Cognitive Science Symposium
June 16th-17th 2003

organized by
the Center for Cognitive Science in Stockholm and
Rutgers Center for Cognitive Science (RuCCS), USA

Financed by
Riksbankens Jubileumsfond and
KognitionsCentrum

Invited speakers from RuCCS:

Prof. Randy Gallistel
Prof. Rochel Gelman
Prof. Jane Grimshaw
Prof. Steve Hanson
Prof. Jerry Fodor
Prof. Ernest Lepore
Prof. Alan Leslie
Prof. Zenon Pylyshyn

Invited speakers from Sweden:

Prof. Elisabeth Engdahl
Prof. Peter Gärdenfors
Prof. Kristina Höök
Prof. Lars-Göran Nilsson
Prof. Dag Westerståhl

Location: IT University in the Forum building in Kista, Stockholm

URL: http://www.dsv.su.se/research/kogc/

Organizing committee:

Robert Ramberg (Department for Computer and System Sciences-DSV, SU/KTH)
Teresa Ceratto (Department for Computer and System Sciences-DSV, SU/KTH)
Henrik Artman (Department for Numerical Analysis and Computer Science, KTH)
Inger Karlsson (Department for Speech, Music- and Hearing, KTH)
Peter Pagin (Department of Philosophy, SU)
Sverker Sikström (Department of Psychology, SU)
Sofia Gustafson-Capkova (Department of Linguistics, SU)

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Program

Monday, June 16

08.00-09.00 Registration and coffee

09.00-09.30 Welcome address - Robert Ramberg, president, The Center for Cognitive Science in Stockholm.

09.30-10.30 Prof. Ernest Lepore *Bewitched by the Spoken Word*
(Westerståhl – chair/moderator)

10.30-11.00 Coffee break and POSTERS/DEMONSTRATIONS

11.00-12.00 Prof. Peter Gärdenfors *Concept combination: a geometrical model*
(Lepore – chair/moderator)

12.00-13.00 Prof. Randy Gallistel *An information processing perspective on conditioning: neurobiological implications* (Höök – chair/moderator)

13.00-14.30 LUNCH

14.30-15.30 Prof. Kristina Höök (Gallistel – chair/moderator)

15.30-16.30 Prof. Zenon Pylyshyn *How we cognize space: or Mental space is not in the head* (Nilsson – chair/moderator)

16.30-17.00 Coffee break and POSTERS/DEMONSTRATIONS

17.00-18.00 Prof. Lars-Göran Nilsson (Pylyshyn – chair/moderator)

19.30 Dinner

Tuesday, June 17

09.00-10.00 Prof. Steve Hanson *Connectionist Neuroimaging*
(vacant chair/moderator)

10.00-10.30 Coffee break and POSTERS/DEMONSTRATIONS

10.30-11.30 Prof. Alan Leslie *How is the "Theory of Mind" Mechanism (ToMM) Doing These Days?*
(Pagin – chair/moderator)

11.30-12.30 Prof. Jane Grimshaw *On the Lexical/Functional Distinction*
(Engdahl – chair/moderator)

12.30-14.00 LUNCH

14.00-15.00 Prof. Elisabeth Engdahl *The Use of Features in Linguistics*
(Grimshaw – chair/moderator)

15.00-15.30 Coffee break and POSTERS/DEMONSTRATIONS

15.30-16.30 Prof. Dag Westerståhl *How Semantics Differs from Pragmatics*
(Lepore – chair/moderator)

16.30-17.30 Prof. Jerry Fodor *Concepts Aren't Stereotypes*
(Pagin – chair/moderator)

17.30- Closing the symposium

ABSTRACTS

Bewitched by the Spoken Word

Ernie Lepore
Rutgers Center for Cognitive Science

Context Shifting Arguments (CSA) ask us to consider two utterances of an unambiguous, non-vague, non-elliptic sentence S. If the consensus intuition is that what's said, or expressed or the truth-conditions, and so possibly the truth-values, of these utterances differ, then CSA concludes S is context sensitive. Consider, for example, simultaneous utterances of 'I am wearing a hat', one by Stephen, one by Jason. Intuitively, these utterances might disagree in truth-value, contingent upon who is or isn't wearing a hat, and so they express distinct propositions and differ in their truth conditions. Since these differences are not the result of ambiguity (lexical or structural), vagueness, conversational implicature, or syntactic ellipsis, we have pretty strong evidence that 'I am wearing a hat' is context sensitive.

A central premise in all CSA is the assumption that the intuitions appealed to (about various utterances of S) are semantic; viz., they are the sort of intuitions a semantic theory must accommodate. One goal of this paper is to present tests for the semantic significance of such intuitions. If we are right, unsound CSA's are ubiquitous. As a consequence a wide range of philosophers have mistaken views about context sensitivity.

My attack on these positions center around three closely related considerations.

1) I show that an expression e is context sensitive just in case it passes what I call the Inter-Contextual Disquotation test and an expression passes this test just in case there can be what we call a Real CSA for it. Ordinary context sensitive expressions, e.g., 'I', 'she', and 'now', pass this test (and there can be Real CSA for them), whereas, we will argue, controversial cases, such as 'know', 'good', 'rich', 'tall', and 'red' don't (and there are no Real CSA for them).

2) An expression e is context sensitive just in case it blocks what I call collective uses. Again, I argue that genuine context sensitive expressions block collective uses, whereas the controversial cases do not.

3) My third consideration takes the form of a challenge: Suppose there is a CSA alleged to establish e is context sensitive. A proponent of this view needs to develop a notion of context sensitivity (and contextual salience) that doesn't undermine the possibility of an effective CSA.

These three points all serve dual purposes. On the one hand, they provide direct evidence that certain claims about context sensitivity are false. They show, for example, that 'know' isn't context sensitive. In addition, my three arguments contribute to a diagnosis of unsound CSAs. They explain how intuitions are led astray by various use-mention confusions and a fundamental misunderstanding about the about the semantics of the locution in context.

Concept combination: a geometrical model

Peter Gärdenfors
Lund University Cognitive Science

A remarkable feature of human thinking is our ability to understand new combinations of concepts. Nobody has problems grasping the meaning of combinations like pink elephant, striped apple and cubic soap-bubble, even if one never will encounter any object with these properties. A successful theory of concepts should be able to explain the mechanisms of concept combination. In classical logic, combinations of concepts are expressed by conjunctions of predicates. This means that the reference of the combination of two concepts is taken to be the intersection of the extensions of the two individual concepts. However, many everyday combinations of concepts cannot be analysed in this simplistic manner.

Also the traditional form of prototype theory has problems. An early proposal was to use fuzzy set theory to compute the prototype of a combination of concepts from the prototypes of its constituents. However, this approach results in incorrect results for many types of combinations. I will propose a geometrical model of concept combination that is based on conceptual spaces. I shall outline how conceptual spaces can be used to model properties and concepts. A natural property is characterized as a convex region in some domain. A natural concept is represented as a set of convex regions in a number of domains together with a prominence assignment to the domains. A first approximation of concept combination, is: The combination XY of two concepts X and Y is determined by replacing the region for some domain of the modifier X by the values of the corresponding region for Y. However, this rule turns out to be too simple. By taking into account the effect of "contrast classes" and dynamic properties of concepts, it is then amended to the following: The combination XY of two concepts X and Y is determined by letting the regions for the domains of X, confined to the contrast class defined by Y, replace the values of the corresponding regions for Y.

An information processing perspective on conditioning: neurobiological implications

Randy Gallistel
Rutgers Center for Cognitive Science

Neurobiologists interested in the mechanism of learning and memory have not come to terms with the finding that the temporal pairing of events is neither necessary nor sufficient to produce the kind of learning that is seen in simple conditioning paradigms. What is necessary, and arguably sufficient, is that the one stimulus provides information about the timing of the other. Subjects respond to predictive stimuli (CSs) to the extent that they reduce the subject's uncertainty about the time at which the predicted stimulus will occur, that is, to the extent that they convey information in Claude Shannon's sense. I argue that the processing required to pick up this information requires a read-write memory. What we need to look for in the nervous system is Turing's tape, not Hebb's synapse.

The affective loop

Kristina Höök
University of Stockholm

The field of affective interaction aims to do something very difficult. We want to touch people's emotions! We want to make end-users affectively involved with interactive systems that model emotions, reason using emotions and express emotions. We know for sure that movies, novels, television shows, arts, music, etc etc are indeed able to get people affectively involved. But is it possible do this with interactive systems that systematically tries to model this phenomenon and from that basis tries to make users involved?

This work builds upon results in psychology showing that emotions reside both in body and in mind (see e g Damasio). For the "body-part", we build on results on tangible interaction (Iishi) combined with ideas of how emotions might be "encouraged" through body posture (Laban). For the "mind-part" we are interested in strong narrative contexts where emotions make sense (Sengers). Thus, combining results from psychology with design based on narratives, in the interdisciplinary meeting grounds of interactive applications is the focus of this work.

In this talk I would like to discuss how physical, tangible interaction and mood-creating modalities such as music, sound, form, drawings, colour... expressions used in strong interesting sense-making contexts (games, narratives) could help us to try and involve both body and mind. In particular, I am interested in those circumstances when we succeed in tying the affective expressions of users, with generated affective output into a loop that "pulls" the end-users into an affective interaction. I will use my experiences from the design and user-studies of the Influencing Machine (created by Phoebe Sengers and colleagues) and Fantasya and Sentoy (created by Ana Paiva and colleges) as examples of what this could mean.

How we cognize space: or Mental space is not in the head

Zenon Pylyshyn
Rutgers Center for Cognitive Science

This talk is concerned with how we cognize space, and in particular with the question of whether certain kinds of thoughts (e.g., ones accompanied by mental imagery) entail a special form of representation of space. I will sketch several reasons to reject the assumption that perceived or imagined space is represented in the brain by a topographic pattern of activity bearing a shape-preserving (homeomorphic or "depictive") relation to the represented layout. Yet there remain reasons for thinking that certain forms of thought may be "spatial" in a way that other forms of thought are not. One important reason is that we can sometimes orient towards some objects of thought (move our attention or gaze to them, point to them, etc) as though they were located in real space. This is demonstrated empirically by phenomena such as spatial "S-R compatibility" and response-interference effects between thoughts and actions, and by parallel deficits in such pathologies as visual and imaginal hemispatial neglect. To account for such phenomena we need to understand how objects of thought can be bound to perceived locations in a scene. This binding is precisely what the theory I call visual indexing

(or FINST) theory is designed to explain. I will show how visual indexes can give certain thoughts a spatial character by exploiting the spatial properties of concurrently-perceived spatial layouts. In this way the apparent spatiality of mental images can be accounted for without appealing to a spatial display inside the head. This leads to a very different way of understanding how people cognize space, both in vision and in thought. The visual indexing theory has other far-reaching implications for how thoughts connect with objects in the world and thus for issues in the design of machine-augmented reasoning and communication.

Memory systems age differently

Lars-Göran Nilsson
University of Stockholm

Basic findings obtained on memory functions in normal aging are presented and discussed with respect to five separate but interacting memory systems. These systems are: episodic memory, semantic memory, short-term memory, perceptual representation system, and procedural memory. Available evidence from cross-sectional research shows that there is a linear, decreasing memory performance as a function of age for episodic memory. Longitudinal studies suggest, however, that this age deficit may be an overestimation by showing a relatively stable performance level up to middle age, followed by a sharp decline. Studies on semantic memory, short-term memory, perceptual representation system, and procedural memory show a relatively constant performance level across the adult life span although some tasks used to assess short-term memory and procedural memory have revealed age deficits. Disregarding the mixed results for these latter two memory systems, it can be concluded that episodic memory is unique in showing an age deficit. Episodic memory is also unique in the sense that it is the only memory system showing gender difference in performance throughout the adult life span with a significantly higher performance for women. Cross-sectional and longitudinal data from the Betula study, a prospective cohort study on memory, health and aging, are used to illustrate how different memory systems age at a different rate.

Secrets of the burgeoning mind: Implications for a theory of learning

Rochel Gelman
Rutgers Center for Cognitive Science

I will argue that innate skeletal domain-specific structures facilitate the kinds of on-the-fly, early learnings that we see around the world. A key point is that implicit mental structures facilitate finding, attending to and assimilating domain-relevant data. The result is movement onto relevant, as opposed to irrelevant learning paths. Now learner's mental structures (no matter how fragile) can use various learning tools to accrue knowledge about the domain). Later learning can be at a disadvantage if existing mental structures are inconsistent with that of what is to-be-learned and/or when new structures have to be mounted. I will use findings from our work on verbal and nonverbal numerical cognition and the nature of the animate-inanimate distinction to put flesh on the theoretical position advanced. see in early and without instruction; why many later learnings can be difficulty.

Connectionist Neuroimaging

Stephen J Hanson
Rutgers Center for Cognitive Science

The Decade of the Brain has come and gone. Although there are a number of excellent venues for Connectionism and Neural Computation more generally, their impact on the neurosciences has been almost absent. The field of connectionist modeling has, nonetheless continued at a frenzied pace and has developed significant results in both theory and application. The Neurosciences have continued to focus on cells and small circuits showing how integrative and system level function dominates brain computations. And at the same time the field of Neuroimaging has overun most of what we now know as Cognitive Neuroscience, which has grown more and more dependent on Cognitive Psychology and Perception then the Neurosciences themselves. This disconnect between computational and brain sciences, I think ,can be explained in three ways. (1) Neural computation has tended not to focus on emergent properties of the underlying computations, leaving neural models either transparent and redundant or complex and opaque. (2) neuroscience has not embraced a computational metaphor and continued in a mainly atheoretical agenda (3) system level neuroscience is the most difficult level for experimentalists and at the same time apparently trivialized by methods in neuroimaging, and the most critical level for computational accounts. In this apparently dismal backdrop, I will review the thread of neural modeling from early feedfoward networks that although were computationally powerful were unable to provide adequate models of process and dynamics obvious in most cognitive and perceptual function. Recurrent neural network (RRN) models, that have both memory and dynamics will be shown in grammar learning to both generalize outside of their training set and have sensible internal representations (Hanson & Negishi 2002). Moreover I will argue that Neuroimaging data is particularly ripe ground for the system level modeling by dynamical computational models such as RNNs, both constraining these models and providing serious contact with neuroscience data.

How is the theory of the "theory of mind" mechanism (ToMM) doing these days?

Alan Leslie
Rutgers Center for Cognitive Science

It is nearly 20 years since I first proposed that an innately specified neuro-cognitive mechanism, specialized for attending to and learning about mental states, emerges during the second year of human life. So I thought I would look at it where that idea, which I call the "theory of mind" mechanism or ToMM, stands today. I will limit my discussion to two issues. First, I will consider the concept, PRETEND, in relation to pretend play, the issue that originally motivated the theory. Second, I will consider the concept, BELIEVE, in relation to findings from experimental false belief tasks. My conclusion is that after nearly two decades in the field, the theory of ToMM is alive and well and increasingly looking as if it might even be true.

On the Lexical/Functional Distinction

Jane Grimshaw
Rutgers Center for Cognitive Science

One of the earliest results of psycholinguistic research within the context of modern theoretical linguistics, is that there is an important distinction between "content" words such as nouns, verbs and adjectives and "function" words such as determiners and complementizers. They are affected differently in aphasia, and function words are frequently absent from speech of young children. This distinction has proved to be of fundamental importance in governing the organization of linguistic structure. We now know that on top of each lexical/content word there is a sometimes elaborate structure of functional elements, all arranged in a head-complement relationship, which is largely constant cross-linguistically. This paper lays out some of the evidence for this conclusion, and highlights the puzzle that lies behind it: while the lexical/functional distinction is highly motivated, a principled theory of the distinction has proved elusive. Why?

The Use of Features in Linguistics

Elisabet Engdahl
Göteborg University

Features are a popular analytic device among linguists. Distinctive features lice [+voiced] have played an important role in phonology. In syntax, features like [+V, -N] have been used to capture certain cross-categorial similarities. Using more complex features Gazdar et al. working within Generalized Phrase Structure Grammar were able to capture a lot of structural dependencies that had hitherto been analysed as requiring structure mapping transformational rules. In Lexical-functional grammar, features play an important role in the part of the theory that connects argument structure and grammatical relations. In Head-driven phrase structure grammar, recursive feature structures are the essential building blocks. In the Minimalist Program, features and feature checking drive the computational system. In this talk, I want to discuss the way some of these features are used. What is the status of linguistic features? Are they just convenient abbreviatory labels for chunks of sound, structure or meaning? Or do they capture something essential about linguistic structure and the way language is processed? Of special interest are features that refer to a particular descriptive generalisation or theoretical assumption such as the V2-feature (verb second feature) or the EPP-feature (extended projection principle).

How Semantics Differs from Pragmatics

Dag Westerståhl
University of Stockholm

Some issues concerning meaning and understanding are considered from a (methodo)logical point of view. In particular, a recent debate on how contextual effects on interpretation relate to the semantics-pragmatics distinction is looked at, with special focus on the principle of compositionality. Distinct versions of 'compositionality in context' are examined, and it is suggested that such a principle usefully demarcates semantics from pragmatics.

Concepts Aren't Stereotypes

Jerry Fodor
Rutgers Center for Cognitive Science

Compositionality is the property that a representational system has if the content of its complex symbols is determined by the contents of their minimal constituents. It is generally assumed that the productivity and systematicity of human concepts is explained by their compositionality. However, there is a prima facie argument that no theory of concepts is compatible with compositionality if it holds that either their individuation conditions or their possession conditions are epistemically constituted. Such widely credited notions as that concepts are stereotypes must be rejected if this argument is sound.

There are various attempts in the recent cognitive science literature to meet this challenge to the stereotype theory of concepts. Perhaps the most popular turns on the claim that the compositionality of stereotypes is the default interpretation of complex concepts.(This is the so-called `default to stereotype (DS)' strategy. I will argue: First, that the DS strategy is a priori irrational (because it relies on the unwarranted assumption that the intersection of two sets normally includes the typical members one or both). Second that experimental findings show that subjects do not, in fact, operate in accordance with DS.