45 days. In the O phases reading and writing tests were administered.

We expect that the learning level increase obtained in the O phases subsequent to a T+ period is higher than the one subsequent to a T- period.

The group we considered is heterogeneous for level and nature of disease, only 6 children having a specific disability on reading and writing (Z score between

-2.5 and -3.0), 6 children having poor general ability (IQ level < 90) and 5 children being foreigners and not speaking Italian at the beginning of the study. For this reason we foresee to examine both the general and the individual effect of computer aided training on reading and writing abilities.

(*) These researches was financied by a C.N.R. contribution.

(**) The software conversion on Windows platform was realized with "SIET Informatica".

MODELS OF SPONTANEOUS RHYTHM AND ASSESSMENT MODALITIES

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The variety of interpretations of the spontaneous rhythm concept makes it extremely difficult to identify a single theory. The literature on this subject evidences 4 main streams of thought.

AN ASSOCIATION MODEL foresees rhythmic organisation as a simple chain of durations, as in S-R bounds. This model describes rhythmic organisation from a perceptive point of view, and explains rhythmic aspects implied in the movement, considering each rhythmic element as a result of a preplanned motor scheme, in which each single movement is the feedback for the next (Lashley, in Jeffres ed., *Cerebral Mechanisms in Behaviour: The Hixon Symposium*, Wiley, 1951, 112-146).

A PHENOMENOLOGICAL MODEL foresees rhythmic organisation as a global experience, whereby on the basis of holistic principles, perceptive aspects are combined with motor aspects. According to this point of view, the structure rises from the opposition of two elements: duration and accent (Fraisse, in Carterette &. Friedman eds., *Handbook of Perception*, Academic Press, 1978, 8, 203-254), or figure and ground (Royer & Garner, *Perception and Psychophysics*, 1970, 7, 115-120; Preusser, Garner & Gottwald, *American J. of Psychology*, 1970, 83; 151-170).

A HIERARCHICAL MODEL foresees rhythmic organisation as a segmentation of temporal sequences into parts of equal duration, according to relevant accents. This segmentation occurs through the arrangement of several hierarchical levels which aim at the most economical and harmonious description of a temporal sequence. This description may be represented by a tree (Martin, *Psychological Review*, 1972, 79, 487-509) or a temporal grid (Povel, *Journal of Experimental Psychology*, 1981, 7, 3-18; Povel, *Psychological Research*, 1984, 45, 315-337.

A SYSTEMIC-COGNITIVISTIC MODEL foresees rhythmic organisation as an isochronical repetition of binary and ternary units, each unit being structured by

beats with different intensity or duration. This dichotomic structure is regarded as the result of an equilibration process, within the organism-environment system (Olivetti Belardinelli, *La Costruzione della Realtà*, Bollati Boringheri, 1986) and for this reason it is considered peculiar to each individual.

Examining these theories we reach the conclusion that one may identify two main methods of analysing rhythmic processes.

PRODUCTIVE METHODS require the subject to produce spontaneously or advertising some temporal sequences, generally by means of tapping. These methods aim at analysing the subject's *skill* in processing structured sequences.

EVALUATION METHODS require the subject to evaluate simultaneous or subsequent temporal sequences which vary in complexity. These methods aim at analysing the subject's *manner* of processing structured sequences.

These methods in their variety imply the use of different perceptive channels.

AUDITORY MODALITY is the most utilised as it is considered the most appropriate modality of elaborating temporal sequences and of producing motor and emotional effects (Fraisse, *Psychologie du Rythme*, Paris: Presses Universitaires de France, 1979). The largest part of rhythmic literature deals with auditory rhythm, and evidences the main principles of perceiving and producing rhythmic temporal sequences, such as definite ratios between durations, the role of pauses, the effects of intensity, frequency and length variations of a sound in a sequence, and so forth.

VISUAL MODALITY is the most controversial modality, given the technical constraints in turning a visual stimulation into the equivalent rhythmic experience (Fraisse, in Deutsch ed., *Psychology of Music*, Academic Press, 1982, 6, 149-180), or in other opinions, the physiologic limits of the visual system in processing temporal sequences (Handel & Yoder, *Quarterly Journal of Experimental Psychology*, 1975; 27, 111-122; Kolers & Brewster, *Journal of Experimental Psychology, Human Perception and Performance*, 1985, 11, 150-167), or according to others, the lack of psychological correspondence between visual and auditory rhythms (Glenberg, Mann, Altman, Forman & Procise, *Memory and Cognition*, 1989, 17, 373-383; Glenberg & Jona, *Memory and Cognition*, 1991, 19, 514-522; Handel, *Perception and Psychophysics*, 1992, 52, 497-507).

Finally, some interesting studies, evidence the role of rhythm, in performing cognitive tasks, (Valentini, Contributi dell'Istituto di Psicologia, 1957; Summers, Sargent & Hawkins, Psychological Research, 1984, 46, 107-119; Hiscock & Chipuer, Neuropsychologia, 1986, 24, 691-698) and set the basis for a systemic model, which delineates individual modality of dealing and solving non rhythmic problems, according to different rhythmic typologies (Olivetti Belardinelli, Comunicazioni Scientifiche di Psicologia Generale, 1979, 6, 7-43; Olivetti Belardinelli & Pessa, Comunicazioni Scientifiche di Psicologia Generale, 1981, 8, 51-81; Olivetti Belardinelli & Besi, Comunicazioni Scientifiche di Psicologia Generale, 1992, 10 n.s., 43-58; Nicole & Olivetti Belardinelli, Comunicazioni Scientifiche di Psicologia Generale, 1993, 10 n.s., 59-89).

ENHANCING AND NORMALIZING INCONGRUOUS INFORMATION THROUGH SERIAL REPRODUCTION.

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A *serial reproduction* is a procedure in which, starting from a given model, a series of subjects sequentially copy one from the other.

Serial reproduction of a black dot which is slightly eccentric, inside a white rectangular sheet of paper, was used by Sir Frederic C. Bartlett (1951) to show the progressive migration of that point toward a corner. Recently Stadler, Kruser & Pfaff (1991), and Stadler, Richer, Pfaff & Kruse (1991), used this demonstration to support the hypothesis of complex psycho-physical and psycho-physiological dynamics due to the presence of "attractors"at the corners of the rectangular field.

Bonaiuto (1991a, 1991b) outlined a different hypothesis: serial reproduction may progressively emphasize a slight anomaly because of contrast effects and communication processes. For example, the serial reproduction of a human head (sideways) with a slightly prominent nose, progressively leads - after sequential copying by 25 subjects - to a drawing of the head with a nose four times as long as the original.

Identical processes may affect serial reproduction of other incongruous information, such as paradoxical *colours*. The task of copying a colour using appropriate tools, pigments, lights, easily engages the human tendencies and processes proposed by Bonaiuto and systematically studied by our research group; progressively leading to "unrealistic" copies.

We suggest that the following special processes are activated both in perception and in the action of recording and communicating information about colour.

a) A simultaneous contrast between the model (coloured) and the preliminary sketch (achromatic) when they are compared with each other by the perceiver. This may favor more saturated colour in each copy.

b) A colour contrast after-effect, if the model is characterized by an incongruous colour. In this case, the mental schema of the normal object acts as an "inducer" (Bonaiuto, Miceu Romano & Bonaiuto, 1991) enforcing the selection of more saturated colour for each copy.

c) A tendency to signal (unintentionally) the above mentioned accentuations, by using more saturated colours even if subjects attempt to make absolutely exact copies.

d) Sometimes there may appear an opposite tendency to attenuate and normalize the incongruous image, when the perceptual conditions are rather ambiguous and,

or, emotionally alarming details should be avoided.

Two basic experimental procedure have been used systematically. Subjects were asked to colour the inside of configurations visible within a black linear contour on a white background, using: a) coloured pastels on paper; or b) a computer with a colour monitor (Power Macintosh 7100/80 with Canvas TM 3.0.5. software).

Different patterns of the same light blue colour (hue: Cyan, saturation 20%) served as models, including: a) a group of *Three Bluebells* (normal and plausible colour); b) an *Amoeboid Shape* (acceptable colour); c) a *Human Head* (incongruous colour).

The serial reproduction significantly emphasized the colour saturation of each different model, but intensified the incongruous colour almost twice as much as the congruous ones. The effects have been obtained both with the computer (series of 10 consecutive copying persons) and the pastels on paper (series of 15 subjects).

We have here replicated and extended our first study (Bonaiuto, Giannini, Biasi & Bonaiuto, 1995), and the new results look very similar to the previous ones.

Our computer technique was quite rigid as the colour was spread homogeneously over the entire surface of the figures. When the procedure was repeated using the blue pencils on the paper, besides the predominant emphasizing phenomena we obtained some normalizing of very striking details. E.g., the sclera of the eye gradually becames white, while other parts of the same human head became bluer. Findings like this last verify the hypothesis that also defenses against distortions occur under certain conditions.

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FACTOR STRUCTURE OF THE WECHSLER ADULT INTELLIGENCE SCALE-REVISED IN A SAMPLE OF ITALIAN UNIVERSITY STUDENTS

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The publication of the Wais-r scale in 1981 (Wechsler 1981) further stimulated attempts to verify the factorial composition of this new version of the scale for adults and its congruence with the earlier version (Wechsler, 1955).

This research has the following objectives:

a. to determine the factorial structure of the Italian adaptation of the Wais-r scale (Laicardi, Passaro, Petropoulou, Picone, 1994) using a group of Italian adults, comparing these results with international results;

b. to study the nature of the factors singled out, relating them to the five personality factors (McCrae, Costa, 1990, op. cit.; Caprara, Perugini, 1991), that is, "Energy," "Conscientiousness," "Emotional Stability," "Agreeableness," and "Culture" (previously called "Openness to Experience"), as they are termed in the latest Italian adaptation of the instrument (Caprara , Barbaranelli, Borgogni, 1993 b; Van Heck, Perugini; Caprara, & Froger, 1994).

SUBJECTS - Seventy-six university students from various faculties at the University of Rome "La Sapienza" were administered the Wais-r scale and the questionnaire of the five personality factors. The instruments were always administered by the same examiner in the same order: first the Wais-r scale and then the Big Five Questionnaire. The 76 subjects included 50 females and 26 males between 19 and 27 years of age, with an average age of 22.93. Five students graduated during the period of test administration. Sixteen students are in the humanities (literature, philosophy, languages, dramatic arts); forty are in social studies, including psychology, sociology, economics, political science, pedagogy; and twenty are in the sciences, such as engineering, mathematics, chemistry, architecture, etc.

RESULTS AND DISCUSSION - The oblique solution presents three factors. The first is also loaded by a performance trial, that is, Picture Arrangement, as well as by the classical verbal trials of Information, Vocabulary, Comprehension and Similarities. The second factor, which can be reconfirmed as factor of "perceptual organization," is loaded by the subtests Picture Completion, Object Assembly, Digit Symbol and, to some degree, by the Block Design trial (r= 0.49). The third factor is loaded by the two classical trials of attention and concentration, that is, Digit Span and Arithmetic.

To study the consistency of the two principal hypotheses contained in the

second objective of this study, scores from the various subtests of the Wais-r scale were intercorrelated with scores of the five personality factors of the FFQ. A factorial analysis was calculated on the table of intercorrelations to verify the level of affinity between the verbal factor of the Wais scale and the "Emotional Stability "factor of the BFQ.

The personality factors most stably correlated with the Wais-r intelligence scale are "Emotional Stability" and "Culture". The fifth factor (7% of variance) is loaded with classical trials of freedom from distractability of the Wais-r scale, that is, Digit Span and Arithmetic, but also with the "Emotional Stability" factor of the BFQ. This completely confirms Wechsler's research and that of the authors who followed him on the emotional and cognitive nature of the attention and concentration factor.

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LINGUISTIC STRATEGIES IN SECOND LANGUAGE ACQUISITION

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The goal of this article is to investigate how Italian primary school children learn a foreign language using a method based on developmental psycholinguistic theory, called the Format approach (see Taeschner 1991).

In this article we compare two groups of children, matched for socio-cultural class, IQ, sex and age. One group was learning the foreign language with the Format approach and the other group was learning the foreign language in the format approach the other with a traditional method. Furthermore, specifically for the first group, we compare : a) results obtained by children of different ages and b) children of the same age in different.Three school classes of first-graders (58 childrens) and three classes of third-graders (36 childrens) are considered in the experimental group and one class of first gradesr (21 children) and one class of third graders (23 children) are considered in the control group.

Data collection consisted in asking the children to tell in the foreign language the story represented in a series of 4 pictures. The story not known to the children, but makes events taken from stories taught to them during the lessons. The collected

data were transcribed according to the CHAT conventions and analysed by the CLAN programs of the CHILDES transcription and analysis system.

Two linguistic analyses were made: 1) lexical analysis; 2) analysis of the semantic sentences structure. Results show a) significant differences between children taught with different methods; b) not significant differences between children of the experimental group regarding factors like age, QI and different teachers.

SEMANTIC PROCESSING OF VISUAL PATTERNS: INDIVIDUAL DIFFERENCES IN SUGGESTIBILITY

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In this study we have tried to connect two approaches to the cognitive functioning: individual differences in suggestibility and human information processing in some experimental conditions of visual perception. In the condition in which the visual stimulus is ambiguous and the subject's task is to give an interpretation, there occurs an integration of information determined by the higher systems-knowledge influencing attribution of meaning. In this case the illusions of thought, which can be strongly affected by suggestion, take place in connection with the visual analysis of figures. This research examines the selective use of ambiguous pictorial stimuli by people classified as high and low suggestibles, as selected by the Suggestible Sensory Group Scale (SSKGS) (Gheorghiu, Koch, Hubner, 1993). Performance of these subjects was studied in relation to the subject's expectancies and to the attribution of meaning referring to the figural properties of stimuli. If it true that the level of expectancies of the good suggestibles is greater than the poor ones, the formers are more sensitive to the suggestive cues than the latters. In particular, it was predicted that poor suggestible subjects would show a more efficient ability to attribute meanings to visual pictures than the poor ones. It was further predicted that the effect of the expectancies, induced by the suggestive cues, in the good suggestibles with respect to the poor suggestibles would be more evident.

Twenty eight volunteers (18 - 26 yrs. age range) from psychology courses served as subjects. The subjects were selected from a group of 104 individuals on the basis of Suggestible Sensory Group Scale (SSKGS; Gheorghiu, Koch, Hubner, 1993). Good and poor suggestible subjects were determined by the top 25% and the bottom 25% of the distribution of scores on the Gheorghius' SSKGS. Seventeen good suggestibles and eleven poor suggestible subjects served as participants.

From a pool of thirty unusual and ambiguous figural stimuli, in which the subject could variously categorize things and recognize objects through a cognitive

integration of information and an attribution of meaning 12 figures were selected. 6 of them were classified as promoting high number of meanings and 6 as promoting low number of meanings. These figures formed two blocks of stimulation that were presented visually to the subject on the screen.

In the experimental phase the visual presentation on the screen was counterbalanced across to subjects. Four unequal groups of subjects were formed. Two groups of good suggestible and 2 of poor suggestible subjects participated in the experiment. The experimental treatment for each group was different in relation to two kinds of instruction inducing different expectancies and in relation to two levels of stimulus meaning.

Suggestion and instruction factors were between subjects whereas number of meanings attributed was within subjects.

The subject was required to identify meanings which he was able to identify in each figure visually presented on the screen and to push a button each time he was able to identify an object or thing. After each attribution of meaning the subject evaluated the level of abstractness and of concreteness relating to each figural stimulus by using rating scale (range 1-10); moreover, at the end of the experimental session the subject was required to evaluate the level of pleasantness experienced on the rating scale with the same range. The number of attributed meanings and response time for each stimulus meaning were detected.

An analysis of variance with two levels of suggestibility (good-poor) x two levels of instruction (A, B) as factors between subjects x two levels of number of meanings (high, low), computed on the number of meanings attributed from subjects to visual stimuli, was carried out. No significant main effect for suggestibility was found ($F_{(1,24)} = .16$, $p > .05$), but the main effect of instruction ($F_{(1,24)} = 8.43$, $p = .007$) and of number of meanings ($F_{(1,24)} = 41.84$, $p < .001$) were significant. Finally, the suggestibility x instruction interaction was also significant ($F_{(1,24)} = 5.92$, $p = .02$) (see Fig. 1) with good suggestibles ($M = 16.12$, $SD = 3.87$), as regards poor suggestibles ($M = 12.8$, $SD = 4.72$), showing a higher number of meanings attributed to the stimuli classified as easier to produce meanings. Moreover, on the mean time of first response an ANOVA, with the number of meanings factor as repeated measure, was computed. We are limited to considering only the response time of the first response associated to the first meaning mentioned since the response times successive (associated to correspondent meanings expressed) to the first were artefacted. The factors and the levels considered were the same as that of the previous analysis. In this case, a main effect for instruction ($F_{(1,24)} = 10.07$, $p = .004$) and for number of meanings factors ($F_{(1,24)} = 14.90$, $p < .001$) was evidenced. Furthermore, a secondary effect for suggestibility, instruction and number of meanings ($F_{(1,24)} = 4.44$, $p = .04$) (see Fig.2) was obtained.

The present results provide some evidence that sensory suggestibility influence the subject's performance if they are engaged in tasks in which it is required to attribute meanings to ambiguous figures. Not only in the social and interpersonal context (Gheorghiu, Wallbott, 1993), but also in specific experimental

conditions in which mental imagery is involved, this fact occurs. In this case the structure of the stimulus facilitates the activation of other information in semantic memory. A semantic integration of the stimulus has been observed. Significant relations between the visual dimension of vividness and suggestibility tend to explain this result as due to the cognitive operations, which are perhaps similar, involved in the evaluation of the self-experience. This may occur both in conditions of sensory suggestion and in conditions of exploration of images as those produced when subjects are required to produce vivid imagery. Moreover, good suggestibles show a higher level of visual vividness than that of poor suggestibles.

This significant difference between good and poor suggestible subjects comes out with the kind of instructions. Results show that the expectation level of poor subjects is smaller than that manifested by the good suggestibles. In this case suggestibility as a kind of illusion of thought influences positively the production of meanings that in good suggestibles was found to be greater than the poor ones.

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A QUESTIONNAIRE ABOUT SELF-AWARENESS FOR TWINS. A MULTIVARIATE ANALYSIS

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The answers to a 14 items (closed format) questionnaire, given by 27 monozygotic

(MZ) pairs (14 males; 13 females) and by 38 dizygotic (DZ) pairs (7 males; 11 females; 20 mixed) are examined. The age ranged from 4 years to 19 years over the whole sample of couples (mean age: 11.12 yrs. ; standard deviation: 4.11 ; median age: 12 yrs.). The answers to a related questionnaire by another sample, consisting of 48 couples of parents of twins (24 MZ and 24 DZ, not necessarily corresponding to the couples of twins of the first sample) have been also examined.

The statistical tests performed (canonical correlation, Fisher's discriminant) (Nicole S., 1994, Tecniche di analisi dei dati. Manuale per gli operatori nelle scienze biologiche e psicologiche. Padova: C.E.D.A.M.) were chosen in the attempt to override some of the methodological difficulties researchers studing twins have so ofter complained of in the past. The Results obtained point to the evidence that

self-awareness tends, for MZs only, to overcome pair-awarennes.

Going into a greater detail, the V statistic for the canonical test was 18.4433 ($p = 0.0304$) for MZ, and 4.2222 ($p = 0.8962$) for DZ; for MZ the first extracted canonical function was the only one statistically significant, giving a correlation coefficient between the twin mates of 0.7040. A high positive correlation, for each component of a MZ couple, was found between the canonical function and the

one's first name evaluation, while the evaluation of shared activities shows a high negative correlation, and the evaluation of the other twin's first name stands somehow intermediate between these two positions, although with a negative correlation. This seems not to be related to any difference in educational style existing between MZ and DZ parents, as Fisher discriminant test yields a $F_{9,38} = 3.7441$ ($p = 0.001$) , with one only stable factor: noting physical differences between twin mates (Del Miglio C., 1985 , Il sè gemellare, Roma, Borla).

The conclusion that may be drawn from the above referred results point toward the fact that one's first name with all likeliness represents a very relevant feature for asserting one's self-identity, albeit for MZs in a rather peculiar way, while the attempt to denegate (or at least to underestimate) the shared activities somehow reveals a refusal of the pair-identity. The Authors would like to suggest, here, the existence of a brand new paradox for MZ twins: the self-reference to the personal identity, pivoting around that powerful token that is one's first name, overcomes the pair's identity (Del Miglio C., Nicole S., in: C. Del Miglio Il Sè gemellare, Roma, Borla, pp. 144 - 153).

RELATIONSHIP BETWEEN DIFFERENT MANIFESTATIONS OF SPONTANEOUS RHYTHM: FIRST EVIDENCE

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From previous research the hypothesis was derived that different manifestations of spontaneous rhythm may constitute a basis for the identification of different cognitive typologies. These studies also evidenced a connection between various forms of spontaneous rhythm and strategies adopted in problem solving (Olivetti Belardinelli & Besi, *Comunicazioni Scientifiche di Psicologia Generale*, 1991, 5 n.s. suppl. 20; Olivetti Belardinelli & Besi, *Comunicazioni Scientifiche di Psicologia Generale*, 1992, 10 n.s., 43-58).

The purpose of this research is to examine the possible relation between different forms of spontaneous rhythm and tempo, assessed through different visual and auditory modalities.

EVIDENCES - The following variables were assessed for a group of 72 subjects, 36 males e 36 females, aged from 18 to 32:

- SPEECH EMITTED RHYTHM is a binary or ternary verbal unit, chosen and repeated in a loud voice;
- AUDITORY/VISUAL PREFERRED RHYTHM is the preferred sequence, between two presented, a binary one and a ternary one;
- AUDITORY/VISUAL SUBJECTIVE RHYTHM is the binary or ternary stressing, autonomously ascribed to a presented homogeneous sequence;
- SPEECH EMITTED TEMPO is the average length of the interval between two subsequent verbal units, of the Speech Emitted Sequence;
- AUDITORY/VISUAL PREFERRED TEMPO is the preferred length of the interval between stimuli presented in succession.

A specific electronic device has been utilised to present acoustic and visual signals. A 350 Hz tone was used for auditory signals, and a neutral coloured LED for visual signals. Both signals had three different intensities. As far as the verbal stimuli were concerned, two units, formed by the words TRAPANI and TRIPOLI, were utilised (Olivetti Belardinelli, *Comunicazioni Scientifiche di Psicologia Generale*, 1979, 6, 7-43).

RESULTS - As in previous research, no significant relation was found between Emitted Tempo and binary or ternary spontaneous rhythm. Conversely tempos in the auditory and visual modality were found to be related ($r=.49$ per $p<.001$), but they were not related with speech emitted tempo. Auditory and visual modality tempos probably reflect a merely perceptive preference, while speech emitted tempo is limited by motor constraints due to verbal articulation.

As far as the spontaneous rhythm is concerned, when Auditory or Visual Subjective Rhythm is assessed, a binary rhythm is chosen much more frequently than a ternary rhythm ($chi^2=13.34$ per $p<.001$ for auditory modality, and $chi^2=19.00$ per $p<.001$ for visual modality), while, in other assessment conditions, the distributions of binary and ternary rhythm, are substantially even.

In considering the relations between pairs of rhythmic variables, it was found that the only significant relation is that between Speech Emitted Rhythm and Auditory Preferred Rhythm ($r=.36$ per $p<.002$). This relation may be explained by admitting that during the testing of Speech Emitted Rhythm, the oral repetition of the unit has a structuring role, given that subjects receive immediate feedback from the sound of their own voice. The same assumption can be made during the Auditory Preferred Rhythm test, where subjects receive acoustic signals by listening to binary and ternary sequences.

DISCUSSION - Our previous research has been carried out by means of Speech Emitted Rhythm or Auditory Rhythm; those researches evidenced a significant relation between Speech Emitted Rhythm and learning, and between Auditory Rhythm and problem solving strategies.

The present research evidences a substantial similarity between Speech

Emitted and Auditory, assessment modalities of spontaneous rhythm, and indirectly confirms the validity of the identified rhythmic-cognitive typologies. We may also conclude that to assess a cognitive style we may use indifferently either modality, bearing in mind that the auditory modality is more strictly monitored, but more difficult to perform, whilst the verbal one, is more economical and easier to perform.

On the other hand as far as visual rhythm is concerned, both in the subjective and in the preferred assessment modalities, we did not find in the present study any direct relation with cognitive strategies.

LOOKING FOR NEURONAL FOUNDATIONS OF MIND BY MEANS OF NEURAL NETWORK MODELING

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The contemporary challenge of neurocognitive modelling is the overcoming of reductionistic approaches to the mind-brain relationships problem and by this way the integrating of "top-down" and "bottom-up" models.

The opportunity of conceiving cognitive processing as relying on both vertical and horizontal architectures finds its deep epistemological reasons in the contemporary revolution of philosophy of science. At the phenomenological level the operativity of the integration is sufficiently proved by recent developments in cognitive and computer sciences. (Olivetti Belardinelli 1993).

Since we accept with Anderson (1993) that cognitive architectures are relatively complete although abstract proposals about the structure of human cognition, we are also convinced that the integrate perspective in modelling mind-brain relationships requires to connect the cognitive and the neural system (Posner & Rothbart, 1994), and to combine the most recent acquisition about natural neurodynamics with those deriving by cognitive modelling.

Insofar as the mind is conceived as a complex process resulting from the interactions between cerebral circuits, that realises adaptive behaviour, the researcher is entitled to look for the production rules that, according to the cognitive architecture, determine cognitive adaptation.

In other words, notwithstanding the degree of individual variation, the aim of an integrate model is that of determining by what ways the mind produces the perceptual rules allowing the organism to survive in its econiche (Edelman 1993).

We understrike three main points in the question:

1) the relative contributions of both autonomous and eteronomous components in

cognitive and neural processing and the way in which the variability sources are 'nested' in neuro-cognition (Varela, 1985);

2) the determination of salient neurocomputational properties in 'bottom-up' and 'top-down' processes with 'dual emergent' dynamics cooperatively established among local neural circuits (Abeles, 1982) and reentrant macrocircuits (Edelman, 1989);

3) the implications of these properties for the coexistence of parallel distributed connections with a hierarchical organisation in mental architectures (Olivetti Belardinelli, 1993).

Three sets of observations seem to be relevant for the solution of the problem:

1) in considering the central nervous system as a 'functional network' one must take into account the non-univocal interdependence between structure and function even from the level of neural microcircuits, (Erb et al., 1986) at which a 'functional connectivity', that is context-dependent and dynamic on several different time scales, is related but different from structural (or anatomical) connectivity;

2) brain computations are related to a 'nested loop processing' in which neuronal cooperativity contribute in the generation of the 'higher brain functions' in an upward fashion (Krueger, 1991) while mental-process-related patterns reciprocally modulate neuronal correlation at lower-levels, in a top-down fashion. Since in the cortex the intracortical fibres outnumber the input fibres by a factor of 2 to 3 (Braitenberg, 1978), it is argued that intrinsic loops dominate the effects mediated by direct, afferent input. However, this dominance should be context-dependent and functionally variant in brain dispositives.

3) a new systemical dynamic property named 'recursive stability', acting within and among levels, could explain both 'circuitational' and 'pre-eminently but not exclusively autonomous' characterisations in neuro-cognitive processing. At this regard, a formalised analysis by means of graph theory is in progress.

By consequence of these arguments the fittest model seems to be a cooperative recurrent neural network based on a non-linear dynamic behaviour of variable phase oscillators. Two phases are dynamically decisive: a) the phase of synaptic inputs, related to the 'correlation detection' function of neurons; b) the impulse emission phase, that regards the neuronal function of generating correlation , due to the assonic bifurcations that send the same signal to different neurons.

Accordingly to other studies in which oscillatory coherence is related to sensory segmentation (Von der Malsburg and Schneider, 1986), perceptual integration (Tononi et al., 1992), memory architecture (Damasio, 1989) and systematic reasoning (Shastri and Ajjanagadde, 1993), our model could explain the space-temporal distribution of the effects in the network during the transition that occurs in presence of noise from a random oscillatory pattern to a coherent (time-locked) oscillatory activity; the transition is related to the global features of the

input and to critical intrinsic network parameters (as conduction delay in correlation generation and neuronal time constant in correlation detection).

PERCETUAL FIELD DYNAMICS IN HOMOGENEOUS RECTANGULAR AREAS

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The phenomenon of the wandering point on an homogeneous stimulation area was discovered for the first time by Bartlett (1951). The experimental procedure is as follows: one draws a single point on a blank sheet of paper, which is presented for a short time to a subject. After removing the stimulation pattern, the subject must reproduce the localization of this point on a second sheet of paper. This latter is presented to a second subject which must accomplish the same task, then to a third, and so on. The set of these reproductions shows a sort of wandering of the point, which appears determined by the form of sheet boundary. Stadler *et al.* (1991) did an experiment on this phenomenon, by using a very different paradigm, in which each one of 609 stimulus points, distributed on a rectangular sheet of paper, was presented isolately to the same subject. A mathematical analysis of the displacements of the reproduced positions with respect to the original ones gave a description of the perceptual field (see also Haken & Stadler, 1990). Namely, because the texture of a blank sheet of paper is homogeneous, the nonhomogeneous displacement structure observed in the experiments could be attributed only to a nonhomogeneous perceptual field. We repeated the Stadler et al. experiment, by using a different apparatus, which led us to control the exposure time, the reproduction time and the light intensity on the stimulation area. As stimuli we used 609 blank DIN A4 sheets of paper, each one containing a single point, 2mm in diameter. Each sheet contained a different position of the point. To each subject we presented in random order all 609 sheets. The exposure time was 1s. The reproduction started immediately after the stimulation pattern disappeared. Twenty subjects partecipated in the experiment. A mathematical analysis of the experimental data showed results very similar to the ones obtained by Stadler *et al.*, i.e. a perceptual field characterized by four point attractors near the corners of the sheet. From the mathematical point of view this field is equivalent to the one of the deformations of a membrane, having the same boundary as the sheet, induced by four loads (one near each corner) and one force, acting on the center with bottom-up direction. In this way we obtained a measure of the force added by each figural element (such as a corner) to the perceptual field. These results let one to build a quantitative theory of Gestalt figural organization.

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THE FORMAL REASONING IN ADOLESCENTS: PIAGETIAN TASKS IN THE LONGEOT'S SCALE

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The Echelle Collective de Developpement Logique (ECDL, 1989), a scale which evaluates the formal reasoning in adolescents, is made up by Piagetian tasks representing several cognitive fields: Crossings (combinatorial system), Lamps (propositional logic), Drawings (INRC group), Letter permutation (mathematical combinatorial system). This Scale allows to allocate the subjects in four operatory levels: Concrete, Preformal, Formal A and Formal B.

The aim of this research was to retest ECDL in the Italian environment (the research sample included 1000 subjects, aged 14-18 years and attending high school) to study the construct, to verify the difficulty and the ordering of the items, to check the concurrent validity with other tests (Raven's PM 38) and finally to evaluate ECDL reliability .

The Principal Components Analysis of the items confirmed the Piagetian construct of ECDL showing that items belonging to different cognitive stages had different factors. 12 factors, accounting for 57.1 % of the variance, have been identified which grouped the items according to the subtests and the stages.

Starting from the factorial loadings, factor scores have been computed by simply adding the scores of each subject in all the factors (Kline, 1994) and, subsequently, second order factors have been assessed to group the 12 first order factors. 4 second order factors have been identified, which explained 52 % of the variance and grouped the firt order factors according to the domain.

To check the consistency of the ECDL scale with a test of "g" factor, a principal components factor analysis has been performed on subtests scores and on the score of Raven's Progressive Matrices 38.

The results of this analysis were consistent with the hierarchical structure of intelligence proposed by the factorialists (Vernon, 1961): in contrast with Longeot, the group factors were not differentiated according to the logic (combinatory and INRC group) structure, but according to the spatial or verbal domain.

A CONTRIBUTION TO THE STUDY OF OBJECT RECOGNITION IN AGING

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Two major phases are distinguishable in an act of perceptual recognition: first the organizing of the incoming stimuli into figure and ground and tridimensionality; and second, the relating of this organized perception to one or more categories (Potter, 1966). Under ordinary conditions, recognition is complete in these two steps, since the stimulus can be easily organized into figure and ground, and there is only one available category that fits it. However, under certain experimental conditions, such as brief presentation, removal of pieces of the stimulus or defocusing, recognition can be made difficult, since the two phases may interact and categories may have to be sought more actively (Bruner e Potter, 1964).

Aging implies changes in sensory functions. With advancing age sensory activities are progressively reduced in their efficency, as a consequence of progressive deterioration of the structures and functions of neural tissues (Corso, 1981, 1987).

However, many authors maintain that there is not necessarily a direct relation between the sensitivity of sensory receptors and the adequacy of behavior in the older persons (Birren, 1964; Fozard, 1990). For example, the individual may be able to adapt by developing vicarious perceptual-cognitive strategies (Cesa-Bianchi, Pravettoni, 1994). Perhaps by necessity, resulting from poorer sensory functioning, older persons are forced to become relatively greater experts at inferring the meaning of stimulus events (Fozard, 1990).

However, a general feature of the numerous studies of context effects and the quality of visual information on stimulus recognition is that older persons are influenced relatively more than younger ones from stimulus impoverishment whether achieved by altering the temporal or the spatial aspects of the signal (for example with short exposures or reduced contrast). Conversely the elderly appear to benefit more than younger adults from good context or stimulus familiarity.

In order to investigate whether and how factors such as stimulus impoverishment and stimulus familiarity may interact in affecting perceptual recognition at different ages, we are carrying out an experiment in which out-of-focus stimuli of different familiarity levels are utilized. Three groups each of 20 subjects, for a total of 60 subjects, ranging in age from 25 to 85 (25-45; 46-65; 66-85), are presented with filmed images of 8 different objects. Each object is seen in 8 different stages of focus: from a badly out-of-focus version to a completely in-focus version, each stage shown for 10 seconds. Also, the 8 stimuli employed in the study are different as regard familiarity: 3 objects of a kind well-known to the young subjects, 3 of a kind well-known to the elders and 2 well-known to all three

age groups.

As a whole, the results still now obtained indicate reliable differences in the time required for recognition between the 3 age groups: recognition occurs later in the older subjects. In addition, the performance of all the three age groups seems to be affected by stimulus familiarity: in each age group recognition occurs earlier for the more familiar objects.

The delay in the recognition time shown by the older subjects may be determined by the normal age-related reduction in the efficiency of the peripheral receptive systems and by the consequent decline in vision acuity. Nevertheless, the results indicate that with long exposure times and with certain kind of stimuli of high familiarity, the limits in perceptual performance related to the decay in the peripheral sensory systems can be overcome.

MESOLIMBIC DOPAMINE RESPONSE TO AVERSIVE EXPERIENCES DEPENDS ON THE ORGANISM'S OPPORTUNITY OF BEHAVIORAL COPING

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Recently we have shown that exposure to a novel, aversive experience produces a time-dependent biphasic alteration of dopamine (DA) release in the nucleus accumbens septi (NAS): an initial increase of DA release is followed by a decrease below control levels (Puglisi-Allegra, et al. *Brain Res.* 554: 217-222, 1991; Cabib S. and Puglisi-Allegra S. *J. Neurosci.*, 14: 333-3340, 1994). This effect was evident in two species, rat and mouse, and under different stressful conditions. Reduced DA release during prolonged stress was not due to exhaustion of DA synthesis or depletion of DA pools since restrained rats were able to respond with a new increase of DA outflow when released from the restraining apparatus (Puglisi-Allegra, et al. *Brain Res.* 554: 217-222, 1991). Consequently, these results were explained in terms of the meaning that aversive conditions have for the organism. As the organism faces aversive and potentially dangerous events it will first attempt to cope behaviorally with such a pressure. The NAS is a brain structure considered to be involved in activation that increases probability and vigour of responses as well as in motor processes, therefore an activation of the mesoaccumbens DA system characterises the initial reaction to an aversive condition. But when, despite the efforts made by the organism, no behavioral coping is possible, a different emotional response takes place which leads to inhibition of DA functioning (Puglisi-Allegra, et al. *Brain Res.* 554: 217-222, 1991; Cabib S. and Puglisi-Allegra S., *J. Neurosci.*, 14: 333-3340, 1994)).

This leads to the hypothesis that in environmental conditions which allow behavioral coping inhibition of mesolimbic DA release should not be produced.

A large body of research has pointed to the different behavioral and physiological effects produced by escapable / controllable and inescapable / uncontrollable aversive situations. The basic technique used by these studies is the shocked-yoked situation in which pairs of animals are subjected to a series of electric shock with only one animal being able to interrupt shock delivery for both by mean of various behavioral responses. In this way the two subjects receive the same amount of shock but experience it either in a coping or in a non coping situation. Consequently, this appears to be the choice experimental condition for testing the above-mentioned hypothesis.

Mice exposed to a series of foot shocks present an increase of DA release in the NAS if they are allowed to control the shock experience (shocked condition) and a decrease of DA release in this brain area if they are not allowed to exert any control (yoked condition). These results indicate that escapable / controllable and inescapable / uncontrollable aversive experiences elicit opposite responses from the mesolimbic DA system. Mice exposed to the apparatus without receiving shock (sham condition) show a time-dependent biphasic evolution mesolimbic DA release in line with previous reports which indicate that confinement in an unknown environment represents a stressful experience for mice. Moreover, exposure to the sham condition for a time comparable to the duration of shock and yoked exposure induces a mesolimbic DA response only quantitatively different from the response of the yoked group but qualitatively different from the response of the shocked mice.

Taken together, these results support the hypothesis that the mesolimbic DA response to aversive experiences does not depend on the intensity of such experiences but on their meaning in term of controllability by species-specific coping strategies or newly acquired ones.

TWO-WAYS PREPOSITIONS IN GERMAN: IMAGE AND CONSTRAINTS

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This paper extends the discussion on two-way prepositions in German as they have been studied in a cognitive framework by Smith 1987, 1988, 1993 (see also Langacker 1991: 403). Two-ways prepositions may cooccur with DAT *and* ACC, where DAT signals static location or motion within the boundaries of the preposition's search domain and ACC "indicates a trajectory that takes the search domain as a goal and penetrates its boundaries" (Langacker 1991: 403).

The aim of this paper is twofold: first I will try to draw a complete network of the configurations implied by the DAT/ACC opposition, showing for instance that ACC not only signals a path-goal image schema (penetrating the boundaries of the search domain) but *any* crossing of them (for instance also if the TR *emerges*

from the boundaries of the search domain). Moreover, the continuity of distribution in the network configurations will be stressed, showing that a sort of "fuzzy" region can be identified at the borderline between the prototypical domains of DAT and ACC.

The second topic of the paper consists in the analysis of the constraints imposed by some verbs on the choice of case on the basis of image schemas. There are some verbs in German which allow (or require) a two-ways preposition *(an, auf, hinter, in, neben, uber, unter, vor, zwischen)* but cannot be used both with DAT and ACC (in other words, they require *either* DAT orACC); on the other hand, some verbs allow the use of two-way preposition with *both* DAT *and* ACC, depending on the image they contribute to evoke. A cognitive account of all the possible semantic compatibilities is of course beyond the scope of one single paper. I will concentrate on the conditions and constraints connected v-i~th only one image schema, notably the containertcontent schema, and try to show that it is consistently applied to a wide range of verb-prepositioncase combinations both in concrete and extended (or metaphorical) meanings.

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COGNITIVE ARCHITECTURES FOR INTENTIONAL AGENTS

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The concept of *cognitive architecture* lies at the heart of cognitive science. The traditional approach to the idea is to conceive of the mind as a complex machine made up of a number of subsystems, and to investigate into the nature and assemblage of its components.

Thus, many researchers envisage a central processor, served by a set of storing devices (e.g., a working memory and a permanent memory, each with its own subcomponents) and connected with the external world via dedicated

input/output channels. Fodor takes this line in his book on the *modularity of mind* (1983). Other researchers reject the idea of a single inferential kernel, in favor of a collection of semiautonomous subagents, in the fashion of Minsky's *society of mind* (1985). Whatever their stance on this topic, most cognitive scientists postulate that the various subcomponents must be *some* sort of computational devices. They only disagree as to *what* sort of such devices: currently, the main controversy concerns the symbolic or nonsymbolic (or hybrid) nature of the representations supposedly entertained by the processors, the controversy about the nature of the relevant algorithms being an obvious consequence thereof.

My work aims at a different construction of the whole topic of cognitive architecture. I conceive of the mind as the conscious, intentional control system that guides the human beings (and, as far as we can tell, other highly developed species) in their complex interactions with the dynamic real world; when this definition is matched against competing ones, the emphasis should be on the words *conscious* and *intentional.*

This definition is clearly not neutral with regard to computations: after the work of Searle (1992) and others, I maintain that consciousness and intentionality are the properties of biological brains and have nothing to do with computation, no matter whether symbolic or not. I also maintain, on the other hand, that such properties make a crucial difference between cognitive systems and other self-propelled objects such as zombies and robots (at least as we can currently design them).

The concept of cognitive architecture needs be revised: if the task of psychology is to describe the cognitive dynamics of such conscious systems, then there is little point in postulating whole hierarchies of mental boxes inside boxes, connected with other boxes, and so on, and to wonder whether the 0's and 1's supposed to travel between them are symbolic or subsymbolic.

A more promising strategy is to borrow the basic structure of so-called folk psychology and to use it to describe the set of competences typical of a certain class of cognitive systems (e.g., human general action, communication, spatial cognition, etc.).

This means to describe cognitive architectures in terms of a set of cognitive states, together with their possible contents and dynamics. Examples of cognitive states are the various kinds of perceptions, beliefs, intentions, emotions, and so on. The typical content of a cognitive state will be some characteristics of the external or the internal situation (past, present or future), as knowable by the particular agent (or class of agents) being considered. A greatly simplified, prescientific example of cognitive dynamics might thus look like this:

BELIEVE john, have (mary, candy) &

WANT john, have (john, candy)

=> INTEND john, ask (john, mary, candy).

Clearly, this code is just a formal tool for the expression of psychological theories, not a sort of a language of thought; there are minds inside the heads, not

logical formulas.

Thus, it is possible to define the architecture of a class of cognitive systems by the set of cognitive states its members may entertain (e.g., lower animals seem to have no long-term intentions), the set of possible contents thereof (e.g., only higher Primates may take cognitive states of themselves and of their conspecifics as contents of their cognitive states), and their possible cognitive dynamics (e.g., dialogue is a uniquely human competence).

DIFFERENT MODELS OF VISUAL INFORMATION PROCESSING IN FIELD-DEPENDENT AND FIELD-INDEPENDENT SUBJECTS

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According to the theories of Marr (*Vision*, New York, Freeman and Company 1982) and Fodor (*The Modularity of Mind. An Essay on Faculty Psychology*, Cambridge, Mass., The MIT Press 1983) on the processing information from the environment, some recent research on the functional characteristics of perceptual processes has shown that species-specific visual stimuli are recognized through different processing modalities than those used for non-species-specific stimuli.

The present research describes further differences in processing modalities. It is postulated that different processing models (both immediate and stepwise) are dependent (1)on the complexity of the figure in the stimulus slide and (2) on the subjectsÕ cognitive style (field dependence/field independence). The experimental work involved analysing the complexity of each figure according to three different qualitative parameters: semantic complexity, complexity of organization and graphic complexity (cf. Uttal W.R. (1988), *On Seeing Forms*, Laurence Erlbaum Associates, New Jersey, pp. 142 and 247-248).The graphic complexity of the stimuli, which were found to have variable values, was measured.

Experimental subjects were distinguished according to cognitive style (field-dependent (FD) and field-independent (FI)). These two groups of subjects were shown all the stimulus slides (some specific and other non specific). The figure recognition data obtained for the two groups of subjects include: (1) reaction time for each verbal response, (2) number of details contained in each response and (3) measurement of *evocativity* of the stimulus slide. The latter measurement (i.e. the capacity of the stimulus to elicit verbal responses of recognition with a variable number of details) corresponds to the maximum number of elements present in all the responses to each stimulus.

Data processing and discussion of the results revealed the following: (1) the FD subjects have lower reaction times in recognizing three stimuli with much lower

evocativity than the others. This feature of the responses makes it logical to assume that subjects with different cognitive styles

(FD/FI) trigger processing that differs for stimuli having lower evocativity, while no difference is observed for more highly evocative stimuli; (2) while the 3 observed stimuli with specific features give rise to different reaction times in the 2 groups (FD and FI), this is not the case for the reaction times of the other 2 stimuli, which nevertheless have specific features. The evocativity of these 2 stimuli is moreover practically double than that of the stimuli described in (1).

CONCLUDING REMARKS 1) no absolute distinction can be drawn between the different performances of FD and FI subjects. This is possible only in the special case of the recognition of stimuli with low evocativity values. Moreover, the results make it possible to accept that stimuli with different degrees of evocativity can have different effects on the processes of FD and FI subjects.

2) The specificity or non-specificity of the stimuli was not found to be a factor affecting or further diversifying the processing as regards the subjectsÕ cognitive style. In any case, this aspect is not *necessarily* due to the priority of the subjectsÕ cognitive style over the specificity characteristics of the figures. Indeed also this aspect of the experimental situation is affected by conditioning factors due to the stimulus-perceiver interaction. In other words, above a given threshold value, the evocativity of each figure does not allow any conditioning of the processing due to stimulus specificity to be detected.

JEALOUSY, ENVY, SADNESS, PRIDE AND JOY: NAIVE THEORIES

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Young Italian adults' naive theories about the emotional experience elicited by two different and prototypical antecedents of jealousy, envy, sadness, pride and joy were studied by asking subjects (N Total: 1.216, about 24 yrs-old) to provide written answers to 6 open questions that concerned: (i) people's Reactions to the event, (ii) what Behavior or reaction would be Adequate in the circumstances, (iii) the Causes of the emotional experience, (iv) why and to what extent the emotional experience is Shared with other individuals (partners, friends, rivals, etc.), whether people might feel (v) in Conflict or (vi) Uncertain about the felt emotions, and why. Each subject judged only one antecedent (e.g., jealousy: 'one's own partner flirts with someone').

A mainly data-driven content-analysis of the protocols showed remarkable similarities in subjects' conceptualization of the various emotions that they had judged. The main results, overall, were the following. (a) Women have somewhat more articulate theories than men. (b) Antecedents which are perceived as having greater subjective salience (e.g., 'actual betrayal', for jealousy; 'death of one's own

grandfather' for sadness) are associated with a larger repertoire of concepts than antecedents not so characterized. (c) The reported immediate reactions to the event typically comprise feelings rather than behaviors, cognitive reactions, or physiological and expressive responses (e.g., crying). (d) Emotional experiences are thought to comprise most often several emotions rather than just one (e.g. sadness, pain, and depression for sadness-events); the emotions are conceptualized either as co-occurring or as closely succeeding one another, and to be elicited by the event's appraisal. (e) 'Adequate' reactions to the event mainly included behaviors proper and cognitive reactions rather than emotions; however, subjects often stressed that whereas control and regulation of felt emotions are desirable features of adequate reactions, people might not be able to cope with the event in the most adequate way. (f) Causes which subjects listed as responsible for the elicitation of emotions focussed on the novelty, unexpectedness, and subjective salience of the event (e.g., loss of a significant other, for sadness-events; enhanced self-esteem for pride-events), its implications for the person's present or future life perspectives (e.g., in terms of interpersonal relationships), individual factors (e.g., cognitive or emotional 'make-up'), and on human nature. (g) Most subjects expected conflict and uncertainty to be experienced and to be caused by the fact that felt emotions might be ambiguous, or be of an opposite nature, or be discrepant with respect to situational or normative requirements (e.g., the felt jealousy elicited by the partner's flirt might be 'too intense' according to social standards). On the other hand, intense emotions that are congruent with one's own aims and norms are expected not to elicit conflict or uncertainty. (h) Finally, according to subjects, emotions are not always sincerely shared with others, because, when sharing them, people pursue various, sometimes opposing goals, such as being comforted, getting advice, venting their own feelings, conveying a positive self-image, and attempting to 'control' others' behaviours, aims, thoughts, and reactions.

In sum, the reported set of studies show that people have very rich and, overall, coherent theories about emotional experiences. Other studies (e.g., V.L. Zammuner, 1995, Naive theories of emotional experience: Jealousy, in J. A. Russell *et al.* (Eds.), *Everyday conceptions of emotion*, Dordrecht, Kluwer, pp. 435-456; V.L. Zammuner, 1994, Discrepancies between felt and communicated emotions, in N.H. Frida (Ed.,) *Proceedings of the VIII Conference of the International Society for Research on Emotion*, Storrs, ISRE, pp. 57-61) show that most concepts that are comprised in these 'general' or 'prototypical' theories (attributions) characterize 'self' attributions as well.