
**EU: NEST Pathfinder Programme**
**"What it means to be human"**

# SEDSU

**Stages in the evolution and development of sign use**

## SEDSU Workshop at the Novartis Foundation, London

## 6 - 7 December 2007

## London, UK

## ABSTRACTS

The workshop is organized by the coordinating institution of the SEDSU project:
Centre for Cognition, Computation, and Culture
Goldsmiths' College, University of London, UK

Research partners in the SEDSU project include:
CNRS, Marseille, France
University of Portsmouth, UK
MPI-EVA, Leipzig, Germany
Lund University, Sweden
ISTC-CNR, Rome, Italy

# SEDSU Workshop
# ABSTRACTS

## Day 1: Thursday 6th December 2007:

### *Morning Session*

**Deloache, J. S.**
**Department of Psychology, University of Virginia, Charlottesville, Virginia, USA**

***"Becoming Symbol-Minded"***

Every society has a wealth of symbols and symbol systems that support cognition and communication, and all children must master a variety of symbolic artifacts to participate fully in their society. My research shows that in the course of learning to use various symbolic representations—including pictures, models, and replica objects—infants and young children experience a surprising amount of difficulty. They often fail to note the distinction between symbols and their referents, behaving toward symbolic artifacts as if they were what they stand for. The extended process of becoming symbol-minded begins in the first year of life, as infants start to learn about the nature of pictures: Through experience, they discover both what pictures are and what they are not. Slightly older children have substantial difficulty understanding and using scale models, but rapidly come to appreciate the nature and use of this type of symbol. At the same time, very young children make dramatic errors in which they try to interact with a miniature representational artifact as if it were its larger counterpart. Mastery of these different types of symbolic objects involves developmental progress in multiple domains.

**Heaton, P. C.**
**Department of Psychology, Goldsmiths' College, University of London**

***"What does the study of children with disorders of development tell us about sign use?"***

Theoretical accounts of autism assign enhanced perception a causal role in abnormal cognitive processing and organisation. However, such bottom-up accounts fail to consider the influence of language abnormalities, also highly characteristic in autism. We present data from studies into colour discrimination, memory and categorisation in

autism and congenital deafness. We conclude that our findings cannot be accommodated by perceptual theories of autism and that the extent that language influences perception of colour in autism is considerable.

**Deruelle, C.**
**Centre National de la Recherche Scientifique, Marseille, France**

***"Perception of pictorial displays in autism"***

Social and communicative deficits are undoubtedly the most striking features of autistic spectrum disorder (ASD). Yet, individuals with ASD also present visual displays-processing impairments. In particular, they have been found impaired at integrating local (or detailed) information into coherent (or global) wholes. This propensity to rely on local aspects of visual stimuli, portrayed as a "weak central coherence", strongly contrasts with that of typically developing individuals who preferentially rely on configural aspects. We conducted a series of experiments focusing on atypical visual processing strategies in both children and adults with ASD. To this aim we examined the emergence of a perceptual bias using various types of visual stimuli such as geometrical patterns, point-light displays, faces and visual scenes. We also compared the performance of children with ASD to that of adults with ASD to establish the developmental pathway of atypical visual processing in ASD.

## *Afternoon Session*

**Gómez, J. C.**
**REFCOM Project, School of Psychology, University of St.Andrews, Scotland**

***"The evolution of referential cognition: comparative perspectives on the emergence of referential signs"***

Referential cognition is the ability to keep track of the relations between targets and organisms in the environment. It comprises two main types of skills: keeping track of targets for oneself (e.g., the whereabouts of objects, such as food, potential predators, or conspecifics), traditionally investigated in developmental psychology as *object permanence*; and, second, social referential skills, to keep track of the targets of other organisms (e.g., identifying the targets of attention of others, such as whether they have

or not detected a piece of food or if they are looking or not at you). In this talk, I will present a view of how social referential skills, such as gaze following, may be at the root of the emergence of referential communication (communicating about objects in the environment). I will review current studies conducted under project REFCOM on referential communication in animals and human children.

**Fagot, J.**
**Centre National de la Recherche Scientifique, Marseille, France**

***"Processing of 2 dimensional iconic displays by nonhuman primates."***

Pictures are interesting stimuli for comparative psychologists, because they are objects (i.e., the pictorial expression) that represent other objects (the pictorial content). Pictures are however imperfect depictions of the reality, they share a list of properties with the object they depict but also miss important cues for object recognition, such as motion or other depth cues. How monkeys process pictures is thus non trivial question given the dual nature of pictorial stimuli. That question has direct implications for our understanding of referential cognition, and its evolution. During this talk, I will report two series of researches on the processing of photographs by nonhuman primates. The first one tested pictorially naïve apes or monkeys. I will show that such pictorially naïve animals tend to confuse pictorial expression and pictorial content, with possible species differences in that mode of stimulus processing. The second line of research studied the processing of pictorial stimuli by monkeys who have been exposed to various two-dimensional displays, including iconic displays during more than 10 years. I will show that that the pictorial content of the stimuli is not a so salient dimension for these animals, the animals focusing on dimensions other than the pictorial object when solving discrimination problems. There is thus an apparent paradox, because animals familiarized with pictures hardly process the pictorial content of images, while more naïve animals do it. It will be proposed that these findings suggest some serious limitations of monkeys to process pictures as referential stimuli.

**Parron, C. & Fagot, J.**

**Centre National de la Recherche Scientifique, Marseille, France**

***"Processing of two-dimensional stimuli representing faces in baboons (Papio papio) show a spontaneous access to first but not to second-order configural properties of faces"***

Pictures are two-dimensional stimuli often used to study animal cognition and to investigate aspects of cognition beyond picture processing. In the current experiment, we used pictures of faces, that are complex stimuli which can be discriminated by a series of "featural" as well as "configural" information (or spatial relational properties of these features) (Carey and Diamond, 1977). Numerous studies have demonstrated that humans strongly rely on configural information to recognize real faces as well as represented faces. However, whether or not configural information prevails over featural information in face recognition in animals remains unknown, especially for nonhuman primates. The question thus arises of how baboons understand this kind of pictures, and if they process them as real faces by analyzing their spatial relational properties. Thus, baboons (n = 7) were tested in a two-alternative forced-choice discrimination task to assess the spontaneous processing of qualitative (i.e., first-order) or quantitative (i.e., second order) variations in the configural arrangement of facial features. In a first experiment, the stimuli used as test stimuli were second-order pictorial faces of humans or baboons in which the mouth and the eyes were rotated upside down relative to the normal face (Thatcherized faces). Results showed that baboons readily discriminated two different normal faces but did not discriminate a normal face from its second-order modified version. In a second experiment, we used as test stimuli human or baboon faces for which the first-order configural properties had been distorted by reversing the location of the eyes and mouth within the face. Discrimination was prompt with these stimuli. Finally, a third experiment replicated some of the conditions and the results of the first experiment, thus ruling out possible effects of learning. It is concluded that baboons are able to process pictures of faces by analyzing the spatial relational properties contained within these stimuli and that they are more adept at spontaneously processing first- than second-order configural facial properties. Indeed, baboons were not sensitive to the Thatcher illusion (Experiment 1), contrary to humans. Thus it raises the possibility that monkeys

processed pictures without paying attention to what they explicitly represent, at least in some particular conditions.

**Addessi, E., Mancini, A., Crescimbene, L. & Visalberghi, E.**
**Unit of Cognitive Primatology and Primate Center, Institute of Cognitive Sciences and Technologies, CNR, Rome, Italy**

***"Symbolic use of tokens in capuchin monkeys (Cebus apella)?"***

Although the use of tokens (i.e., inherently non-valuable objects that acquire an associated value upon exchange for food with an experimenter) has been the topic of several recent studies, it is still unclear whether non-human primates employ tokens as symbols. To this aim, we carried out five experiments with capuchin monkeys. After training 10 capuchins to associate two types of tokens (A and B) with different amounts of food (namely, token A was worth one reward and token B was worth three rewards), we assessed their performance in relative numerousness judgment tasks with food (Experiment 1) and with tokens A (Experiment 2). In both experiments, all capuchins chose the highest quantity regardless of the type of item presented, although their performance was lower with tokens than with food. Then, when one token B was presented versus one to five tokens A (Experiment 3), four out of 10 capuchins used a flexible strategy and maximized payoff. Next, when required to choose between 1-2 token(s) B and 3-6 tokens A (Experiment 4), only two out of six capuchins maximized payoff. Finally, to assess whether the value assigned to three items combined according to transitivity (i.e. if an individual prefers A to B and B to C, then she should prefer A to C), capuchins received paired comparisons (2A vs. 1B, 1A vs. 1-5B; 2B vs. 1C, 1B vs. 1-5C; 2A vs. 1C, 1A vs. 1-5C) between different quantities of either food or tokens (Experiment 5). Subjects could assign a relative value to food and to tokens, satisfying transitivity both in a weak sense (order of preference) and in a strong (quantitative) sense. Interestingly, tokens increased the distance between the relative value of the offers presented. In conclusion, capuchins could flexibly estimate, represent, combine and make rational evaluations on tokens as they do with real food. In contrast they did not take advantage from the use of tokens and there was no evidence of psychological distancing through symbolic representation.

**Potì, P. & Saporiti, M.**
**Unit of Cognitive Primatology and Primate Center, Institute of Cognitive Sciences and Technologies, CNR, Rome, Italy**

***"Capuchins use symbolic artefacts."***

We show that capuchins can use symbolic artefacts such as scale models or videos to solve spatial search tasks. Two capuchins saw a pre-recorded silent video-clip of an experimenter hiding food under one of two different objects or they saw the experimenter hiding food under one of two scale models of two other objects (ratio 1:2). After a temporal delay, capuchins searched for food under one of the two real or bigger objects. The real objects were indices of food and the scale models or the video images were iconic signs of indices of food. The video task proved more difficult, but one capuchin solved both tasks. He also generalized to new objects in the video task. So, capuchins understand the reference relation between signs and real objects and can use the information gained through the signs to solve practical problems. Moreover, capuchins can use more than one minimal system of signs flexibly. We discuss our findings in relation to different properties of signs.

**Spinozzi, G.[1] , De Lillo, C.[1, 2] & Truppa, V.[1]**

**[1]Unit of Cognitive Primatology and Primate Center, Institute of Cognitive Sciences and Technologies, CNR, Rome, Italy**

**[2]School of Psychology, University of Leicester, Leicester, UK**

***"A comparative analysis of perceptual grouping processes in humans and capuchin monkeys."***

In order to visually identify objects and segregate them from a background, organisms must be able to group their component parts into perceptual wholes. General principles regulating perceptual grouping have been identified in humans and might pertain to some extent to nonhuman species which depend to a great extent on vision for their survival. However, findings with nonhuman primates, our closest relatives, have shown that, compared with humans, these species process visual information in a different way. I will present some recent data of our comparative investigations on

perceptual grouping in humans and capuchin monkeys. The first line of research compared the sensitivity of these species to basic forms of spatial organisation. Here emerged that monkeys are either hindered by or insensitive to some of the organizational factors, which facilitate the processing of part-whole relationships in humans. In the second one, we investigated the role played by several grouping cues in the visual processing of humans and capuchins. The results indicated interspecies differences between humans and capuchins in their relative use of some gestalt laws of organization. Overall, these findings suggest that human and non-human primates use different processes to segment a visual scene into its component parts and to integrate these parts into a coherent whole.

## Day 2: Friday 7th December 2007:

### *Morning Session*

**Hurford, J. R.**
**Department of Theoretical and Applied Linguistics, University of Edinburgh, Edinburgh, UK**

***"The Origins of Meaning"***

Apes don't talk to us, but they construct complex cognitive mental representations. In apes we find the evolutionary seeds of relational thought, of referring to objects, of episodic memory, and of propositional thinking. None of these bases for thought and language are as well developed as in humans.

Why do humans alone have a disposition to express thoughts in complex detail? This is attributed to a degree of trust in other group members, ability to read others' minds, and willingness to cooperate with them. Thus, the scene is set for the explosive emergence of complex human language and culture.

**Davidoff, J.**
**Centre for Cognition, Computation and Culture (CCCC), Department of Psychology, Goldsmiths College, University of London, London, UK**

***"Attentional and linguistic constraints on perception"***

Attention and language (i.e., names) constrain the global similarity within displays. Cross-cultural evidence will be presented a) to show that a narrowed attention can lead to enhanced accuracy in size judgements and to striking local biases more pronounced than has been recorded in atypical development (e.g., autism) and b) that names change the appearance of similarity. These findings for names provide evidence in favour of the linguistic relativity (Whorfian) view of the relationship between language and perception. The Whorfian argument with respect to colour categorisation will be supported by cross-species comparisons of monkeys and human primates.

**Sinha, C.[1] , Da Silva Sinha, V.[1], Zinken, J.[1] & Sampaio, W. [2]**

**[1] Psychology Department, University of Portsmouth, Portsmouth, UK**
**[2] Federal University of Rondônia, Brazil**

***"When time is not space: evidence from an Amazonian language"***

The recruitment of spatial lexicon and grammar to linguistically conceptualize time intervals and temporal relations is widespread in the world's languages. It has therefore been proposed that there is a natural, universal cognitive of domain of time, whose linguistic organization is universally derived via metaphoric mapping from the lexicon and grammar of space and motion. We challenge this account on the basis of our research on the linguistic conceptualization of space, motion and time in the Amondawa language and culture of Amazonia. Amondawa is a Tupi Kawahib language with a complex, distributed spatial relational lexicon and verb-framed/equipollent motion typology. Like other Tupi languages, Amondawa lacks verbal tense but has a rich nominal aspectual system. It does not employ cardinal chronologies such as ages of individuals, or ordinal chronologies such as yearly or monthly calendars. An abstract term for time does not exist in Amondawa. The word *kuara* ("sun") is preferentially used to denote time intervals in general, since it is the movement of the sun which governs the passage of both the time of day and the seasons. The system is based not on countable units (the Amondawa number system has only two numerals with a maximum combinatorial value of four, but on social activity, kinship and ecological regularity. The

system therefore does not permit conventional "time-reckoning". This does not mean that Amondawa speakers have no time awareness, or that they are unable to talk about temporal relations between events and activities, and between such events and activities and the time of speaking. But they do not talk *about* time, or frame relations between events in terms of a notion of time separate from the events and activities being talked about. This abstracted (or reified) notion of a separate time plane or domain we call the notion of "time as such".

We advance three conclusions. First, time-based time interval systems are constituted by the use of linguistically organized, materially-anchored symbolic cognitive artefacts. Second, the conceptual domain of "time as such" is not a human cognitive universal, but a cultural evolutionary construction constituted by schematic time-based time interval systems, reflection upon which is language and culture dependent. Third, because the cognitive domain of "time as such" is a cultural, historical and linguistic construction, the hypothesis that it is universally constructed by metaphoric mapping from the conceptual domain of space is false. Rather, it is the cultural, historical and linguistic construction of the domain of "time as such" that potentiates the linguistically widespread recruitment of spatial linguistic resources for the structuration of the temporal domain, and perhaps the grammaticalization of temporal relations.

**Reddy, V.[1], Hicks, K.[1], Jonnalagadda, S.[2], Liebal, K.[1], Conforti, M.[1], Chintalapuri, B. [2]**
**[1] Centre for Ecology, Culture and Communication, Department of Psychology, University of Portsmouth, UK**
**[2] Department of Psychology, Osmania University, Hyderabad, India**

***"Crossing the line? The emergence of compliance in infants in two cultures"***

Grasping others' intentions for the completion or change of one's own intentions is a crucial achievement for development of interpersonal coordination, understanding and indeed for the sharing of culture. Although the emergence of this ability is attributed to the last quarter of the first year of human infancy, we have almost no empirical data about how it develops, what factors influence its achievement, or whether it is affected by differing cultural emphases on directing infant actions.

This paper reports the results of a major longitudinal project exploring naturally occurring adult directives and infant compliance from 6 months to 12 months of age, in the UK and in India. Two striking findings, contrary to predictions in the developmental literature, are discussed. One, positive directives are not developmentally 'harder' than negative directives: infant-adult engagements show the incidence of and compliance with positive directives earlier than negative. Two, the emergence of compliance is earlier than previously predicted, evident even at 6 months in dyadic (person-person) contexts and increasing with age in the complexity and triadicity of its 'objects'. The incidence of socio-cultural supports in both cultures in the form of redundant directives and cultural variations in the style and content of directives are discussed.

## *Afternoon Session*

**Csibra, G.**
**School of Psychology, Birkbeck, University of London, London, UK**

***"Infants' interpretation of indexical referential signals"***

Human infants tend to follow the gaze of interactive partners, which is usually explained as a reflex, an instrumental response, or an indication that infants understand the mental state of attention in others. I present an alternative account based on the hypothesis that gaze perception serves two functions in humans: in addition to informing the perceiver about the content of the attentional state of the observed individual, gaze can also operate as a non-verbal communicative referential signal. I propose that infants' tendency to follow others' gaze primarily reflects this second, communicative- referential interpretation of gaze. This account is supported by evolutionary, developmental, and cognitive arguments, and explains the peculiarities of the development of gaze following that existing theories have difficulties of accounting for.

**Call, J.**
**Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany**

***"On the evolution of gestural communication in human and apes"***

A growing number of scholars have suggested that gestural communication may have been especially important in the early stages of language origins. Of special interest in this debate is the communication of other primates, especially those most closely related to humans, the great apes. A comparison between human and ape gestures reveals an interesting mixture of similarities and differences. Like humans, apes use gestures flexibly and they can even learn new gestures. Unlike humans, however, imitative learning does not seem to be the main mechanism underlying gesture acquisition. Instead apes seem to learn many of their gestures in social interaction with others via processes of ontogenetic ritualization. A possible reason for this difference is that apes have greater difficulties than humans in translating visual information into novel motor commands, and not on simply perceiving the differences between gestures. I will discuss the implications of these findings for the question of the evolution of culture and language.

**Brinck, I.**
**Theoretical Philosophy, Lund University, Lund**

***"Gaze, pointing and verbal reference: Some essential differences."***

The term 'referential behaviour' is a central term in the research about preverbal infants' communicative abilities. It stands for behaviour that either directs or follows, purposively or not, another agent's attention to a target in common space, such as gaze following, gaze alternation, and pointing, in contrast to instrumental behaviour that is directed at an object, such as reaching and grasping. Recent data shows that referential skills in human infants emerge several months earlier than they generally are expected (e.g., gaze following by 4 months), while other data apparently show the opposite (infants do not reliably and consistently follow point and gaze until 18 months). What should we make of this? When is it appropriate to draw the conclusion that infants have referential capacities? What does it mean to say that they have such capacities? Moreover, intersubjective behaviour that involves gaze is considered an important indicator of the capacity for spontaneous and purposive intentionally communicative behaviour. Such behaviour influences the attention of another agent relative to a target in common space,

and involves mutual attention. However, only a fraction of the behaviour that is referential is also communicative in this sense.

An analysis of existing data on gaze-following abilities at different ages reveals not only that the capacity for understanding gaze varies with the infants' age, but is also heavily influenced by contextual elements. The behaviour evidently exploits several mechanisms and cognitive strategies, depending on properties of the behavioural context (with which other behaviours gaze is combined), of the physical context (e.g., saliency), and of the behaviour of the other agent. This makes it vital to take the entire situation (at a given time and place) into account when interpreting observations of referential behaviour. Furthermore, gaze can have several functions to the observer, and acquires its function-in-the-context (as opposed to its teleological function, or effect) with respect to the situation in which it occurs.

To systematically account for the differences in the observer's behaviour and put them in a wider developmental and cognitive perspective, an initial distinction is made between three fundamental ways to react to gaze, viz., by cue-driven, target-driven, and agent-driven attention shifts. In the first case there is no processing of the direction of the sender's action, but the observer's reaction is reflexive, in the second case, the action is perceived as goal-directed, and in the third case, as intention-guided. Goal-directed gaze following occurs from processing of the sender's individual intention-to-act by its manifest behavioural properties relative to the physical context and expected goal. Intention-guided gaze-following occurs from processing of the sender's combined intention-to-interact and intention-to-act by following the path of gaze to the target, primarily paying attention to the behaviour of the agent, letting it override saliency of context and target.

Further discussion concerns the central role of eye gaze at the transition stages between the three forms of gaze reading and the importance of inhibitory behaviour, the developmental relation between these forms, and the function that gaze acquires in different contexts of action.

**Zlatev, J.**
**Centre for Languages and Literature, Lund University, Lund**

***"From proto-mimesis to language"***

How can we reconcile the conception of language as a conventional-normative semiotic system with a perception/action-based account of its structure and meaning? And why should linguistic meaning – as opposed to linguistic expression – be so closely related to motor activity and its neural underpinnings, as suggested by recent findings? A conceptual framework and evolutionary scenario building on the concept of *bodily mimesis* (Zlatev, 2005, 2007) imply answers to these questions. I present evidence for a particular evolutionary stage-model called The Mimesis Hierarchy (Zlatev in press) by reviewing recent neuroscientific studies in monkeys and human subjects. I argue that "mirror neuron" systems can subserve basic motoric and social capacities, but they need to be considerably extended in order to provide an efficient basis for bodily mimesis, and even more so for language. While language may be ultimately "grounded" in perception and action, it is essential not to try to reduce it to them.