HANDBOOK

FIRST INTERNATIONAL SUMMER INSTITUTE IN COGNITIVE SCIENCE

Multidisciplinary Foundations of Cognitive Science

JULY 5-30, 1994

UNIVERSITY AT BUFFALO

FIRST INTERNATIONAL SUMMER INSTITUTE IN COGNITIVE SCIENCE (FISI-CS)

Multidisciplinary Foundations of Cognitive Science

Center for Cognitive Science

State University of New York at Buffalo, Buffalo NY, USA
(North Campus)

JULY 5–29, 1994

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CALENDAR OF FISI-CS EVENTS

Tuesday, July 5	8:30 am - 6:00 pm	**Registration**
	7:30 pm	**Reception**
Wednesday, July 6	7:30 am - 12:00 pm	**Registration**
	9:00 am	**MWF Classes Begin**
	5:00 pm - 7:00 pm	**Eleanor Rosch** "Cognitive Science and Human Experience"
Thursday, July 7	8:30 am	**TTh Classes Begin**
	5:00 pm - 7:00 pm	**Susan B. Udin** "The Environment Shapes the Brain"
Friday, July 8	5:00 pm - 7:00 pm	**Leonard Talmy** "The Conceptual Structuring System of Language"
Saturday, July 9	9:00 am - 6:00 pm	Workshop: **"Topological Foundations of Cognitive Science"**
	9:00 am - 4:30 pm	Workshop: **"Language and Thought"**
Sunday, July 10	9:00 am - 6:00 pm	Workshop continued: **"Topological Foundations of Cognitive Science"**
	9:00 am - 4:30 pm	Workshop continued: **"Language and Thought"**
Monday, July 11	5:00 pm - 7:00 pm	**Michael Silverstein** "A 'Minimax' Approach to Verbal Interaction"
Tuesday, July 12	5:00 pm - 7:00 pm	**Dedre Gentner** "Comparison and Cognition"
Wednesday, July 13	5:00 pm - 7:00 pm	**John Searle** "Consciousness and Cognition"
Thursday, July 14	5:00 pm - 7:00 pm	**Lila Gleitman** "A Picture Is Worth a Thousand Words - But That's the Problem"
Friday, July 15	5:00 pm - 7:00 pm	**Brian C. Smith** "Metaphysics for the 21st Century"
	9:00 pm - 11:00 pm	Workshop: **"Speech Acts and Linguistic Research"**
Saturday, July 16	9:30 am - 6:00 pm	Workshop continued: **"Speech Acts and Linguistic Research"**
	9:00 am - 4:30 pm	Workshop: **"Connectionism and Neuroscience"**
Sunday, July 17	9:00 am - 6:00 pm	Workshop continued: **"Speech Acts and Linguistic Research"**
	9:00 am - 4:30 pm	Workshop continued: **"Connectionism and Neuroscience"**
Monday, July 18	5:00 pm - 7:00 pm	**Eve V. Clark** "Taking Perspective with Words"
Tuesday, July 19	5:00 pm - 7:00 pm	**Thomas G. Bever** "Is the Hippocampus the Chinese Smithy"

Wednesday, July 20	5:00 pm - 7:00 pm	**Stephen M. Kosslyn** "The Resolution of the Imagery Debate"
Thursday, July 21	4:45 pm	**TTH Classes End**
	5:00 pm - 7:00 pm	**David L. Waltz** "Building Truly Intelligent Machines"
Friday, July 22	4:40 pm	**MWF Classes End**
	5:00 pm - 7:00 pm	**Janet Dean Fodor** "Language Acquisition: Fewer But Better Triggers"
Saturday, July 23	9:00 am - 4:00 pm	Workshop: **"Intelligence, Attention, Intention"**
	10:00 am - 5:00 pm	Workshop: **"Cognitive and Ontological Foundations of Knowledge Engineering"**
Sunday, July 24	10:00 am - 4:00 pm	Workshop continued: **"Cognitive and Ontological Foundations of Knowledge Engineering"**
	9:00 am - 5:30 pm	Workshop: **"Philosophy and Cognitive Science"**
	9:00 am - 5:30 pm	Workshop: **"Language and Space"**
Monday, July 25	9:00 am - 4:30 pm	Workshop: **"Deixis in Narrative"**
	9:00 am - 4:30 pm	Workshop: **"Connectionism"**
	5:00 pm - 7:00 pm	**Jerry Fodor** "Concept Atomism"
Tuesday, July 26	9:00 am - 4:30 pm	Workshop continued: **"Connectionism"**
	9:00 am - 4:30 pm	Workshop: **"Ontology of Space"**
	5:00 pm - 7:00 pm	**Gilles Fauconnier** "Cognitive Construction of Meaning"
	9:00 pm - 11:00 pm	Workshop: "Towards an Embodied and Unified Cognitive Science"
Wednesday, July 27	9:00 am - 4:30 pm	Workshop continued: **"Ontology of Space"**
	9:00 am - 4:30 pm	Workshop: **"Applied Cognitive Science: Cognitive Science in the Workplace"**
	5:00 pm - 7:00 pm	**Donald A. Norman** "Applied Cognitive Science"
	9:00 pm - 11:00 pm	Workshop: "The Role of Metaphor Systems in Embodied Cognitive Science"
Thursday, July 28	9:00 am - 4:30 pm	Workshop: **"The Evolution of Cognition"**
	9:00 am - 4:30 pm	Workshop: **"The SNePS Knowledge Representation and Reasoning System"**
	5:00 pm - 7:00 pm	**Edwin Hutchins** "Studying Cognition in the Wild"
Friday, July 29	9:00 am - 4:30 pm	Workshop continued: **"The SNePS Knowledge Representation and Reasoning System"**
	9:00 am - 4:30 pm	Workshop: **"Cognition and Bilingualism"**
	5:00 pm - 7:00 pm	**Ray Jackendoff** "How Language Helps us Think"
	7:30 pm	**Closing Festivities**

COURSE SCHEDULE:

Classes begin Wednesday, July 6.

Monday / Wednesday / Friday

9:00–10:40 A.M.

.01 THE ANTHROPOLOGY OF KNOWLEDGE	KELLER
.06 EPISTEMOLOGY	HARE
.14 INTRODUCTION TO LINGUISTICS IN COGNITIVE SCIENCE	DRYER
.29 PRIMATE COGNITION	TOMASELLO
.33 REASONING AND ARTIFICIAL INTELLIGENCE	SHAPIRO

10:45 A.M.–12:25 P.M.

.04 COGNITION AND CULTURE	QUINN, STRAUSS
.12 INTRODUCTION TO COGNITIVE NEUROSCIENCE	JAEGER
.16 KNOWLEDGE OF LANGUAGE: SEMANTICS	WILKINS
.21 LANGUAGE DISORDERS IN CHILDREN	DUCHAN, HEWITT
.28 PHILOSOPHY OF PERCEPTION	CASATI

12:25–1:15 P.M. Break

1:15–2:55 P.M.

.08 GEOGRAPHIC ORGANIZATION OF SPACE	MARK, FREUNDSCHUH
.09 INFERENCE IN DISCOURSE	ZUBIN
.15 INTRODUCTION TO PHILOSOPHY FOR COGNITIVE SCIENCE	RAPAPORT
.24 COMPUTATIONAL LINGUISTICS & NATURAL-LANGUAGE UNDERSTANDING	HIRST
.25 NEUROLOGICAL DEVELOPMENT	SHUCARD

3:00–4:40 P.M.

.07 FOUNDATIONS OF COGNITIVE SCIENCE	SMITH
.17 KNOWLEDGE OF LANGUAGE: SYNTAX	VAN VALIN
.18 KNOWLEDGE REPRESENTATION	MARTINS
.32 PSYCHOLOGY OF PROBLEM SOLVING	SEGAL
.34 LANGUAGE AND SPATIAL COGNITION	HERSKOVITS

Tuesday / Thursday

8:30–11:00 A.M.

.02 ARTIFICIAL INTELLIGENCE APPROACHES TO VISION	SWAIN
.03 COGNITIVE DEVELOPMENT	GOPNIK, KEIL
.11 INTRODUCTION TO ARTIFICIAL INTELLIGENCE	RAPAPORT
.20 HEMISPHERIC MECHANISMS OF LANGUAGE AND COGNITION	DRONKERS, ZAIDEL
.30 PSYCHOLOGY OF LANGUAGE USE	H. CLARK

11:05 A.M.–1:35 P.M.

.05 CONNECTIONISM	RUMELHART, SMOLENSK
.10 INTRO. TO THE ANTHROPOLOGICAL STUDY OF COGNITION	POLLOCK
.27 PERCEPTION AND PRODUCTION OF SPOKEN LANGUAGE	JUSCZYK
.31 PSYCHOLOGY OF PERCEPTION	PALMER, TARR

1:35–2:15 P.M. Break

2:15–4:45 P.M.

.13 INTRODUCTION TO COGNITIVE PSYCHOLOGY	SEGAL
.19 LANGUAGE AND CONCEPTUAL STRUCTURE	TALMY
.22 FIRST LANGUAGE ACQUISITION	E. V. CLARK
.23 LOGIC	KEARNS
.26 NEUROPSYCHOLOGY OF VISION	LEIBOVIC

1 COURSE DESCRIPTIONS.

.01: THE ANTHROPOLOGY OF KNOWLEDGE.

Instructor: Janet Dixon Keller

Time: MWF 9:00–10:40 A.M.

Prerequisites:
None necessary, but a basic knowledge of anthropology or other social science will be helpful. In addition, a previous introduction to cognitive science would be useful.

Intended Audience: Advanced Undergraduates and Graduate Students.

Description:
This class will approach the anthropology of knowledge with a view toward the development of an integrated account of different ways of knowing. This is a significant goal of much contemporary research in the field, encompassing perceptual, conceptual, symbolic, and psychodynamic processes. The diverse contributions to knowledge from propositional reasoning, emotion, imagery, and the senses will be addressed. We will begin by exploring the range of mental phenomena targeted by anthropological researchers. The tension that arises for anthropologists between a focus on individual understanding and analysis of social or cultural phenomena will be introduced. Subsequently, we will examine the form and content of particular systems of knowledge. The readings and lectures in this section of the course focus on the organization of information in the form of "naive" theories. The final section of the course will explore the interface of structure and practice, ideas and actions. We will conclude with a general discussion of the relations between agency and modeling in both synchronic and developmental/historical perspectives, with attention to the characteristic significance of this set of relations for both cognition and culture.

Assignments:
It is anticipated that this course will be run as lecture and discussion. Participation from those in the class will be strongly encouraged. It will be further expected that a critical review essay briefly assessing the contributions of three papers (one from each of the three weeks' assignments) will be handed in at the end of the course. This review should address the three papers taken together as they provide a coherent and shared theoretical framework, a common directive and careful methodology for research, and significant discussion of the implications of research results for theory and practice in anthropology or another cognitive science discipline.

Readings:
Each block of readings indicated below will cover approximately one week of the course. All readings will be on reserve at Lockwood Library.

1. Week 1:
   (a) Ohnuki-Tierney, Emiko (1981), "Phases in Human Perception/Conception/Symbolization Processes: Cognitive Anthropology and Symbolic Classification," *American Ethnologist*.
   (b) Keller, Charles, & Keller, J. D., "Imaging in Ironwork," in S. Levinson & J. Gumperz (eds.), *Rethinking Linguistic Relativity*.
2. Week 2:
   (a) Keller, Janet D., & Lehman, F. K. (1991), "Complex Concepts," *Cognitive Science*.
3. Week 3:
   (a) Holland, Dorothy (1993), "The Woman Who Climbed the House: Some Limitations of Schema Theory," in Goeffrey White, Catherine Lutz, & Theodore Schwartz (eds.), *New Directions in Psychological Anthropology*. Cambridge University Press.
   (b) Keller, Charles, & Keller, Janet Dixon, "Emergence and Accomplishment in an Account of Production," in *Forging Principles of a Protean Mind*.

.02: ARTIFICIAL INTELLIGENCE APPROACHES TO VISION.

Instructors: Brian Funt, Michael Swain

Time: TTh 8:30–11:00 A.M.

Prerequisites: None. In particular a background in artificial intelligence is not required.

Description:
Computational vision addresses the problem of programming computers to see. It's easy to input an image of a scene to a computer with a camera and digitizer, but how is the image data to be interpreted? Since the retina of the eye produces data which is then processed by the brain, this question directly relates to that of how the human visual system works. Human vision provides clues about how best to structure computer vision programs; and similarly the successes, and particularly the failures, of computer vision provide clues about human vision.

The first half of the course will be taught by Brian Funt and will cover representative aspects of early vision: edge detection, radiometry, shape-from-shading, shape-from-stereo, optical flow (shape-from-motion), and color perception. Fundamentally, early vision extracts the 3D structure of a scene from its 2D image.

The second half of the course will concentrate on two topics: object recognition and active vision.

Object Recognition:
To recognize objects it is important to extract aspects or features of objects that are invariant to ways in which their appearance changes. Often we want our representations to be invariant to translation, so that we can recognize an object irrespective of its position in an image. For recognizing three dimensional objects, we may wish our representations to be invariant to arbitrary changes in 3D view, which can dramatically change the image of the object. There are other difficulties that may need to be overcome, for example sensor noise, changes in lighting, occlusion (hiding one object by another), deformation of the object, and variance from individual to individual within a class of objects we wish to recognize.

Where invariants cannot be found, search must be performed: to match to a large database of models, to find an object among distractors in a scene, or to search over possible changes in view. There have been a number of techniques developed to speed search in object recognition. How they work, and their limitations, will be explained.

It's interesting to compare these approaches to object recognition with what is known about human recognition. I'll review some recent and not so recent research that shows: human recognition is extremely fast (and therefore highly parallel), the representations used are view dependent, and humans appear not to employ perspective invariants (a commonly used approach in computer vision).

Objects are not the only things we need to recognize; I will also discuss recognition of textures (e.g. grass, bark, sand) and temporal textures (e.g. leaves blowing in the wind, waves).

Active, purposive vision:

In an animal or a robot, a vision system forms part of a organism that interacts with its environment. I'll look at vision as part of this process, introduce the concept of selective sensing in space, resolution and time; and discuss the design of a visual system whose basic components are visual behaviors that do not require elaborate representations of the 3D world, and are tightly integrated with the actions they support. Because the cost of generating and updating a complete, detailed model of natural environments is exceedingly high, I believe this task-directed approach to vision is vital for achieving robust, real-time perception in the real world.

I will review some effective techniques that fit this paradigm: for tracking moving objects, avoiding obstacles when moving through the environment, and segmenting objects from their backgrounds.

Readings:

Books:

- *Perceptual Organization and Visual Recognition David G. Lowe.* Kluwer, 1985.

Papers:

- "An Approach to Object Recognition: Aligning Pictorial Descriptions" Shimon Ullman. AI Memo No. 931, December 1986
- "Color Indexing" Michael J. Swain and Dana H. Ballard. *International Journal of Computer Vision* 7, 1991, 11-32.
- "Animate Vision" Dana H. Ballard. *Artificial Intelligence* v. 48, 1991, pp 57-86.
- "Purposive and Qualitative Active Vision" John Aloimonos. *International Conference on Pattern Recognition A*, 1990, 346-360.

.03: COGNITIVE DEVELOPMENT.

Instructors: Alison Gopnik, Frank Keil

Time: TTh 8:30–11:00 A.M.

Description:

Part 1: This course will cover recent research in children's cognitive development in the period from infancy to around four years of age. The course will consider the child's developing concepts of the physical, biological, and psychological worlds. Topics to be considered will include the child's conception of objects, the child's conception of living things, and the child's conception of aspects of "theory of mind" such as desires, intentions, perceptions, and beliefs. The focus of the course will be on specifying which aspects of this knowledge are innately specified, which undergo conceptual change, and how innate knowledge and conceptual change are related to one another. In particular, we will contrast three possible theoretical accounts of the structure and dynamics of conceptual change in infancy: modularity theories, "script" theories, and "the theory theory". In the first class, we will consider the theoretical background to current issues in cognitive development. In the second class, we will consider the evidence concerning the child's physical and biological knowledge. In the third class, we will consider the child's "theory of mind."

Part 2: The second part of this course will cover the growth of knowledge from late preschool years on into middle and late childhood. The central organizing question will ask about the nature of concepts during this period, how they are represented and how those representations might change over time. Related questions will ask about the domain specificity of concepts and about their relations to larger scale systems of belief and explanation in the course of cognitive development. To illustrate key points, much of the discussion will examine the emergence of biological thought. Other issues discussed will include: different variants of nativism and empiricism and their alliances with past and present theories of cognitive development, why abstract to concrete shifts in conceptual structure may be just as common as the reverse, and possible kinds of conceptual change and how empirical evidence bears on these kinds.

Readings: All readings will be on reserve at Lockwood Library.

1. Astington, J. W., & Gopnik, A. (1991), "Theoretical Explanations of Children's Understanding of the Mind," *British Journal of Developmental Psychology*, Special Issue on Children's Theories of Mind, Vol. 9: 7–31.
2. Baron-Cohen, Simon (in press), *Mindblindness*.
3. Gelman, S., & Wellman, H. (in press), "Insides and Essences," *Cognition*.
4. Chapters from: Gopnik, A. & Meltzoff, A. (in preparation), *Words, Thoughts, and Theories*.
5. Nelson, Katherine, *Event Knowledge*, Chap. 1
6. Spelke, L.; Breinlinger; Macomber; & Jacobson (1992), "Origins of Knowledge," *Psychological Review* 99: 605–632

.04: COGNITION AND CULTURE.

Instructors: Naomi Quinn, Claudia Strauss

Time: MWF 10:45 A.M.–12:25 P.M.

Prerequisites: No background in cultural anthropology is needed to take this course.

Description:

Cognitive science has shown little appreciation for the role of culture in cognition. This course will present an account of cultural meaning that is plausible in cognitive terms, arguing for the inclusion of culture, so defined, in cognitive scientific models. It will then consider how this view of culture informs a sample of important issues that have been dominated by the work of cognitive scientists other than cognitive anthropologists:

1. models of natural reasoning in psychology;
2. the treatment of metaphor in linguistics;
3. proposition-based models of belief from philosophy.

It will be argued that the cognitive processes underlying reasoning, metaphor, and belief can best be investigated through analysis of naturally occurring reasoning, the use of metaphor in ordinary speech, and the form of beliefs real people hold. Such analyses reveal the dependence of all three phenomena on the socially variable, learned schemas that constitute a group's shared, taken-for-granted understandings of the world. Their properties can all be better explained once fundamentally rethought grounded in these cultural schemas.

Assignments:

Those students taking the course for S/U grades will be expected to come to class prepared to discuss the readings assigned for that week. Any student who wishes a letter grade will be graded on the basis of a short (3–5 page) critical analysis of the readings for one section of the course.

Readings:

1. Bruner, Jerome (1990), *Acts of Meaning* (Cambridge, MA: Harvard University Press), Ch. 1, "The Proper Study of Man," pp. 1–32.
2. D'Andrade, Roy (1989a), "Cultural Cognition," in M. Posner (ed.), *Foundations of Cognitive Science* (Cambridge, MA: MIT Press): 795–830.
3. D'Andrade, Roy (1989b), "Culturally Based Reasoning," in A. Gellatly, D. Rogers, & J. Sloboda (eds.), *Cognition and Social Worlds* (Oxford: Oxford University Press): 132–143.
4. Quinn, Naomi (1991), "The Cultural Basis of Metaphor," in J. Fernandez (ed.), *Beyond Metaphor: The Theory of Tropes in Anthropology* (Stanford, CA: Stanford University Press): 56–93.
5. Quinn, Naomi (1993), "Culture and Contradiction: The Case of Americans Reasoning about Marriage," unpublished manuscript.
6. Strauss, Claudia (1988), "Culture, Discourse, and Cognition: Forms of Belief in Some Rhode Island Working Men's Talk about Success," Ph.D. dissertation, Harvard University, Ch. 4 ("Three Types of Belief"), pp. 127–160.
7. Strauss, Claudia (1992), "What Makes Tony Run? Schemas as Motives Reconsidered," in R. D'Andrade & C. Strauss (eds.), *Human Motives and Cultural Models* (Cambridge, UK: Cambridge University Press): 197–224.

Background Reading (not required):

1. Fodor, Jerry (1981), "Propositional Attitudes," in J. Fodor, *Representations: Philosophical Essays on the Foundation of Cognitive Science* (Cambridge, MA: MIT Press): 177–203.
2. Johnson-Laird, Phillip N. (1983), *Mental Models: Towards a Cognitive Science of Language, Inference, and Consciousness* (Cambridge, MA: Harvard University Press), Chs. 2–5, pp. 23–125.

3. Lakoff, George, & Kovecses, Zoltan (1987), "The Cognitive Model of Anger Inherent in American English," in D. Holland & N. Quinn (eds.), *Cultural Models in Language and Thought* (Cambridge, UK: Cambridge University Press): 195–221.
4. Quinn, Naomi, & Strauss, Claudia (1993), "A Cognitive Framework for a Unified Theory of Culture," unpublished manuscript.
5. Holland, Dorothy, & Quinn, Naomie (eds.) (1987), *Cultural Models in Language and Thought* (Cambridge, UK: Cambridge University Press).
6. D'Andrade, Roy, & Strauss, Claudia (eds.) (1992), *Human Motives and Cultural Models* (Cambridge, UK: Cambridge University Press).

.05: CONNECTIONISM.

Instructors: David Rumelhart, Paul Smolensky

Time: TTh 11:05 A.M.–1:35 P.M.

Prerequisites: This course assumes no prior background in connectionism (or linguistics).

Description:

A description of the first half of the course will be provided in the opening session on Thursday, July 7.

The second half of the course will focus on higher-level cognition. From many corners of cognitive science—AI, philosophy of mind, linguistics—there has been strong doubt that connectionism can handle the demands of higher cognition. Progress over the past 5 years, it will be argued, makes it possible for connectionism to inform the theory of higher cognition, even in one of the bastions of the symbolic paradigm: the theory of universal grammar.

Topics will include: the relation of connectionism to symbolic models/theories of higher cognition; realizing elements of symbolic processing in connectionist networks; higher-level principles of connectionist computation; connectionism and grammar, including an introduction to the grammatical formalism of Optimality Theory and its relation to connectionism.

.06: EPISTEMOLOGY.

Instructor: Peter H. Hare

Time: MWF 9:00–10:40 A.M.

Description:

An introduction to the basic issues of contemporary epistemology. Although some prior work in philosophy and logic would be helpful, the subject matter of the course should be accessible to anyone with background in one of the cognitive science fields. Topics:

1. The problem of defining knowledge.
2. The foundationalist theory of epistemic justification and its competitors.
3. The problem of whether there is knowledge independent of experience.
4. Competing theories of the nature of truth.
5. Skepticism: The varied claims that knowledge is not obtainable.
6. Nonstandard approaches: Naturalized epistemology, evolutionary epistemology, social epistemology, etc.

Readings are from a broad range of Anglo-American philosophers. Some authors are from early in the century (Russell, Moore, Dewey), but most are active today (Alston, Chisholm, Lehrer, Nozick, Goldman, Quine, Bonjour, Stich, and others).

Assignments:

Study questions will be distributed in conjunction with the readings. An exam will be given in the last class.

Readings:

Goodman, Michael F., & Snyder, Robert A. (eds.) (1993), *Contemporary Readings in Epistemology* (Englewood Cliffs, NJ: Prentice-Hall).

.07: FOUNDATIONS OF COGNITIVE SCIENCE.

Instructor: Barry Smith

Time: MWF 3:00–4:40 P.M.

Intended Audience:

The course will have a strongly philosophical bent, but no training in philosophy is presupposed.

Description:

The methodologies embraced by practitioners in the cognitive science field might be divided, provisionally, into the following four groups:

1. computational approaches (relating especially to information-processing models in psychology, to work in automated natural-language processing, automated planning, etc.);
2. implementational/infrastructural approaches (relating especially to research on the neurological underpinnings of cognitive phenomena);
3. holistic-interactive approaches (cross-disciplinary studies of, e.g., the effects of social and institutional context on cognition);
4. conceptual-qualitative approaches (research in linguistics, perceptual psychology, and related domains on the modes of conceptualization and categorization effected by different cognitive systems).

Computational approaches enjoy, it is true, a position of dominance within most cognitive science research communities. Yet there are many cognitive science fields in which issues of computationalism are not such as to impinge directly upon experimental work. Thus, in areas such as cognitive anthropology or cognitive geography, as also in developmental and clinical areas, computationalism plays at best a peripheral role.

One striking difference between the four approaches is the degree to which they have been the explicit object of philosophical or methodological concern in the different cognitive science communities. Broadly speaking, we can say that it has been almost exclusively the computational and implementational methodologies that have received serious philosophical attention, especially in the Anglosaxophone world. The interactive and conceptual-qualitative methodologies, in contrast, have been widely neglected, though some European philosophers have begun to subject these approaches to serious treatment.

This course is designed to provide, against this background, an overview of foundational issues in contemporary cognitive science.

Assignments:

Students who wish to take the course for credit will be required to prepare a short discussion note on one or another of the topics discussed in class.

Readings:

1. Required Reading:
   Boden, M. (ed.) *The Philosophy of Artificial Intelligence*, Oxford: Oxford University Press, 1990.
2. Background Reading:
   (a) Dreyfus, H. L.; & Hall, H. (eds.) *Husserl, Intentionality and Cognitive Science*, Cambridge, Mass.: MIT Press, 1982.
   (b) Jackendoff, R., *Consciousness and the Computational Mind*, Cambridge, Mass.: MIT Press, 1987.
   (c) Kanizsa, G., *Organization in Vision: Essays on Gestalt Perception*, New York: Praeger, 1979.
   (d) Macnamara, J., *A Border Dispute: The Place of Logic in Psychology*, Cambridge, Mass.: MIT Press, 1986.
   (e) Searle, J. R., *The Rediscovery of the Mind*, Cambridge, Mass.: MIT Press, 1992.

.08: GEOGRAPHIC ORGANIZATION OF SPACE.

Instructors: David M. Mark, Scott M. Freundschuh

Time: MWF 1:15–2:55 P.M.

Description:

This course will provide an overview of topics in spatial cognition and perception, with emphasis on geographic (large-scale, transperceptual) space and its distinctions from manipulable space. Topics will include map perception, wayfinding and navigation, behavioral geography, and environmental 'perception'. We will also examine how human natural languages represent and express spatial concepts. Implications for applications such as vehicle navigation systems, and both database contents and user interfaces for geographic information systems will also be examined. Topics discussed will include most of the following: what is "geography"?; geographic information systems and the ontology of space; the role of formal models; experiential realism and metaphor; Talmy's "How Language Structures Space"; the Whorf hypothesis; "mental maps"; behavioral geography; environmental "perception"; navigation and wayfinding; typologies of spatial knowledge; scale: kinds of spaces; spatial knowledge acquisition; spatial categories: entity types and feature codes; formalizing spatial relations; human-computer interaction for GIS; and cultural difference in concepts of geographic space.

.09: INFERENCE IN DISCOURSE.

Instructor: David A. Zubin

Time: MWF 1:15–2:55 P.M.

Description:

This course will explore the extent to which five different models of discourse structure and process give different views of the role of pragmatic inference in the production and comprehension processes. The models are:

Linear Connection Model
Social Accommodation Model
Compositional Model
Constructional Model
Information Management Model

A specific text-based project on inference in the constructional model will be carried out by class members as a group.

.10: INTRODUCTION TO THE ANTHROPOLOGICAL STUDY OF COGNITION.

Instructor: Donald Pollock

Time: TTh 11:05 A.M.–1:35 P.M.

Prerequisites: No prior coursework in anthropology or cognitive science is required.

Intended Audience:

The purpose of this course is to equip students with the background necessary to pursue more advanced work in cognitive anthropology, and to assess other work in cognitive science from a basic anthropological perspective.

Description:

This course provides an overview of anthropological approaches to the study of cognition and its relationship(s) to culture.

Anthropological interest in cognition goes back to the origins of the discipline in the 19th century, when differences between cultures were attributed to differences in modes of thought. While the evaluative quality of this early research has long been abandoned (we no longer speak of deficient "primitive" mentalities), the fact of mutual influences between cognition and culture continues to shape the field.

This course will survey modern anthropological studies of cognition that have emerged since the early 1960s. These include the field of ethnosemantics, the systems of meaning through which members of any culture classify and order their world, and the detailed study of the implicit rules that guide behavior in a variety of social contexts. We will consider models of cognition, including schemas, maps, and styles, and cross-cultural issues in the development and acquisition of cognition. In particular, we will examine the possibility of both universal and culturally specific features of cognition, and their implications for anthropology and for cognitive science more generally.

Finally, we will consider how the cross-cultural and comparative focus of anthropology may illuminate studies of cognition produced within other disciplines.

Readings:

1. Berlin, Brent, & Kay, Paul (1969), *Basic Color Terms: Their Universality and Evolution* (Berkeley: University of California Press, 1992).
2. Lave, Jean (1988), *Cognition in Practice* (Cambridge, UK: Cambridge University Press).
3. Dougherty, Janet W. D. (ed.) (1985), *Directions in Cognitive Anthropology* (Urbana: University of Illinois Press).

.11: INTRODUCTION TO ARTIFICIAL INTELLIGENCE.

Coordinator: William J. Rapaport

Participating Faculty: Graeme Hirst, João Martins, Stuart C. Shapiro, Paul Smolensky

Time: TTh 8:30–11:00 A.M.

Prerequisites: None.

Intended Audience: Cognitive scientists who have never taken a course in AI.

Description:

This course will introduce AI and computational methodology to cognitive scientists. We will focus on those aspects of AI that are of central interest to cognitive science (i.e., those that may be classified as "computational psychology" and "computational philosophy", rather than more engineering-oriented or applied techniqes). Topics will include: the nature of AI, knowledge representation and reasoning, natural-language understanding, and—depending on time and student interests—planning, learning, connectionism, and/or perception. Students will also have an opportunity to learn Lisp programming.

Guest lectures:

July 12: João Martins: Knowledge representation.

July 14: Stuart C. Shapiro: Reasoning.

July 19: Paul Smolensky: Connectionism.

July 21: Graeme Hirst: Natural-language understanding.

Assignments:

Grading will be on an S/U basis as a function of attendance and participation in class discussions.

Readings:

1. Required:

   Rich, Elaine, & Knight, Kevin (1991), *Artificial Intelligence*, 2nd edition (New York: McGraw-Hill).

2. Recommended:

   Shapiro, Stuart C. (1992), *Common Lisp: An Interactive Approach* (New York: Computer Science Press/W. H. Freeman).

.12: INTRODUCTION TO COGNITIVE NEUROSCIENCE.

Coordinator: Jeri J. Jaeger

Participating Faculty:

Christopher Cohan, David Shucard, Nina Dronkers, Alan H. Lockwood, Nicholas Leibovic, Sharilyn Redeiss, Eran Zaidel

Time: MWF 10:45 A.M.–12:25 P.M.

Prerequisites:

Intended Audience:

Description:

Wednesday, July 6	**Jeri Jaeger**: Introduction to the issues.
Friday, July 8	**Christopher Cohan**: Functional neuroanatomy for cognitive science.
Monday, July 11	**David Shucard**: Electrophysiological studies of developmental neurocognition.
Wednesday, July 13	**Nina Dronkers**: Localization studies of aphasia.
Friday, July 15	**Alan Lockwood**: PET studies of cognition
Monday, July 18	**Nicholas Leibovic**: Vision and cognition.
Wednesday, July 20	**Eran Zaidel**: Split brain research.
Friday, July 22	**Sharilyn Redeiss**: Aging and cognition.

Assignments: Grading will be S/U, assigned on the basis of attendance.

Readings: Short readings for most lectures will be on reserve.

.13: INTRODUCTION TO COGNITIVE PSYCHOLOGY.

Coordinator: Erwin M. Segal

Participating Faculty: LouAnn Gerken, Paul A. Luce, James Sawusch, J. David Smith

Time: TTh 2:15–4:45 P.M.

Prerequisites: None.

Description:

Cognitive psychology is one of the major divisions of cognitive science. It is primarily concerned with how people perceive, interpret, comprehend, and remember, and under what conditions they do it. We focus primarily on the structures and processes of mind that sustain this cognition. We are also interested in the developmental processes that lead to the cognitive capabilities found among older members of the community.

This course will cover some of the fundamental concepts and methods in cognitive psychology and will sample some major topic areas. We will examine the concept of information and information processing systems that is presumed by most researchers in cognitive psychology, and we will look at how such a system is implemented in the major conceptual systems of perception, memory, and language. These three systems underlie the acquisition, storage, transformation, and communication of information. We will also examine metacognition, the process of reflecting on our own cognition. Metacognitive studies help us understand cognitive processes and how they differ from behaviors that do not require cognition.

The instructors will each be responsible for one 2.5 hour class session:

July 7: Erwin M. Segal:
Information and information processing: An overview of cognitive systems and how they may be understood.

July 12: Paul A. Luce:
Perception: Extracting information from the physical (or perceptual) world around us.

July 14: James R. Sawusch:
Memory: Examining the levels and types of representation, and some of the constraints to memory.

July 19: LouAnnGerken:
Psycholinguistics: Examining psychological evidence for linguistic levels of representation in language comprehension, production, and acquisition.

July 21: J. David Smith:
Metacognition: Studies and analyses of how we use self-reflection in cognitive tasks.

Assignments:

Students who take this course for credit will be asked to turn in a paper consisting of one or more paragraphs identifying important take-home lesson(s) from each of the classes. If this cannot be done, the paragraph should explain why.

Readings:

Reading for the course is optional, since it takes place in an incredibly dense academic atmosphere. There will, however, be an article or two on reserve in Lockwood Library associated with the topic of each session. There are several good texts in cognitive psychology. John R. Anderson's *Cognitive Psychology and its Implications*, Third Edition, will be available in the University bookstore. Reading it will help the student grasp some of the issues under discussion.

.14: INTRODUCTION TO LINGUISTICS IN COGNITIVE SCIENCE.

Coordinator: Matthew Dryer

Participating Faculty: Jeri Jaeger, Madeleine Mathiot, Karin Michelson

Time: MWF 9:00–10:40 A.M.

Description:

An introduction to the core areas of linguistics, with a focus on issues of relevance to cognitive science: phonetics (the study of the physical and physiological nature of linguistic sounds), phonology (the study of sounds as part of speakers' knowledge of language), morphology (the study of the structure of words), syntax (the study of the structure of sentences), semantics (the study of meaning), pragmatics (the study of language use), and first language acquisition.

Lecture Schedule:

July 6	Introduction	Chap. 1	**Matthew Dryer**
July 8	Phonetics & Phonology	Chaps. 2 & 3	**Jeri Jaeger**
July 11	Morphology	Chap. 5	**Karin Michelson**
July 13–15	Syntax	Chap. 4	**Matthew Dryer**
July 18	Semantics	Chap. 6	**Madeleine Mathiot**
July 20	Discourse–Pragmatics	Chap. 6	**Matthew Dryer**
July 22	First Language Acquisition	Chap. 10	**Jeri Jaeger**

Readings: O'Grady, W.; Dobrovolsky, M.; & Aronoff, M., *Contemporary Linguistics: An Introduction*

.15: INTRODUCTION TO PHILOSOPHY FOR COGNITIVE SCIENCE.

Coordinator: William J. Rapaport

Participating Faculty: John Corcoran, John Kearns, Mariam Thalos

Time: MWF 1:15–2:55 P.M.

Prerequisites: None.

Intended Audience: Cognitive scientists who have never taken a course in philosophy.

Description:

This course will introduce philosophy and the methodology of analytic philosophy to non-philosopher cognitive scientists. After a brief introduction to the history and nature of philosophy (understood as the search for truth, by rational methods, in any discipline), we will focus on developments in philosophy of language and philosophy of mind that constitute some of philosophy's main contributions to cognitive science. Topics will include: philosophical analyses of language and semantics, intentionality, the mind–body problem, functionalism, the Turing test, and the Chinese Room Argument.

Guest lectures:

July 13: John Corcoran: Logical methodology.

July 15: Mariam Thalos: Philosophy of science.

July 18: John Kearns: Speech acts.

Assignments:

Grading will be on an S/U basis as a function of attendance and participation in class discussions.

Readings:

1. Required:

   Bechtel, William (1988), *Philosophy of Mind: An Overview for Cognitive Science* (Hillsdale, NJ: Lawrence Erlbaum).

2. Recommended:

   (a) Garfield, Jay L., & Kiteley, Murray (eds.), (1991), *Meaning and Truth: Essential Readings in Modern Semantics* (New York: Paragon House).

   (b) Rosenthal, David M. (ed.) (1991), *The Nature of Mind* (New York: Oxford University Press).

.16: KNOWLEDGE OF LANGUAGE: SEMANTICS.

Instructor: David P. Wilkins

Time: MWF 10:45 A.M.–12:25 P.M.

Prerequisites: None.

Description:

At various times, there have been anthropologists, psychologists, semioticians, and linguists who have all proclaimed that the essence of their particular discipline is the search for meaning. If we understand semantics to be the study of meaning, such claims may be taken to represent the fact that semantics is an inherently interdisciplinary subject. Very roughly, it can be said that anthropologists are concerned with the cultural construction of meaning, psychologists are concerned with the mental processes involved in meaning construction, semioticians are concerned with how signs of all types (linguistic and non-linguistic) convey meaning, and linguists are concerned more particularly with how language conveys meaning.

While this course stresses the interdisciplinary nature of semantics, and will discuss the relation between language, thought, culture and reality, its primary focus is linguistic semantics. In linguistic semantics, we are interested in discovering what linguistic elements (e.g., words, phrases, utterances) mean, and we examine the contextual conditions that aid interpretation. Part of this task involves identifying procedures for uncovering components of meaning, and for testing such components. This task also involves the issues of how to represent meanings and how best to link the interests of semantics with other areas inside and outside of linguistics.

The main aims of this course are:

1. To familiarize students with the basic concepts of Semantics.
2. To introduce students to various theoretical approaches to analyzing and describing natural language meaning. This includes a comparison of cognitivist, structuralist, and model-theoretic views, as well as discussing the use of prototype theory, semantic primitives, and frames.
3. To investigate the position of semantics in the description of a language *vis à vis* syntax, pragmatics and semiotics. In particular, comparison will be made between semantic analyses of English and those of less familar languages (e.g., Arrernte, a language of Australia).

Assignments:

Students who wish to take the course for credit will need to participate in in-class discussion and will be asked to prepare a short discussion note (approximately 5 pages) related to one of the issues raised in the course. A simple grading of "Satisfactory/Unsatisfactory" will be given.

Readings:

1. Lyons, John (1981), *Language, Meaning and Context* (London: Fontana).
2. Eco, Umberto; Santambrogio, Marco; & Violi, Patrizia (eds.) (1988), *Meaning and Mental Representations* (Bloomington: Indiana University Press).

.17: KNOWLEDGE OF LANGUAGE: SYNTAX.

Instructor: Robert Van Valin

Time: MWF 3:00–4:40 P.M.

Prerequisites: This course presupposes only a basic introduction to syntax.

Description:

One of the central issues in Cognitive Science is what kind of knowledge speakers possess of their native language. A crucial component of the answer is given by theories of syntax, which seek to characterize the psychologically-real grammar speakers use. This course will present the essential features of Role and Reference Grammar (RRG), a functionalist and cognitivist approach to syntax. The majority of the course will focus on specific features of RRG, especially the syntax–semantics and syntax–pragmatics interfaces, and comparisons will be drawn to other theories such as Chomsky's Principles-and-Parameters approach. The final section in the course will briefly look at the implications of RRG for language acquisition and processing.

Assignments:

Those taking it for credit will be expected to write one 5-page paper on a topic to be arranged in consultation with the instructor.

Readings:

Van Valin, Robert (ed.) (1993), *Advances in Role and Reference Grammar* (Amsterdam/Philadelphia: John Benjmains).

.18: KNOWLEDGE REPRESENTATION.

Instructor: João P. Martins

Time: MWF 3:00–4:40 P.M.

Description:

Knowledge representation is one of the core areas of artificial intelligence. The work in knowledge representation can be looked at under different perspectives:

1. The development of knowledge representation formalisms.
2. The study of the principles underlying knowledge representation.
3. The study of how to share knowledge among different formalisms.

This course is designed to give a perspective on these aspects. In particular, we will look into different formalisms for representing knowledge: semantic networks (SNePS), frames (KEE), and hybrid systems (KRYPTON); we will look into some of the underlying theories for knowledge representation; and we will discuss some of the efforts that have been made in order to allow sharing information among knowledge representation systems.

Readings:

1. Required reading:
   (a) Brachman, Ronald J., & Levesque, Hector J. (eds.) (1985), *Readings in Knowledge Representation* (Los Altos, CA: Morgan Kaufmann).
   (b) Reichgelt, H. (1991), *Knowledge Representation: An AI Perspective* (Norwood, NJ: Ablex).
   (c) Sowa, John F. (1991) (ed.), *Principles of Semantic Networks: Explorations in the Representation of Knowledge* (San Mateo, CA: Morgan Kaufmann).
2. Background reading:
   (a) Bobrow, D., & Collins, A. (eds.) (1975), *Representation and Understanding: Studies in Cognitive Science* (New York: Academic Press).
   (b) Cercone, N., & McCalla, G. (eds.) (1987), *The Knowledge Frontier: Essays in the Representation of Knowledge* (New York: Springer-Verlag).
   (c) Davis E. (1990), *Representations of Commonsense Knowledge* (San Mateo, CA: Morgan Kaufmann).
   (d) Findler, N. (ed.) (1979), *Associative Networks: Representation and Use of Knowledge by Computers* (New York: Academic Press).
   (e) Ringland, G. A. & Duce, D. A. (1988), *Approaches to Knowledge Representation: An Introduction* (Letchworth, UK: Research Studies Press).

.19: LANGUAGE AND CONCEPTUAL STRUCTURE.

Instructor: Leonard Talmy

Time: TTh 2:15–4:45 P.M.

Description:
Using the framework of cognitive linguistics, this course will analyze the nature of conceptual structure in language and compare it to the structure found in other cognitive systems. The analysis starts with the observation of a fundamental design feature of language: It has two subsystems, the open-class (lexical) and the closed-class (grammatical). These subsystems can be seen to perform complementary functions involving content as against structure. In any sentence, the open-class forms together contribute most of the *content* of the total meaning expressed, while the closed-class forms together determine the majority of its *structure*. It can be further observed that, across the spectrum of languages, all closed-class forms are under great semantic constraint: They specify only certain concepts and categories of concepts, but not others. Accordingly, taken together from across all languages, these closed-class specifications appear to constitute the fundamental conceptual structuring system of language.

This course will explore the particular concepts and categories of concepts that closed-class forms can specify, the properties that such closed-class specifications have in common and that distinguish them from open-class specifications, and the structuring function served by the fact that language is organized in this way. Further, it will compare and contrast this conceptual structuring system of language with that found in other cognitive systems, such as visual perception, reasoning, memory, planning, kinesthesia, affect, and cultural knowledge. The greater issue, toward which this investigation ultimately aims, is the general character of conceptual structure in human cognition.

Readings: All readings will be on reserve at Lockwood Library.

.20: HEMISPHERIC MECHANISMS OF LANGUAGE AND COGNITION.

Instructors: Nina Dronkers, Eran Zaidel

Time: TTh 8:30–11:00 A.M.

Prerequisites: Some background in basic neuroanatomy and in psychological statistics might be useful, but is not required.

Description: This course will consider the neural mechanisms of language and cognition. This will be done from two perspectives. First, Nina Dronkers will discuss the contributions of the left and right cerebral hemispheres to these processes as determined by studies of language and cognitive disorders. These lectures will be augmented with video tapes of patients displaying these particular deficits. Next, Eran Zaidel will review language and cognitive functioning in commissurotomy patients and will discuss interhemispheric relations in split and normal brains.

Schedule and Readings:

Thursday, July 7: Aphasia and other Language Disorders (Dronkers)

- Goodglass, H. (1993). *Understanding Aphasia,* Chapter 12: "Classifications of Aphasia," pages 209–229. San Diego: Academic Press.

Tuesday, July 12: Related Disorders of Cognition (Dronkers)

- Kaplan, E. & Goodglass, H. "Aphasia-related disorders." In M.T. Sarno (Ed.) *Acquired Aphasia,* second edition, pages 313–338. New York: Academic Press.

Thursday, July 14: Neural Mechanisms of Language and Related Disorders (Dronkers); Disconnection Syndrome (Zaidel)

1. Dronkers, N. F., Shapiro, J. K., Redfern, B., & Knight, R. T. (submitted). *The third frontal convolution and aphasia: On beyond Broca.*
2. Zaidel, E., Zaidel, D.W. & Bogen, J.E. (1990). "Testing the commissurotomy patient." In A.A. Boulton, G.B. Baker & M. Hiscock (Eds.), *Neuromethods: Methods in Human Neuropsychology,* Vol. 15. pages 147–201. Clifton, N.J.: Human Press.
3. Zaidel, E. (in press). "Interhemispheric transfer in the split brain: Long term status following complete cerebral commissurotomy." In R.H. Davidson & K. Hugdahl (Eds.), *Human Laterality.* Cambridge: MIT Press.

Tuesday, July 19: Interhemispheric Relations in the Normal Brain (Zaidel)

1. Zaidel, E., Clarke, J. & Suyenobu, B. (1990). "Hemispheric independence: A paradigm case for cognitive neuroscience." In A.B. Scheibel & A.F. Wechsler (Eds.), *Neurobiology of Higher Cognitive Function,* pages 297–355. New York: Guilford Press.
2. Abiotiz, F., Scheibel, A.B., Fidher, R.S. & Zaidel, E. (1992). "Individual differences in brain asymmetries and fiber composition in the human corpus callosum." *Brain Research* 598, pages 154–161.
3. Clarke, J.A. & Zaidel, E. (in press). "Anatomical-behavioral relationships: Corpus callosum morphometry and hemispheric specialization." *Behavioral Brain Research.*

Thursday, July 21: Hemispheric Reinterpretation of Clinical Syndromes (Zaidel)

1. Schweiger, A., Zaidel, E., Field, T. & Dobkin, B. (1989). "Right hemisphere contribution to lexical access in an aphasic with deep dyslexia." *Brain and Language,* 37, pages 73–89.
2. Robertson, L.C., Lamb, M.R. & Zaidel, E. (1993). "Interhemispheric relations in processing hierarchical patterns: Evidence from normal and commissurotomized subjects." *Neuropsychology* 7, pages 325–342.

.21: LANGUAGE DISORDERS IN CHILDREN.

Instructor: Judith Felson Duchan, Lynne E. Hewitt

Time: MWF 10:45 A.M.–12:25 P.M.

Prerequisites: This course requires a basic background in cognitive science.

Intended Audience:
It is, however, intended to be accessible to those unacquainted with language development or language disorders.

Description:
There is a tradition in linguistics and psychology in which theories of language and cognition are both generated from and tested against various types of data derived from populations with disorders of communication. Jakobson, for example, used examples from individuals with aphasia to support his linguistic theorizing. Generative linguists have adduced examples of intact and deficient syntax in children with language disorders as evidence for modularity theory. This course will provide an overview of the state of the art in language disorders in children, showing its relevance for proposing and testing theories of language and cognition.

Topics:

1. Introduction to disabilities—a competence vs. deficit view along with a historical account of how views have changed with theorizing in linguistics and psychology.
2. Specific language impairment—implications for models of language and language acquisition.
3. Autism and the theory of mind—impact of cognitive difficulties on particular language structures.
4. Clinical approaches to nonspeaking children with autism—recent research and issues being raised by facilitated communication.
5. Approaches to assessing children with language disorders.
6. Language intervention—approaches to the remediation of language disorders and its ties to linguistic and cognitive theorizing.
7. Pragmatics—where the decontextualized presentation of language fails.

Readings:
All readings will be on reserve at Lockwood Library and will be discussed in the lectures, but are not required for understanding the course content.

1. Baron-Cohen, L.; Leslie, A.; & Frith, U. (1985), "Does the Autistic Child Have a 'Theory of Mind'?" *Cognition* 21: 37–46.
2. Dromi, E.; Leonard, L.; & Shteiman, M. (1993), "The Grammatical Morphology of Hebrew-Speaking Children with Specific Language Impairment: Some Competing Hypotheses," *Journal of Speech and Hearing Research* 36: 760–771.
3. Duchan, J. (1993), "Issues Raised by Facilitated Communication for Theorizing and Research on Autism," *Journal of Speech and Hearing Research* 36: 1108–1119.
4. Duchan, J.; Hewitt, L.; & Sonnenmeier, R. (eds.), (1994), *Pragmatics: From Theory to Practice* (Englewood Cliffs, NJ: Prentice Hall).
5. Lund, N., & Duchan, J. (1993), *Assessing Children's Language in Naturalistic Contexts* (Englewood Cliffs, NJ: Prentice Hall).
6. McGregor, K., & Leonard, L. (1994), "Subject Pronoun and Article Omissions in the Speech of Children with Specific Language Impairment: A Phonological Interpretation," *Journal of Speech and Hearing Research* 37: 171–181.
7. Rice, M., & Oetting, J. (1993), "Morphological Deficits of Children with SLI: Evaluation of Number Marking and Agreement," *Journal of Speech and Hearing Research* 36: 1249–1257.
8. Tager Flusburg, H. (1994), *Constraints on Language Acquisition: Studies of Atypical Children* (Hillsdale, NJ: Lawrence Erlbaum).

.22: FIRST LANGUAGE ACQUISITION.

Instructor: Eve V. Clark

Time: TTh 2:15–4:45 P.M.

Description:
One major element in acquiring a first language is acquisition of the lexicon. Children rely on words in interpreting the meanings conveyed by others and in conveying their own meanings. They use words as they build up phrases and clauses, and construct more complicated utterances. The words children learn affect their learning of inflections, and they play an important role in the acquisition of syntax. Children are selective in which words they combine and how they combine them as they construct longer, more complex utterances. They also treat words as building blocks when they extend their lexicon by coining new words, whether through compounding or derivation. In short, the lexicon provides a meeting place for phonology, morphology, and syntax during the course of acquisition.

This course is designed to provide an overview of early language acquisition, from first words to early word combinations, to more complex clauses and clause combinations. The emphasis will be on the lexicon, on the acquisition of meaning, on processing in comprehension versus production, and on the role of pragmatic principles in language acquisition.

Assignments:
Students taking this course for credit will be expected to write a short paper on some aspect of acquisition.

Readings: There will be a package of articles on reserve at Lockwood Library.

1. Bloom, P. (ed.) (1993), *Language Acquisition: Core Readings* (New York/London: Harvester Wheatsheaf).
2. Clark, E. V. (1993), *The Lexicon in Acquisition* (Cambridge, UK: Cambridge University Press).
3. Clark, H. H., & Clark, E. V. (1977), *Psychology and Language* (New York: Harcourt Brace Jovanovich).
4. Pinker, S. (1989), *Learnability and Cognition* (Cambridge, MA: MIT Press).

.23: LOGIC.

Instructor: John Kearns

Time: TTh 2:15–4:45 P.M.

Prerequisites:

This is not a first course in logic. The prerequisite is a one-semester introductory course in symbolic logic.

Description:

This course will explore the relevance of formal logic and logical research to actual (real-life) deductions and arguments. A full-blown logic or logical system consists of (1) an artificial language, (2) a rigid assignment of truth conditions to sentences of the artificial language, and (3) a deductive system for establishing results that are either sentences or arguments of the artificial language. The language of the logical system isn't used for thinking or for saying things, either to oneself or to others. Sentences of the artificial language are neither used nor intended for use in reasoning or solving problems (by analogy to our use of numerals and arithmetic symbols in carrying out calculations). An artificial language with its truth conditions and deductive system provides an, at best, simplified representation of statements and arguments that people actually make.

There will be a comparison of conventional (classical) and "alternative" systems of logic, to consider the extent to which the various systems capture our actual practice, especially with respect both to arguments intended to provide complete support to their conclusions and to cogent deductions which extract the consequences of hypotheses.

The alternative systems to be considered include many-valued logics, logics with truth-value gaps, relevance logic, intuitionist logic, modal logic, and illocutionary logic. The different logics will be characterized deductively and semantically (in terms of truth conditions) and related to one another. Applications of the various logics in philosophy, linguistics, and artificial intelligence (knowledge representation) will be considered.

Readings:

There is no text. A number of materials will be placed on reserve at Lockwood Library. Xeroxed handouts will be provided; a fee will be charged for these. A partial list of references follows:

1. Epstein, Richard L. (1990), *The Semantic Foundations of Logic*, Vol. 1: *Propositional Logics* (Dordrecht: Kluwer).
2. Kearns, John T. (1978), "Intuitionist Logic, a Logic of Justification," *Studia Logica* 37: 243–260.
3. Kearns, John T. (1979), "The Strong Completeness of a System for Kleene's Three-Valued Logic," *Zentralblatt für mathematische Logik und Grundlagen der Mathematik* 25: 61–68.
4. Kearns, John T. (1981), "A More Satisfactory Description of the Semantics of Justification," *Notre Dame Journal of Formal Logic* 22: 109–119.
5. Kearns, John T. (1981), "Modal Semantics without Possible Worlds," *The Journal of Symbolic Logic* 46: 77–86.
6. Kearns, John T. (1989), "Lesniewski's Strategy and Modal Logic," *Notre Dame Journal of Formal Logic* 30: 291–307.
7. Kripke, Saul A. (1963), "Semantical Analysis of Intuitionistic Logic I," in J. N. Crossley & M. A. E. Dummett (eds.), *Formal Systems and Recursive Functions* (Amsterdam: North-Holland, 1965).
8. Montague, Richard, "English as a Formal Language," in R. Montague, *Formal Philosophy: Selected Papers of Richard Montague*, R. Thomason (ed.) (New Haven: Yale University Press, 1974): 188–221.
9. Searle, John R., & Vanderveken, Daniel (1985), *Foundations of Illocutionary Logic* (Cambridge, Eng: Cambridge University Press).

.24: COMPUTATIONAL LINGUISTICS AND NATURAL-LANGUAGE UNDERSTANDING.

Instructor: Graeme Hirst

Time: MWF 1:15–2:55 P.M.

Prerequisites:

Some experience in computer programming and preferably some experience in linguistics or psycholinguistics or the study of a second language.

Description:

Computational linguistics is the science of processing human languages ("natural languages") by computer. Goals of the field include giving computers the ability to converse with people in their own language, automatic translation between natural languages, and building computational models of human language processes. Computational linguistics is an inherently interdisciplinary science, drawing upon computer science, linguistics, and psycholinguistics.

This course will introduce the basics of the field, and will equip the student to explore further topics and the research literature of the field. Topics to be covered will include the following:

- Background: What is language understanding? Is it possible for a computer to understand?
- Grammars and parsing: Finding the syntactic structure of a sentence; models of human sentence processing.
- Semantics: Computational representations of meaning; the resolution of ambiguity.
- Applications: Machine translation; natural language interfaces.

Readings:

Allen, James (1994), *Natural Language Understanding*, 2nd edition (Benjamin Cummings).

.25: NEUROLOGICAL DEVELOPMENT.

Instructor: David W. Shucard

Time: MWF 1:15–2:55 P.M.

Prerequisites: None.

Intended Audience:

Cognitive scientists and students interested in neurocognitive development with a focus on electrophysiology and cognition.

Description:

The course will be centered around the work that our laboratory has been doing in examining the relationship between electrophysiology and cognitive development in infants and children. A basic description of the electrophysiology of cognition will be presented, and theoretical issues such as the development of cerebral specialization, sex differences in cognitive devlopment, etc., will be discussed.

Assignments:

Grading will be based on attendance and participation in class discussions. Grades will be S/U.

Readings: Readings will be distributed in class.

1. Broman, S. H., & Grafman, J. (eds.) (1994), *Atypical Cognitive Deficits in Developmental Disorders* (Hillsdale, NJ: Erlbaum), Ch. 1.
2. Kimura, D. (September 1992), "Sex Differences in the Brain," *Scientific American*.
3. Kolb, B., & Whichaw, I. Q. (1990), *Human Neuropsychology*, 3rd edition (New York: W. H. Freeman); selected chapters.
4. Shucard, D. W., & colleagues, selected articles.

.26: NEUROPSYCHOLOGY OF VISION.

Instructor: K. Nicholas Leibovic

Time: TTh 2:15–4:45 P.M.

Prerequisites: None.

Intended Audience:

It is assumed that participants will have a mature background in general science with some mathematics.

Description:

Vision is our primary sensory modality, and the evolution of the brain is grounded in sensorimotor activity. Thus, vision plays an important role in mental processes, from thought to memory.

In this course, we shall consider some psychophysical aspects of vision and the underlying neural machinery. In particular, we shall discuss such topics as the perception of time and space, color vision, and light adaptation. We shall review both psychophysical and neurophysiological findings and how they relate to each other.

In recent years, there has been much activity in computational vision. We shall also look at this, in particular where it draws its inspiration from vision in biological systems, since, in the spirit of cybernetics, there are basic principles that apply to both man-made and natural systems.

Assignments: Students taking this course for credit will write a short paper on a chosen course topic.

.27: PERCEPTION AND PRODUCTION OF SPOKEN LANGUAGE.

Coordinator: Peter W. Jusczyk

Participating Faculty: LouAnn Gerken, Paul A. Luce, James R. Sawusch, J. David Smith

Time: TTh 11:05 A.M.–1:35 P.M.

Prerequisites: Some prior background in psycholinguistics would be useful for the course.

Description:

This class is intended to provide an overview of current research in the area of the perception and production of spoken language. The initial portions of the class will focus on issues related to the way in which fluent speakers of the language deal with information in the speech signal. The remaining lectures will deal with how these capacities develop as children acquire fluency in a native language and the implications that developmental changes in these capacities have for understanding spoken language processes in adults. A description of the topics and readings for each class follows.

July 7: Speech Perception (Sawusch)

This class focuses on two essential aspects of speech perception: (1) the nature of information in the speech signal and the qualities that cue language distinctions and (2) the nature of the perceptual mapping and representation for the sounds of speech (with special focus on the language-based coding of sound that forms the basis for both word and talker recognition).

July 12: Word Recognition (Luce)

This class deals with current issues in spoken word perception, with special emphasis on theories of recognition. Topics include: the nature of the temporal processing window, multiple activation of phonetic and semantic representations, the nature of form-based lexical representations, connectionist accounts of phonotactic effects on priming, exemplar vs. abstractionist theories of lexical representation.

July 14: Unspoken Language (Smith)

This class will focus on subvocalization and inner speech—phenomena that surface in a variety of different speech domains and occupy a prominent role in normal mental life. These processes may occur in the articulatory rehearsal processes of working memory, in the silent speech accompanying reading, in speech and music imagery, and even in the speech-like processes that structure planning, thinking, and behavioral and cognitive self-regulation.

July 19: Development of Spoken Language Capacities (Jusczyk)

This section of the course will examine the basic capacities that infants have for perceiving speech and how these capacities evolve to serve comprehension of utterances in the native language. Special attention will be given to: (1) the way that language-specific categories evolve from general perceptual capacities, (2) the development of word recognition processes, and (3) how information in the speech signal may facilitate language acquisition.

July 21: Developmental Changes in Speech Production (Gerken)

This lecture will focus on processes related to the production of function morphemes, such as articles and verb inflections, in the speech of young language learners. Function morphemes tend to share a set of segmental and suprasegmental properties and thus are thought to form a phonological class. Moreover, function morphemes are either not produced or produced inconsistently by individuals who have difficulties with phonology. The claim that the poor production of function morphemes by various populations is based on phonological processes during speech production will be examined in light of data from normally developing 2-year-olds.

Assignments:

Students who wish to take the course for credit will be required to prepare a short discussion note on one of the topics discussed in class.

Readings:

1. Class 1: Sawusch
   (a) Pisoni, D. B., & Luce, P. A. (1986), "Speech Perception: Research, Theory, and the Principle Issues," in E. C. Schwab & H. C. Nusbaum (eds.), *Pattern Recognition by Humans and Machines*: Vol. 1, *Speech Perception* (New York: Academic Press): 1–49.
   (b) Sawusch, J. R., & Dutton, D. L. (1992), "Computational Metrics for Place of Articulation in Consonants and Vowels," *Speech Research* (Buffalo: SUNY Buffalo Speech Research Laboratory Status Report), Vol. 4: 3–34.
2. Class 2: Luce
   (a) Luce, P. A.; Pisoni, D. B.; & Goldinger, S. D. (1990), "Similarity Neighborhoods of Spoken Words," in G. Altmann (ed.), *Cognitive Models of Speech Perception: Psycholinguistic and Computational Perspectives* (Cambridge, MA: MIT Press).
   (b) Auer, E. T., & Luce, P. A. (1993), "Dynamic Processing in Spoken Word Recognition: The Influence of Paradigmatic and Syntagmatic States," *Technical Report No. 1* (Buffalo: SUNY Buffalo Department of Psychology Language Perception Laboratory).
3. Class 3: Smith
   (a) Baddeley, A. (1986), *Working Memory* (Oxford: Clarendon Press): 75–107.
   (b) Smith, J. D.; Reisberg, D., & Wilson, M. (1992), "Subvocalization and Auditory Imagery: Interactions between the Inner Ear and Inner Voice," in D. Reisberg (ed.), *Auditory Imagery* (Hillsdale, NJ: Erlbaum): 95–119.
   (c) Smith, J. D. (1992), "The Auditory Hallucinations of Schizophrenia," in D. Reisberg (ed.), *Auditory Imagery* (Hillsdale, NJ: Erlbaum): 151–178.
4. Class 4: Jusczyk
   (a) Jusczyk, P. W. (in press), "Developmental Speech Perception," in N. J. Lass (ed.), *Principles of Experimental Phonetics* (St. Louis: Mosby).
   (b) Jusczyk, P. W., & Kemler Nelson, D. G. (in press), "Syntactic Units, Prosody, and Psychological Reality during Infancy," in J. L. Morgan & K. Demuth (eds.), *Signal to Syntax* (Hillsdale, NJ: Erlbaum).
5. Class 5: Gerken
   (a) Gerken, L. A.. (in press). "Young Children's Representation of Prosodic Structure: Evidence from English Speakers' Weak Syllable Omissions," *Journal of Memory and Language*.

.28: PHILOSOPHY OF PERCEPTION.

Instructor: Roberto Casati

Time: MWF 10:45 A.M.–12:25 P.M.

Prerequisites: None.

Description:

Philosophy of perception lies between philosophy of mind (the theory that tries to give a unified philosophical account of psychological phenomena such as desire, feeling, belief, awareness, understanding, and action) and epistemology (the theory of knowledge and justification). Perception is functionally subordinate to action; it prompts action, and controls its output. Thus, its central feature is the generation of beliefs about the world, about states of the perceiving organism, and about the latter's relation to the world. At the same time, perceptual states have a qualitative complexity that does not reduce to this functional role. In some cases—as happens for colors—the properties hinted at by perceptual content do not quite match properties in the environment; accordingly, the mind is here supposed to contribute some representative features independently of the represented world. Where are these features, and representations in general, located? What is their function? And do we perceive the external world directly, or mediately, in virtue of the perception of some representation? What guarantee do we have as to the reliability of our perceptual beliefs? The course, which is self-contained, will chart several answers to these and related problems: the relation between philosophy of perception and psychological theories; the structure of perceptual content; intentionality and the place of qualia and of object-dependent perceptual states in psychological explanation; and the differences between direct realist, representational, disjunctive, and adverbialist theories of perception.

Readings:

1. Text:
   Dancy, Jonathan (ed.) (1988), *Perceptual Knowledge* (Oxford: Oxford University Press).
2. Background reading:
   (a) Biederman, Irving (1993), "Visual Object Recognition," in A. I. Goldman (ed.), *Readings in Philosophy and Cognitive Science* (Cambridge, MA: MIT Press).
   (b) Crane, Tim (ed.) (1992), *The Contents of Experience* (Cambridge, UK: Cambridge University Press).
   (c) Dretske, Fred (1969), *Seeing and Knowing* (Chicago: University of Chicago Press.
   (d) Hardin, C. L. (1993), "Color Subjectivism," in A. I. Goldman (ed.), *Readings in Philosophy and Cognitive Science* (Cambridge, MA: MIT Press).
   (e) Searle, John (1983), *Intentionality* (Cambridge, UK: Cambridge University Press), Chapter II.
   (f) Spelke, E. S. (1993), "Object Perception," in A. I. Goldman (ed.), *Readings in Philosophy and Cognitive Science* (Cambridge, MA: MIT Press).

.29: PRIMATE COGNITION.

Instructor: Michael Tomasello

Time: MWF 9:00–10:40 A.M.

Description:

This course is designed to acquaint cognitive scientists with the basic theoretical approaches and empirical findings of research into nonhuman primate cognition. In the past 15 years, many new facts have been discovered about the cognitive abilities of nonhuman primates, especially monkeys and apes. These new facts have come from detailed field studies, from experimental work with captive animals, and from research with apes who have been raised in human-like cultural environments with exposure to cultural artifacts such as tools and language. Many of the new findings have come as a result of the discovery that most of the intellectual resources of primates are used to deal not with the physical environment, but with the social environment.

The course will focus on three types of primates: (i) monkeys, (ii) apes, and (iii) "enculturated apes". Both naturalistic and experimental work will be reviewed, and cross-species comparisons will be emphasized. In terms of content, the focus will be on two main sets of issues:

1. Issues of Cognitive Representation: including such things as the understanding of objects, the understanding of relations, the formation of conceptual categories, memory, problem-solving, and spatial cognition.
2. Issues of Social Cognition: including such things as communication, symbols and "language", cooperation, deception, coalition formation, social learning, and theory of mind.

Wherever appropriate, the research on nonhuman primate cognition will be compared with research on human cognitive and social-cognitive development and with what is known about the evolution of human cognition.

Readings:

Readings will be original research articles, placed on reserve at Lockwood Library, and will include chapters or articles from many sources, including the following:

1. Cheney, D., & Seyfarth, R. (1992), *How Monkeys See the World* (Chicago: University of Chicago Press).
2. Parker, S., & Gibson, K. (eds.) (1990), *"Language" and Intelligence in Monkeys and Apes* (Cambridge, UK: Cambridge University Press).
3. Byrne, R., & Whiten, A. (eds.) (1988), *Machievellian Intelligence: Social Expertise and the Evolution of Intellect in Monkeys, Apes, and Humans* (Oxford: Oxford University Press).
4. Theoretical articles, many appearing in *Behavioral and Brain Sciences* over the past 15 years, with commentaries by leading theorists in the field, for example: Parker & Gibson (1979); Savage-Rumbaugh (1979); Premack & Woodruff (1979); Premack (1983); Byrne & Whiten (1988); Cheney & Seyfarth (1992); Tomasello, Kruger, & Ratner (1993).

.30: PSYCHOLOGY OF LANGUAGE USE.

Instructor: Herbert H. Clark

Time: TTh 8:30–11:00 A.M.

Description:

Language use is that class of activities in which language plays an essential role. These activities are fundamentally joint activities in which two or more people have to coordinate on their individual actions in order to accomplish their goals. As a result, many features of language use are really features of joint activities more generally. This course is designed to examine this point of view and its consequences. It will begin with a look at language use as a type of joint activity. It will then proceed to account for details of language use, including: the nature of signals; levels of action; utterances, confirmations, and repairs; adjacency pairs and their uses; turn taking; conversational sections; discourse markers; and the layering of one discourse on top of another. In this view, the study of language use is necessarily both a cognitive science and a social science.

Readings:

A specially designed reader of assorted articles consisting of selected chapters from the following sources will be on reserve at Lockwood Library.

1. Atkinson, J. M., & Heritage, J. (1984), *Structures of Social Action: Studies in Conversation Analysis* (Cambridge, UK: Cambridge University Press).
2. Clark, H. H. (1992), *Arenas of Language Use* (Chicago: University of Chicago Press).
3. Cohen, P. R.; Morgan, J.; & Pollack, M. E. (eds.) (1990), *Intentions in Communication* (Cambridge, MA: MIT Press).
4. Levelt, W. J. M. (1989), *Speaking* (Cambridge, MA: MIT Press).

.31: PSYCHOLOGY OF PERCEPTION.

Instructors: Steve Palmer, Michael Tarr

Time: TTh 11:05 A.M.–1:35 P.M.

Description:

This course will cover basic phenomena and theories of vision from an interdisciplinary perspective that includes psychology, computer science, and neuroscience. Topics will include color perception, image processing, depth perception, perceptual organization, perceptual constancies, representation of shape, object recognition, event perception, and imagery.

.32: PSYCHOLOGY OF PROBLEM SOLVING.

Instructor: Erwin M. Segal

Time: MWF 3:00–4:40 P.M.

Prerequisites: None.

Description:

Problem solving is the process by which one tries to achieve a goal when the path to the goal is not immediately obvious. An analysis of what problems are, and what kinds of knowledge, skills, and representations are involved in solving them, helps us understand the nature of mind and of higher mental processes. Insights into how to understand problems and problem solving comes from Gestalt psychology, information-processing models, the theory of computation, logical and conceptual analyses, and empirical psychological studies of problem solving. In this course, we will examine some of these insights, and we will consider the role of mental structure, problem structure, problem content, decision rules, strategies, knowledge, and experience in problem solving. We will discuss the fact that popular approaches to solving problems are often inefficient or unsuccessful. We will attempt to understand why people sometimes come up with wrong answers, and why some people seem to be able to solve problems better than others.

Readings:

Mayer, Richard E. (1992), *Thinking, Problem Solving, Cognition*, 2nd ed. (New York: Freeman).

.33: REASONING AND ARTIFICIAL INTELLIGENCE.

Instructor: Stuart C. Shapiro

Time: MWF 9:00–10:40 A.M.

Prerequisites: An introduction to computational methods. An introduction to symbolic logic.

Intended Audience:

Anyone who wants to appreciate how computers can be made to reason, and who has the appropriate background. Neither an introductory course in artificial intelligence nor an ability to program are necessary, but the student must be able to understand and appreciate formal presentations and sketches of algorithms.

Description:

The study of various techniques for reasoning found to be useful in computer systems that exhibit some aspects of intelligent behavior, and some of the formal underpinnings of these techniques. Among the topics to be covered will be: syntax and semantics of propositional and predicate logic, natural deduction, unification and resolution, nonmonotonic reasoning, belief revision, probabilistic reasoning, situation calculus, the frame problem.

Assignments: Problem sets; experimenting with some programs; S/U grading.

Readings:

1. Ginsberg, Matthew (1993), *Essentials of Artificial Intelligence* (San Mateo, CA: Morgan Kaufmann).
2. Other readings to be handed out.

.34: LANGUAGE AND SPATIAL COGNITION.

Instructor: Annette Herskovits

Time: MWF 3:00–4:40 P.M.

Prerequisites:

The course presupposes some familiarity with linguistics and artificial intelligence, such as could be obtained from courses introducing these topics or a course in cognitive science.

Description:

On the assumption that semantic structures and processes, and their relation to cognition, would be easiest to decipher in the spatial domain, there has been a flowering of work on the semantics of spatial expressions in the various disciplines of cognitive science in recent years. We will consider some of these efforts—particularly in linguistics, psychology, and artificial intelligence—in light of their potential contribution to a psychologically-grounded and computationally-explicit account of the use of spatial expressions.

The course will examine three central problems:

1. *The flexibility of lexical (prepositional) meaning.* A series of fine semantic studies of spatial relation terms (principally English and French prepositions) in the early 1980s revealed the extraordinary flexibility of lexical meaning and the complex, heterogeneous nature of prepositional categories. We will review these studies and compare the various versions of polysemy, prototypicality, and family resemblance they propose to account for the coherence of lexical categories. Our particular concern here will be whether these approaches provide models of the lexical knowledge underpinning language comprehension and production.
2. *Object knowledge.* Another source of semantic flexibility, besides the multiform nature of prepositional meaning, lies with the many possible geometric conceptualizations of objects. We will look at naive physics and Bierwisch's use of a conceptual structure distinct from semantic structure, to see what they tell us about the conceptualizations of objects and their role in comprehension and production.
3. *The interface between language and spatial cognition.* Using the semantic analyses mentioned above, and some studies of spatial terms in non-IndoEuropean languages, we will put together a—necessarily partial—account of the cognitive geometry underlying language. We will then consider work from psychology and computer vision on spatial representations, and discuss
   (a) which representations or aspects of representations might be accessible to the linguistic module;
   (b) whether distinct linguistic subsystems have access to distinct representations, and
   (c) what computations might take place in the language-spatial cognition interface.

Assignments:

Students who wish to take the course for credit will be required to prepare a short discussion note on one or another of the topics discussed in class.

Readings: All readings will be on reserve at Lockwood Library.

1. Required reading:
   (a) Herskovits, A. (1986), *Language and Spatial Cognition: An Interdisciplinary Study of the Prepositions in English* (Cambridge, UK: Cambridge University Press): 39–95, 127–192.
   (b) Herskovits, A. (1994), "'Across' and 'Along': Lexical Organization and the Cognitive Geometry underlying Language," manuscript.
   (c) Landau, B., & Jackendoff, R. (1993), "'What' and 'Where' in Spatial Language and Spatial Cognition," *Behavioral and Brain Sciences* 16: 217–265.
   (d) Levinson, S. C. (1992), "Vision, Shape, and Linguistic Description: Tzeltzal Body-Part Terminology and Object Description," *Working Paper No. 12* (Nijmegen: Max Planck Institute for Psycholinguistics).

(e) Talmy, L. (1983), "How Language Structures Space," in H. Pick & L. Acredolo (eds.), *Spatial Orientation: Theory, Research, and Application* (New York: Plenum Press).

(f) Vandeloise, C. (1991), *Spatial Prepositions: A Case Study from French* (Chicago: University of Chicago Press).

2. Recommended reading:

(a) Bryant, D. J.; Tversky, B.; & Franklin, N. (1992), "Internal and External Spatial Frameworks for Representing Described Scenes," *Journal of Memory and Language* 31: 74–98.

(b) Brugman, C., & Lakoff,G. (1988), "Cognitive Topology and Lexical Networks," in S. I. Small et al. (eds.), *Lexical Ambiguity Resolution* (San Mateo, CA: Morgan Kaufmann): 477–508

(c) Hayes, P. (1985), "The Second Naive Physics Manifesto," in J. R. Hobbs & R. C. Moore (eds.), *Formal Theories of the Commonsense World* (Norwood, NJ: Ablex).

(d) Jackendoff, R. (1987), "On beyond Zebra: The Relation of Linguistic and Visual Information," *Cognition* 26: 89–114.

(e) Langacker, R. W. (1988), "An Overview of Cognitive Grammar," in B. Rudzka-Ostyn (ed.), *Topics in Cognitive Linguistics* (Amsterdam: John Benjamins).

(f) Talmy, L. (1988), "The Relation of Grammar to Cognition," in B. Rudzka-Ostyn (ed.), *Topics in Cognitive Linguistics* (Amsterdam: John Benjamins).

2 PLENARY SPEAKER SERIES

All plenary talks are in **Knox 20** from 5:00–7:00 P.M. and will be followed at 9:00 P.M. by a "fireside chat" with the speaker (locations to be announced).

Wednesday, July 6:
Eleanor Rosch
"Cognitive Science and Human Experience"

The purpose of this talk is to place the evolution of cognitive science within the perspective of other disciplines which purport to study human lived-experience directly—i.e., phenomenology, psychoanalysis, and several meditative traditions. The representational elementalism of cognitivism, with its modular implications for consciousness, bears interesting similarities to Husserl, Freudian analysis, basic element analysis in early Buddhism, and the experiences of beginning mindfulness meditators. Connectionism, with its demonstrations of emergent properties and the society of mind concept, is related to object relations theory in psychoanalysis and to some meditative portraits of habit. A third phase, strongly represented in the experiential fields, is proposed for cognitive science under the name enaction. J. J. Gibson spoke of the active mutual definingness of organism and environment. Taoist meditation and much of Chinese medicine is based on the embeddedness of the dependent nouduality of subject and object. In phenomenology, both Heidegder (for action) and Merleau-Ponty (for perception) challenge the usual assumed subject/object split. The experiential fields go on to even further developments in which experience may be seen in terms of energy, the space in which these occur, and the inherent value of being. Can there be research paradigms in cognitive science which capture these enactive and value sensing modes of experience?

Thursday, July 7:
Susan B. Udin
"The Environment Shapes the Brain: The Influence of Visual Experience on the Formation of Neuronal Connections during Development"

One of the challenges for the developing brain is to establish appropriate connectional patterns that allow integration of input from different parts of the body. For example, the view of the world relayed to the brain from the left eye normally is integrated with the view of the world relayed from the right eye by formation of matching topographic connections from the retina to the tectum. The matching-up process is initially controlled by biochemical cues but is refined or corrected by use of the neuronal firing patterns elicited by visual input. Certain molecules that mediate communication between neurons are critical for this refinement. Evidence showing the role of one such molecule, the NMDA receptor, will be presented. The capacity of the brain to reorganize its connections in response to altered sensory input usually is limited to a critical period of development. We will present data showing that this capacity can be restored in the projection to the tectum by artificial stimulation of the tissue with NMDA.

Friday, 8 July 8:
Leonard Talmy
"Fictive Motion in Language and 'Ception'"

Language exhibits a fundamental and extensive system for organizing conceptual material in accordance with what can be termed the "fictive motion" system. In this system, linguistic forms that basically refer to motion or change are instead applied to referents that analytically are static. Such otherwise static referents thus either exhibit a pre-linguistic conceptualization—or have linguistically imposed on them a reconceptualization—in terms of dynamism. The fictive motion system includes such categories as (the conceptualization

of) radiation and emanation, abstract-pattern motion and observer-relative motion, sensory and communicative paths, demonstrative and orientational paths, and access and advent paths. Some of these categories are readily apparent to speakers as imaginative, while others are compelling illusions. At every point, the categories of fictive motion in language suggest analogs in visual perception; some of the categories seem to extend or emend familiar principles of perception, while some apparently constitute novel principles for Gestalt/perception psychology. To accommodate such analogies, we introduce the concept of a unified and continuous psychological system of "ception". Ception eliminates the seemingly arbitrary boundary between the traditional discrete systems of perception and conception/cognition; it allows the demonstration of parallelisms between perception and linguistic conceptualization; and it accommodates the positing of a number of gradient parameters that extend continuously through the new unified system. On the evidence from linguistic and related considerations, we live in a dynamic—or "dynamized"—conceptual world.

Monday, July 11:
Michael Silverstein
"A 'Minimax' Approach to Verbal Interaction"

"Culture," orientations of value symbolically realized in social action, is immanent in social—including verbal— interaction. It emerges to analytic view in how social actors indexically inhabit positions of interest with respect to one another. We propose a model of verbal discourse that captures the minimum of such "cultural" coherence in interaction by maximizing the mapping of denotational text into interaction text via deixis (indexical denotational) and other grammaticized indexicality, working examples.

Tuesday, July 12:
Dedre Gentner
"Comparison and Cognition: Similarity is like Analogy"

Wednesday, July 13:
John Searle
"Consciousness and Cognition"

Thursday, July 14:
Lila Gleitman
"A Picture Is Worth a Thousand Words, but That's the Problem:
Structural Sources of Vocabulary Acquisition"

Friday, July 15:
Brian Cantwell Smith
"Metaphysics for the 21st Century"

This talk is presented with the cooperation of Xerox PARC and NYNEX.

Monday, July 18:
Eve V. Clark
"Taking Perspectives with Words"

Speakers mark their perspective on an object, an event, an activity, or a relation through the words they choose. The range speakers can draw on include different levels in hierarchical taxonomies (*animal, mammal, dog, spaniel; meal, lunch; ingest, eat, chew*) and orthogonal domains (*teacher, cellist, parent, gardener*). Diversity in the lexicon offers choices to speakers in representing their perspectives to addressees. One consequence is that the same object or the same event may be referred to in a number of ways on different occasions, where each expression reflects a different perspective and hence a different goal on the part of the speaker. There is no simple one-to-one relation between terms used for making reference and

their intended referents. This talk explores some consequences for early lexical acquisition of such input.

Tuesday, July 19:
Thomas G. Bever
"Is the Hippocampus the Chinese Smithy?"

Previous research shows that the hippocampus is necessary for linking representations of the world (e.g., spatial location) together with meaningful events (e.g., food). Some have argued that this shows that the hippocampus has a level of computational power, that is "relational." "Relational" processing stats with undifferentiated "association," but includes symbolic manipulations such as "negation," "metonymy," "reversal," and so on. I will argue on logical and empirical grounds that the hippocampus has "associative" power but nothing beyond that. Logically, the existing results do not show that the hippocampus performs symbolic operations on representations, beyond linking them together. Empirically, our new research shows that spatial representations in rats are different in the left and right cerebral hemisphere. In effect, the rat has two distinct kinds of representations of its environment: the left hemisphere represents the environmental "scene," the right hemisphere represents vectors between reward locations. At the least, these results show that the hippocampus is not itself the seat of spatial information. They suggest further that the hippocampus functions to link distinct kinds of representations, provided to it by the hemispheres. In other words, the hippocampus is like the Chinese Room, in the sense that it is where arbitrary links between representations of different kinds are forged, and handed back to the cortex.

Wednesday, July 20:
Stephen M. Kosslyn
"The Resolution of the Imagery Debate"

Visual mental imagery has long been a very slippery topic. Indeed, at various points in history, there has been debate about whether imagery even exists; one cannot pull an image out of the head and hold it up to the light for inspection. The most recent "imagery debate" hinges on attempts to characterize the internal representations that underlie the experience of imagery. Although many response-time experiments were conducted to characterize the representation underlying visual mental images (such as showing that more time is required to scan greater distances across imaged objects), none of the results proved conclusive. The problem was that it was always possible to mimic a theory that posits a "depictive" representation by a theory that does not. In addition to inconclusive empirical results, the study of imagery became mired because many of the key concepts are vague. What is an image? How can a depictive representation exist in the brain? What "looks" at such a representation? And so on. This talk will present a new perspective on the debate. I will claim that a visual mental image is a pattern of activation in at least some of the topographically mapped areas of visual cortex, and will develop a theory of the processing system that produces, interprets, and transforms such representations. Recent results from PET (positron emission tomography) and fMRI (functional magnetic resonance imaging) will be presented that support these claims.

Thursday, July 21:
David L. Waltz
"Building Truly Intelligent Machines"

What obstacles need to be overcome in order to build really intelligent machines? Which are the most challenging? How soon could these challenges be met? This talk will discuss current trends and long range prospects; it will be argued that the challenges fall into four categories (hardware, models for cognition, software), and applications, and that of these three, the most difficult will probably be software. Machines of sufficient power to be truly intelligent will likely be available within the next thirty years, though the architectures of

such machines may not be well-matched to our understanding of cognitive architectures or brain organization. Parallel computational models are emerging that are realistically brain-like, yet precise enough to express and prove performance bounds for various algorithms, but there may be a mismatch with available hardware. Learning will be critical, and is appropriately attracting the most intense efforts—and yielding the most exciting results—in AI today. But the difficulties of building very large-scale software systems are likely to persist, and will for this sort of fault-tolerant architecture be especially troublesome to debug, since various components will tend to "cover for each other." It is not at all clear whether such systems can be best constructed by programming, by building and then "raising" a system that learns from experience, by supervised training of a learning system, by grafting together independently developed "agents," or by some other means. Other issues to be discussed include: enumerating and representing items—knowledge and abilities—that are innate in humans; technological trends and prospects for architectures appropriate to the models of cognition and learning they must support; and likely applications and societal effects of the systems that we build along the way that must pay for the development of the next, smarter, generation of machines.

This talk is presented with the cooperation of NEC Research Institute.

Friday, July 22:
Janet Dean Fodor
"Language Acquisition: Fewer but Better Triggers"

Chomsky swept away the complications that troubled traditional hypothesis-testing models of language learning, by proposing that learning is nothing but the setting of certain parameters in innate linguistic principles. However, the automatic triggering of parameters has its own dangers. It is susceptible to speech errors in the input and to ambiguity of triggers. Furthermore, a trigger sentence cannot safely set a parameter in one language if it is an idiom or exception (peripheral construction) in some other possible language. Yet core–periphery overlaps of this kind do exist in natural languages. This is a puzzle within a triggering model. I will illustrate with examples that violate Binding Principle B. I will consider several attempts at a solution. The one that I believe in imposes a severe restriction on the class of possible triggers. It overthrows the Subset Principle. And it makes an empirical linguistic prediction about the extent to which core and periphery can overlap in learnable languages.

Monday, July 25:
Jerry Fodor
"Concept Atomism"

Tuesday, July 26:
Gilles Fauconnier
"Cognitive Construction of Meaning"

Wednesday, July 27:
Donald A. Norman
"Applied Cognitive Science"

This talk is presented with the cooperation of Apple Computer, Inc.

Thursday, July 28:
Edwin Hutchins
"Studying Cognition in the Wild"

Friday, July 29:
Ray Jackendoff
"How Language Helps Us Think"

Although it is a widespread platitude that language helps us think, detailing the underlying cognitive mechanisms whereby it does so is not an easy matter. I will argue that language is not the form of thought but that it is one of a number of consciously available modalities in which thought can be made partly manifest. Language, however, is the only such modality in which the abstract and relational aspects of thought can become conscious. Although consciousness of these apects of thought is not in itself efficacious, it permits processes of attention to be applied to linguistic forms; the additional computational power afforded by attention enhances thoughts that can be linguistically expressed.

3 WORKSHOPS.

3.1 Workshop Schedule.

Days:	Dates:	Title and Room:
Saturday–Sunday	July 9–10	1. Topological Foundations of Cognitive Science Park 280
		2. Language and Thought Baldy 684
Friday–Sunday	July 15–17	3. Speech Acts and Linguistic Research Baldy 684
Saturday–Sunday	July 16–17	4. Connectionism and Neuroscience Park 280
Saturday	July 23	5. Intelligence, Attention, and Intention Baldy 684
Saturday–Sunday	July 23–24	6. Cognitive and Ontological Foundations of Knowledge Engineering Park 280
Sunday	July 24	7. Philosophy and Cognitive Science Baldy 653
		8. Language and Space Baldy 684
Monday	July 25	9. Deixis in Narrative
Monday–Tuesday	July 25–26	10. Connectionism
Tuesday	July 26	11. Towards an Embodied and Unified Cognitive Science
Tuesday–Wednesday	July 26–27	12. Ontology of Space
Wednesday	July 27	13. Applied Cognitive Science: Cognitive Science in the Workplace
		14. Role of Metaphor Systems in Embodied Cognitive Science
Thursday	July 28	15. Evolution of Cognition
Thursday–Friday	July 28–29	16. SNePS Knowledge Representation and Reasoning System
Friday	July 29	17. Cognition and Bilingualism

3.2 Workshop Descriptions.

3.2.1 JULY 9–10: WORKSHOP ON TOPOLOGICAL FOUNDATIONS OF COGNITIVE SCIENCE.

Directors: Christopher Habel, Barry Smith

Days and Location: Saturday–Sunday, July 9–10, Park 280

Saturday, July 9:

1. 9:00 A.M.
   Barry Smith
   "Introduction: Topological Foundations of Cognitive Science"

   In a range of cognitive science disciplines (for example in the psychology of perception, in artificial intelligence research, in cognitive geography, and in the semantics of natural languages), topological concepts and theories have in recent years been increasingly exploited. Topology is standardly conceived as a branch of mathematics in which, starting from set-theoretic constructions, abstract spaces of specific sorts are investigated and differentiated. The goal of the present symposium is to provide a foundation for research in cognitive science in which topology is understood more generally, as a theory of a certain family of concepts centered around the notions of 'region', 'connectedness', 'boundary' or 'limit', 'point', 'neighbourhood', 'similarity', 'relevance', and so on. The inventory of topological concepts and the associated differentiations allow a series of quite different qualitative—which is to say non-metrically-describable—phenomena to be grasped in a unified way. The topological approach thus yields a hitherto unanticipated overarching perspective for a range of different types of research within the cognitive science field. Papers will be presented on the foundations of this unified perspective, as also on specific applications in a range of different fields.

2. 10:00–11:00 A.M.
   Almerindo Ojeda
   "Mass Reference and the Geometry of Solids"

   To account for the semantics of mass nouns, models have been proposed that provide atomless mereologies. Atomless mereologies are, however, prodigiously rich and varied. For indeed, if c is an infinite cardinal, then there are exactly 2^{2^c} atomless mereologies of cardinality 2^c no two of which are isomorphic. The purpose of this paper is to claim that natural reference to masses calls for only one of these structures—that of Tarski's mereology of solids. It follows from our proposal that the mass domain contains the masses of all individuals and that no two individuals share their mass, that (i) the mass domain has the power of the continuum, that (ii) the intuitive analyses of space and time can be unified, that (iii) we can account for the fact that natural languages routinely locate all masses in space, that (iv) all mass nouns have the same semantic structure, and that (v) they indeed have the same structure as the entire mass domain. Furthermore, the count domain may only have (vi) denumerably many atoms, (vii) a cardinality with at most the power of the continuum, and (viii) denumerably many possible structures. Finally, if a universe of discourse contains only masses, aggregates of atoms, and the combinations thereof, then a universe of discourse may only have (xi) a cardinality that is either zero or that of the continuum, (x) one of denumerably many possible structures, (xi) each of which is determined by the structure of its count domain.

3. 11:00–11:15 A.M.: Break

4. 11:15 A.M.
Carola Eschenbach
"On Regions, Points, and Boundaries"

Mereology, the formal theory of part-of and related concepts, is a sound and suitable basis for the definition of topological structures. "Mereotopological approaches" interrelate mereological and topological notions. The paper discusses a mereotopological definition of 'point' based on the topologically primitive notion of 'region'. This definition enables us to investigate whether a mereotopological structure allows for something other than points (i.e., for something not overlapping any point), whether points have to be parts of boundaries of regions, etc. As this discussion of points will show, mereotopology is not a mere terminological variant of classical topology but may contribute to the foundations of the theory of space, time, and other domains of interest in cognitive science that exhibit mereological and topological structures.

5. 12:30–2:00 P.M.: Lunch break

6. 2:00 P.M.
Tony Cohn
"Expressing Spatial Vagueness in Terms Of Connection"

We consider the problem of how best to deal with vagueness in topological spatial representation and reasoning, particularly within the framework of the region-based theory ("RCC-theory") axiomatised with a single relation of "connection" (C(x,y), which is reflexive and transitive). Many of the spatial regions we consider in everyday contexts do not have precise boundaries: Consider urban areas, clouds of gas, galaxies, and areas where a particular plant will grow. Such "regions" will be called 'vague' or noncrisp here, in contrast to crisp regions: those with precisely-defined boundaries. RCC-theory as originally devised has no means of representing and reasoning about noncrisp regions. We axiomatise the properties we believe such a theory should have and also discuss a possible "translation" into the original theory.

7. 3:15–3:30 P.M.: Break

8. 3:30 P.M.
Nick Gotts
"Defining a 'Doughnut' Made Difficult"

It is shown how taxonomies of the possible topological properties and relationships of spatial regions can be developed, using the single primitive 'C' as defined in Randell, Cohn, and Cui's work on a modification of Bowman Clarke's "logic of connection". The formula 'C(x,y)' indicates that regions x and y are "connected". Here, regions are taken to be regular open sets of points in some Euclidean space, with C(x,y) interpreted as meaning that the closures of regions x and y share at least one point. A specific task is used as an aid to exploration: deciding whether or not a region has the topology of a "doughnut", or solid torus. A range of "near misses" and doubtful cases is discussed, and ways of distinguishing these from the "target", the solid torus, are considered. It is shown how the task could be performed given certain assumptions about the region in question and regions in general. These assumptions can then be progressively relaxed; as this is done, the task requires the definition of successive layers of terminology, all derived ultimately from 'C', and providing the basis for successively broader taxonomies of topological properties and relationships.

9. 4:45 P.M.
Christopher Habel
"Distance, Succession, and the Structure of Topological Spaces"

In mathematics, there is the well-known trichotomy of discreteness, density, and continuity, standardly characterized by the natural numbers, the rational numbers, and the real numbers. Which of the corresponding structuring principles are relevant in "cognitive topology"? For example: In which way do we experience time; i.e., is the internal, mental representation of external time discrete, dense, or continuous? Examples in natural language are divergent with respect to the question whether to assume time either as a dense—or even continuous—or as a discrete ordered structure. Instead of assuming one dense time structure (or space), it is possible to use "systems of discrete time structures" together with embedding relations between the time structures. By this mechanism, "density in extension" is approximated by "density in intension". This approach—which is committed to the concept of granularity levels—allows the simultaneous existence of more than one distance and succession system on a cognitive domain or dimension such as that of time or space.

Sunday, July 10:

1. 9:30 A.M.
Achille Varzi
"The Mereotopology of Event Structures"

We examine some difficulties that arise when we move from the mereotopological analysis of spatiotemporal regions to the corresponding analysis of their natural occupants: physical bodies and events. When we focus on the latter, we re-encounter in a new light some issues relating to the traditional taxonomy of processes, accomplishments, and achievements. In the final part of our paper, we examine how the temporal dimension can be reconstructed from the basic primitives of mereological parthood and topological boundary, and we speculate about the possibility of treating space in a similar fashion.

2. 10:30 A.M.: Break

3. 10:45 A.M.
Graham White
"Problems with Mereology"

There have been a number of recent attempts to formalise "common-sense reasoning" using Hilbert-style axiomatisations of mereological and topological ideas. Demonstrably, there can be no theory of dimensionality in these terms: Baire space, and subsets thereof, are a counterexample. I develop this example and conclude with an examination of how mathematicians actually use concepts like dimensionality, advocating a formalism that would be closer to mathematical practice than are Hilbert-style axiomatisations.

4. 11:45 A.M.
Wlodek Zadrozny
"Computational Mereology and Set Theory"

We discuss using mereology and set theory for multimedia indexing and retrieval, e.g., of video clips. Part-of hierarchies would be used to encode the relatively permanent background knowledge, while member-of hierarchies should describe arbitrary multimedia records. We propose a language and a set of axioms for natural mereologies with sets (SetNM). A multimedia indexing system can then be viewed as a particular SetNM theory.

5. 12:45 P.M.: Lunch break

6. 2:00 P.M.
Wojciech Zelaniec
"Rethinking Boundaries"

Standard set theory is assumed by some to be inadequate as the framework for a commonsense ontology. But are alternative approaches based on mereology, topology, sheaf theory, or theories of boundaries so much better? Perhaps, but only for regional ontologies of extensional entities. A more general approach is proposed that can overcome this limitation.

7. 3:00 P.M.
Max J. Egenhofer
"Topological Similarity"

The 4-intersection, a model for binary topological relations, is based on the intersections of the boundaries and interiors of two point sets in a topological space, considering the content invariant (i.e., emptiness/non-emptiness) of the intersections. If the 4-intersections of two pairs of point sets have different contents, then their topological relations are different as well; however, the reverse cannot be stated, since there may be different topological relations that map onto a 4-intersection with the same content. This paper refines the model of empty/non-empty 4-intersections with further topological invariants to account for more details about topological relations. The invariants used are the dimension of the components, their types (touching, crossing, and different refinements of crossings), their relationships with respect to the exterior neighborhoods, and the sequence of the components. These invariants, applied to non-empty boundary-boundary intersections, comprise a classification invariant for binary topological relations between homogeneously 2-dimensional, connected point sets (disks) in the plane such that if two different 4-intersections with the necessary invariants are equal, then their topological relationships are identical. The model presented applies to processing GIS queries about whether or not two pairs of spatial objects have the same topological relation and gives rise to the formal definition of "topological similarity". We will show how the different invariants apply to formalizing metric changes among spatial objects when the objects are represented at different levels of detail.

8. 4:00 P.M.: Break

9. 4:15 P.M.
Jean Petitot
"Sheaf Mereology and Spatial Cognition "

Husserl has shown in his third Logical Investigation that one of the main features of spatial cognition concerns the ways in which spatial domains are filled or covered by qualities (colors, textures, etc.). The cognitive sciences have confirmed this phenomenological description. Problem: What can the formal status of the mereology underlying these filling-in and covering relations be? Covering relations can be mathematically modeled by what are called "sections" of suitable "fibrations". Sets of such sections yield typical examples of "sheaves". The aim of the paper is to show that the deep link established by the categorical concept of "topos" between sheaf theory and formal logic can shed some light on the difficult problems in this area. The main philosophical conclusion is that, in many perceptual judgments, space acts as a very special sort of modality.

3.2.2 JULY 9–10: WORKSHOP ON LANGUAGE AND THOUGHT

Moderator: Wojciech Zelaniec

Days and Location: Saturday–Sunday, July 9–10, Baldy 684

Saturday, July 9:

1. 9:55 A.M.: Welcome and introduction
2. 10:00–11:00 A.M.
Chris Janeke
"The Role of Salient Categories in Memory Development"

During development, children accumulate a vast amount of content knowledge. This process of knowledge acquisition consists partly in a growing awareness of the taxonomic structure associated with conceptual categories. My paper is based on the assumption that young children do not acquire all categories uniformly, but that some categories are salient for them. It is predicted that such "salient" categories are easy to activate in memory, and consequently that improved levels of performance can be expected with them relative to non-salient categories during the execution of memory tasks. The results of a multitrial, free-recall experiment are presented to support the assumption about salient categories. The experiment analyzed children's level of recall and organization over trials as a function of salient and non-salient category, and also investigated the effect of category type on hypermnesia (i.e., gains over trials without an opportunity to relearn the stimuli). The experiment yielded intracategory differences in recall and clustering, and also in the rate with which items were accessed over trials. The paper concludes by discussing some implications deriving from these results for theories of cognitive development.

3. 11:15 A.M.–12:15 P.M.
Tania Kuteva
"Auxiliation and Conceptual Constraints"

My paper deals with the widely observed crosslinguistic regularity for one and the same verbs to turn, over time, into the auxiliary elements of analytical verb forms, which is regarded as a result of what is here referred to as the "Auxiliation Constraint". I identify specific correlations existing between sources for auxiliaries on the one hand, and image-schematic representation and basic-level categorization, on the other hand. These correlations show that it is verbs directly encoding image-schemas in the spatio-physical, temporal, intra-subjective, and inter-subjective domains, or verbs encoding basic-level notions, which typically evolve into auxiliaries. The Auxiliation Constraint is claimed to be the reflection of a basic principle of the human conceptualization capacity, namely, that the abstract notions are conceptualized via their relatedness to a limited number of concepts directly meaningful for human beings (basic-level and image-schematic concepts).

4. 12:30–2:00 P.M.: Lunch break
5. 2:00–3:00 P.M.
Daniel Campos
"Knowledge Based Multimedia Output Generation for Spanish Speakers"

We are researching the problem of automatic generation of multimedia output for knowledge-based systems. Although the problem has been studied for some years, we think research is necessary in order to develop multimedia systems for Spanish speakers, according to their environments and characteristics. We have taken a linguistic approach to the problem, using as a theoretical basis for our work Searle's theory of speech acts and ideas about deixis.

Sunday, July 10:

1. 10:00–11:00 A.M.
   Thomas Guthke
   "The Interaction of Text Information and Reader's Knowledge"

   This talk focuses on assumptions dealing with the influence of implicit knowledge in text processing. There is no question that the reader's knowledge is integrated into an internal text representation during the comprehension process. The critical problem is to show empirically how background knowledge and text representation interact. In a first step, we use the assumptions of Kintsch regarding different kinds of text representations. He distinguishes between a surface representation, a propositional representation, and a situation model. Especially the creation of the situation model leads to an integration of external information and of knowledge already available.

   In a first experiment, the subjects had to read short texts. Texts were followed by old and several types of new test sentences (paraphrases, inferences, context-inappropriate sentences). Subjects were required to decide whether or not the test sentence had been part of the text. The proportion of yes-answers to the different types of test sentences follows the same rank orders as in certain experiments by Zimny. A higher proportion of yes-answers is given to old sentences, followed by paraphrases, inferences, and inappropriate test sentences. In a second experimental manipulation, we varied the semantic relation between test sentence and text, in accordance with Klix. For each type of test sentence (old, paraphrase, inference), we introduced three types of semantic relations (actor, instrument, purpose). These semantic relations influenced the proportion of yes-responses to the test sentences. Overall, the proportion of yes-responses is higher for actor and instrument reactions for that purpose. One proposed explanation for this result is a higher cognitive effort for complex relations (purpose).

   This explanation was further supported by additional experimental manipulations (e.g., distance between text and test sentence, test words instead of sentences, special populations) and by simulations. These simulations were based on the Construction-Integration Model elaborated by Kintsch. We varied the influence and structure of the background knowledge during the simulation and compared the correspondence with the experimental data.

2. 11:15 A.M.–12:15 P.M.
   Sangeeta Mahurkar
   "The Cognitive Structure of Emotion Terms in Semantic Memory of Native Speakers of Bulgarian and Hindi"

   An attempt has been made to examine the structure of the cognitive psychosemantic space of emotion terms as used by native speakers of Bulgarian and Hindi. As was expected, cultural factors were seen to influence cognitive activity which results in the formation of different conceptual structures in the domain of emotions of the two cultures. However, these conceptual structures have aspects that are identical as well as specific to a culture. The latter evolve, we argue, from the multi-faceted social, religious, spiritual, historical, and mythological heritage of the given culture, giving meaning to and structuring the semantic universe of the languages of the two cultures.

3. 12:30–2:00 P.M.: Lunch break

4. 2:00–3:00 P.M.
   Toshikazu Ito
   "Constraints on Sentences by a Japanese Connective 'Shikashi'"

   Many researchers have pointed out that connectives constrain relations that the latter sentence can take to the former sentence, and that such constraints facilitate readers' inference of sentential relations. In my paper, formalization of constraints on sentences by a Japanese connective 'shikashi' is conducted. 'Shikashi' has been thought to have function to connect sentences which have either the relations called "violation of expectation" or the relation called "contrast" (like an English connective 'but'). My paper focuses mainly on the "contrast" relation. So, in this paper, constraints were formalized that 'shikashi' has on such sentences that the predicate of the latter sentence takes either the same value or the negative value of the predicate of the former sentence. As a result, some rules were proposed which specify acceptable case relations between sentences connected by 'shikashi'. For example, one of the rules proposed is as follows: "If the predicate of the latter sentence takes the negative value of the predicate of the former sentence, only one case of the latter sentence can take the different value from that of the corresponding case of the former sentence". In general, acceptability of case relations between sentences connected by 'shikashi' was found to be determined by whether the values of case and predicate could be appropriately assigned to "key of contrast" (i.e., objects to be contrasted) or "value of contrast" (i.e., values given to each object to be contrasted). I also discuss the acceptable use of Japanese postpositions 'wa' and 'mo', which are thought to mark "key of contrast" explicitly in the latter sentence.

5. 3:15–4:15 P.M.
   Chris Kenneally
   "Models of Human Sentence Processing"

6. 4:15–5:15 P.M.
   Ninsheng Liu
   "Word Order of Endocentric Constructions in Chinese"

   It is well known that Mandarin Chinese is a non-consistent language with regard to word order typology. On the other hand, some consistency of word order within Mandarin has been noticed and discussed.

   The set of assumptions operative in the present study were arrived at after reviewing previous studies on word-order correlations. As such, the following assumptions serve as a starting point for the present study: (a) word-order correlations, and explanations for those, in one language do not necessarily agree with the word-order correlations, and explanations for those, in another; (b) word-order correlations are not necessarily established between the basic word order of the main clause and the order of other constructions; (c) because SVO languages are not sensitive to parsing difficulty, semantic and pragmatic factors will play important roles in linearization.

   Word-order consistency, with an explanation from a cognitive perspective, within Mandarin will be established. The asymmetric relation between the concept of Figure and Ground is thought to review itself through the word order behavior of their corresponding constituents the Head and the Dependent in NPs. First, the Figure and Ground correspond respectively to the Head and Dependent in both physical situations and non-physical situations. Presumably, there are two opposite orientations for human beings to observe Figure and Ground in a scene; (b) from Ground to Figure. Although it is logical to expect that language utilizes the aforementioned orientations to describe a scene, only one way has been observed in NPs, that is, the Head corresponds to the Figure and the Dependent to the Ground. Just as we don't say "*Tingzi zhouwei you hu" (t"here is a lake around the pavilion") or "*Hue zai tingzi zhouwei" ("the lake is around the pavilion") to describe a scene in which the pavilion is in the center of the lake;

likewise, we don't say "*tingzi zhouwei de hu" ("the lake near the pavilion") to describe the same scene. Extending this physical orientation to the non-physical situation, we can say, "wo de yifu" ("my cloth") but not "*yifu de wo" ("I of the cloth").

The Principle of Ground-Precede-Figure, which entails a construction involving both the Figure and Ground in which the Ground is realized in the syntax before the Figure, was developed on the basis of a textual investigation of a Chinese play entitle "Peking Man". In this play, preference for the Ground to the figure was observed in both the static and dynamic situations. This observation is notably different from observation of the order of the figure and Ground in English. The Principle of Ground-Precede-Figure proposed in this paper is supported by the following factors: (1) the orientation of address in Chinese is exactly opposite to that in English, namely from the whole to part; (2) the place name NPs in Mandarin exhibit the same whole to part orientation; (3) this same orientation is reflected in topicalization, where the whole is syntactically at a higher level than the part.

3.2.3 JULY 15–17: WORKSHOP ON SPEECH ACTS AND LINGUISTIC RESEARCH.

Director: Elisabetta Fava

Days and Location: Friday–Sunday, July 15–17, Baldy 684

Description:

The aim of the workshop is to do justice to the interdisciplinary complexity of the interface between speech-act theory and language; to evaluate its relevance in the development of cognitive science; to discuss general problems posed by different approaches; to bring under scrutiny theoretical assumptions taken for granted in recent analyses, which may not be so obvious as they seem; and to stress the theoretical and methodological relevance developed in this area by focusing on empirical data of different languages. Contributions to the workshop will be taken from different areas, such as philosophy, linguistics, social psychology, and developmental psychology.

Friday, July 15, 9:00–11:00 P.M.:
Madeleine Mathiot
"Interface Between the Illocutionary and Perlocutionary Organization of Conversation"

I propose to present the theoretical frame of reference developed by me and my students for the analysis of conversation. The empirical basis for the theory is a series of in-depth case studies of naturally occurring conversations between intimates and casual acquaintances in a variety of formal and informal occasions, from business meetings to casual socializing with friends. The case studies use a dual data base on the one hand, audio-taped recordings of naturally occuring events; on the other hand, accounts by participants acting as respondents of what is taking place in these events. Accounts elicited from respondents are interpreted on the basis of Austin's notions of illocutionary force (i.e. the effect intended or unintended that some particular utterance in a particular situation may cause).

The illocutionary organization of conversation rests, as expected, on topics, individual speech acts and strings of speech acts.

The perlocutionary organization depends on a number of viewpoints taken by respondents. Four types of viewpoints have been identified at this stage, but it is anticipated that this is only an intital list. They are:

1. an interactive viewpoint, as when the respondent describes the interpersonal dynamics that obtain between the participants;
2. a reactive viewpoint, as when the respondent describes the participants only in terms of their psychological states or personality traits;
3. a purposive viewpoint, as when the respondent describes his own, or another participant's hidden agenda;
4. an egocentric viewpoint, as when the respondent states only his own concerns, which can be evaluative (e.g. like vs. dislike of the other participants' behavior) or jocular (e.g. what strikes him as funny in the other participants' behavior).

The interface between the two organizations, illocutionary and perlocutionary, is not a constant. They may be on a par with each other or one organization may be foregrounded while the other is backgrounded. Three types of factors are relevant:

1. the respondent's willingness to disclose his thoughts and/or feelings to the analyst;
2. the respondent's level of awareness of the significance of his own behavior or the behavior of the other participants;
3. the respondent's distancing from, or closeness to, the other participants in the event.

If the respondent is either unwilling to disclose, unaware, or distancing, then the illocutionary organization is foregrounded and the perlocutinary organization is backgrounded.

If the respondent is willing to disclose, has some awareness, and is not distancing, then the perlocutionary organization is either on a par with the illocutionary organzation or it is foregrounded and the illocutionary organization is backgrounded.

It is interesting to note that the perlocutionary organization is backgrounded when it is threatening to the respondent whereas, once the illocutionary organization is backgrounded it is perceived as unimportant by the respondent.

Saturday, July 16:

1. 9:30 A.M.–12:30 P.M.
   Bruce Fraser
   Invited speaker: title to be announced
2. 3:00–3:45 P.M.
   Ik–Hawan Lee
   "Imperative Sentence Enders and Their Illocutionary Forces in Korean"
3. 3:45–4:30 P.M.
   Katarzyna Jaszczolt
   "Relevance and Infinity"

   This paper provides an answer to two questions posed by Sperber and Wilson in their theory of Relevance: (1) How are assumption schemas filled out? and (2) What exactly determines the order of accessibility of hypotheses? These questions are denied a theoretical status within Relevance; they are allocated to cognitive psychology in general.

   It is widely acknowledged in the literature that a pragmatic approach to communication should pursue the link between utterances and thoughts not only in the sense of positing a relation between them as Sperber and Wilson do by stating that the propositional form of an utterance is an interpretation of a thought of a speaker, but also in the sense of analyzing the communicative behavior in terms of psychological states (such as intentions). I propose after Recanati that meaning should be analyzed in terms of psychological properties, along the path leading from sentence meaning, through utterance meaning, communicative behavior, to psychological states.

   Sperber and Wilson's claim that context formation undergoes changes and revisions throughout the process of comprehension has to be given two perspectives: one of the search for relevance and one of the interfering role of psychological states other than intention. I establish that the psychological processes producing what I call acceleration or impairment of the derivation of assumptions should be viewed as lying within the study of intention recovery. I utilize Levinas's theory of infinity to demonstrate that the process of discourse interpretation is doubly dynamic: Interpretation is created in between the interlocutors, in addition to the singly-dynamic claim of Relevance that the context is not established before the relevance is assessed.

   I suggest that in order to arrive at the interpretation of an utterance, the hearer does the following: he/she (a) invokes perception, linguistic decoding, encyclopedic memory, and deductive process, i.e., sources of assumptions; but also (b) responds to the psychological states of the speaker that differ from intention and that indirectly accelerate or impair intention recovery; and finally (c) exhibits psychological states different from intention him/herself.
4. 4:30–5:15 P.M.
   Alessandro Lenci
   "A Relevance-Based Approach to Speech Acts"
5. 5:15–6:00 P.M.
   Susumu Kubo
   "Illocutionary Potentials in Illocutionary Force Understanding"

Sunday, July 17:

1. 9:00–9:45 A.M.
   Hiromi Oda
   "The Socio-Cognitive Functions of Japanese Sentence-Final Particles"
2. 9:45–10:30 A.M.
   Vassiliki Theodossopoulou–Papalois and Mari Vasarainen
   "The Interrelation of Speech Acts with the Psychosocial Lexical Orientation (P.S.L.O) Theoretical Framework: Linguistic and Interdisciplinary (Linguistics-Social Psychology) Implications"
3. 10:30–11:15 A.M.
   Emanuela Cresti
   "Intonational Units and Speech Act Units in the Theory of Spoken Language"
4. 11:15 A.M.–12:00 NOON
   Massimo Moneglia
   "Intonation and Illocutionary Force in the Acquisition of Italian: Notes on the Transition from One Word to Two Word Utterances"
5. 12:00 NOON–12:45 P.M.
   Chungmin Lee
   "The Development of Mood and Modality in Korean"

Special Session: "On Forms and Functions in Grammatical Theory"

1. 3:00–3:45 P.M.
   Jeff Lidz
   "Modularity and Reflexivization"
2. 3:45–4:30 P.M.
   Arie Verhagen
   "Syntax, Semantics, and the Coordination of Cognition"
3. 4:30–5:15 P.M.
   Louise Cornelis
   "Passive and Pronoun"
4. 5:15–6:00 P.M.
   Anita Cremers
   "Some Factors Influencing Object Reference in a Shared Domain"

3.2.4 JULY 16–17: WORKSHOP ON CONNECTIONISM AND NEUROSCIENCE

Moderator: Wojciech Zelaniec

Days and Location: Saturday–Sunday, July 16–17, Park 280

Saturday, July 16:

1. 8:55 A.M.: Welcome and introduction.
2. 9:00–10:00 A.M.
   Boicho Nikolov Kokinov
   "The DUAL Cognitive Architecture: A Close Integration of Symbolism and Connectionism"

   The cognitive architecture DUAL integrates the connectionist and symbolic approaches as describing dual aspects of human cognition (like the continuous and discrete theories of light). This architecture implements a close integration of both approaches, because it does not consist of connectionist and symbolic modules each implementing a particular cognitive process or stage, but it is hybrid at the micro level. DUAL consists of a large number of micro-agents, and the behavior of the system emerges from the micro-computations performed by these micro-agents. Each micro-agent is hybrid—it has a connectionist part (R-Brain) and a symbolic part (L-Brain) that work in close cooperation. From the symbolic perspective, each agent represents a piece of world knowledge and performs some specific task, while from the connectionist perspective it computes simply the activation level of the agent which reflects its relevance to the general state and task of the system. In this way, the system becomes dynamic and context-sensitive, supporting or suppressing particular operations or facts. The DUAL cognitive architecture has been used in modeling similarity judgments, analogical and deductive reasoning, plan recognition, and decision making. The simulation results are coherent with the results obtained in psychological experiments and demonstrate context effect on high-level cognitive processes.
3. 10:15–11:15 A.M.
   Helen de Hoop
   "Model-Theoretic Semantics and Event Related Brain Potentials"

   I explore some questions concerning the interface between semantic theory and mental processes. I consider the claims that are put forward in psycholinguistic literature concerning the psychological reality of the autonomy of syntax and the interaction between syntax and semantics, and argue that ERPs so far hardly tell us anything about a semantic component, although in principle, ERPs are promising in this respect.
4. 11:30 A.M.–12:30 P.M.
   István S. N. Berkeley and Michael R. W. Dawson
   "How to Interpret the Hidden Units of Networks of Trained Value Units"

   Two different types of connectionist networks were trained to detect problem type and validity of a set of logic problems. The first network was a standard backpropagation network in which all units used a sigmoidal activation function. The second network was a value-unit network in which all units used a Gaussian activation function. After training was successfully completed, jittered density plots were computed for each hidden unit and used to represent the distribution of activations produced in each hidden unit by the entire training set. The density plots for the standard network revealed a "smearing" across the entire range of possible activations. In contrast, the density plots for the value-unit network revealed a marked banding. Further analysis revealed that almost all of these bands could be assigned federal interpretations. These results indicate that value-unit networks may be a valuable tool for researchers interested in interpreting final network structure. The possibility of gaining theoretically interesting results by employing this technique is briefly illustrated.

5. 12:30–2:00 P.M.: Lunch break
6. 2:00–3:00 P.M.
   Keven L. Waghorn
   "A Generalized Model of Perceptual Classification: Evidence for Complete Link-Processing"

Sunday, July 17:

1. 10:15–11:15 A.M.
   Thomas P. Urbach
   "Neurophysiological Evidence for the "What" and "How" of Higher Cognitive Processing: The Case from Event-Related Potentials (ERPs) during Sentence Comprehension"

   In a genuinely empirical cognitive neuroscience, it must be possible to test hypotheses about higher level cognitive processing against neurophysiological data. There are familiar arguments in the philosophy of psychology that the details of central nervous system activity do not relate systematically to the details of mental activity, and this seems to be borne out by at least some experimental neuroscience. These concerns appear to militate against confronting information processing theories of mental activity with brain data as directly as is programmatically required by an empirical cognitive neuroscience. After sketching these concerns, some of my recent brain-wave studies of human sentence comprehension are reviewed, and it is argued that these studies do, in fact, provide neurophysiological evidence directly relevant to deciding between hypotheses about the fine structure of mental representations and the algorithms involved in human information processing, i.e., "what" the neuronal tissue is computing and "how". These results are of interest in psycholinguistics and illustrate a philosophically important evidential relation between the physical and the mental.
2. 11:30 A.M.–12:30 P.M.
   Klaus Zechner
   "Brain Models, Language Models, and their Relationship to Aphasia Therapy"

   Speech errors and language disorders have always been a fruitful field for constructing models of the human brain and its language functions. On the other hand, theories about the organisation and recovery of the brain's language functions have a strong influence on the way that methods of aphasia therapy are established and implemented. I discuss some of the more important theories of language (re-)organisation in the brain and their influence on concepts of aphasia therapy. Specifically, I mention some of the major dichotomies in this field, such as modular vs. representational views, static vs. dynamic models, autonomous vs. dependent modules, stimulus–response vs. self-organizing concepts. Considering these various aspects, it can be seen that the construction of a well-founded theoretical basis for aphasia therapy is a highly complex enterprise and therefore has to be discussed more thoroughly and comprehensively than has been the case in recent years.
3. 12:30–2:00 P.M.: Lunch break
4. 2:00–3:00 P.M.
   Maria G. Knyazeva
   "Spatial Processing: Developmental Change in Underlying Cortical Mechanisms"

   The assumption that visual subsystems underlying spatial vision and object vision undergo reorganization in humans during adolescence has been analyzed with EEG methods. The EEGs from F3, F4, P3, P4, T3, T4, 01, 02 according to the 10–20 system were recorded while children aged 7–8, 9–10, and 16–17 years performed mental rotation tests.

Involvement of cortical areas in information processing has been assessed through intra-hemispheric alpha band coherence changes reflecting interregional coupling. Coherence dynamics appeared to be associated with regular transformations of cortical mechanisms for visual–spatial function in the course of child development. They could be reconstructed as evolution from the diffusely represented right-hemispheric processing system through bilateral occipital-temporal-parietal subsystems dealing with object and spatial vision respectively.

5. 3:00–3:15 P.M.: Break
6. 3:15–4:15 P.M.
   Marc–Denis Weitze and G. L. Hofacker
   "Logic without Learning: The Implementation of Propositional Logic in Neural Networks"

   Describing the evolution of cognition as an informational process, we want to compare the complexity and computational power of connectionist models of some cognitive functions to the maximal information transmitted in brain-relevant genes during neocortex evolution. We implement propositional logic as Boolean functions in neural networks and investiate what types of functions are performed by nets with specified architecture (feedforward vs. fully backcoupled) and random weights. For $N = 2, 3$ arguments, the relative portions of Boolean functions are given as results of a Monte Carlo simulation.

3.2.5 JULY 23: WORKSHOP ON INTELLIGENCE, ATTENTION, AND INTENTION

Moderator: Wojciech Zelaniec

Day and Location: Saturday, July 23, Baldy 684

Program:

1. 8:55 A.M.: Welcome and introduction
2. 9:00–9:45 A.M.
   Oscar Castillo and Patricia Melin
   "An Intelligent System for Discovering Mathematical Models for Financial Time Series Prediction"

   We describe a computer program that can be considered an intelligent system for the domain of financial time series prediction. Given a financial time series for a specific problem, the intelligent system develops mathematical models for the problem based on the geometry of the data, using different statistical methods. The computer program develops the kind of models that are more likely to give a "good" prediction, based on the knowledge of the human experts contained in the knowledge base. The intelligent system then analyzes the mathematical models obtained before to make a selection of the model that will give us the "best" prediction. This selection is done by the intelligent system using a combination of heuristics and calculations that are contained also in the knowledge base. To our knowledge, this is the first system for prediction combining techniques from AI and statistics. An intelligent system that can learn models from financial data would be very useful in practice in making the job of prediction easier and less time-consuming.
3. 9:55–10:40 A.M.
   Aidan Moran
   "Understanding Attention in Sport: A Challenge for Cognitive Psychology"

   Attention, or the concentration of mental activity on sensory or mental events, is widely regarded by athletes, coaches, and psychologists as a vital cognitive prerequisite of successful performance in sport. Accordingly, the ability to pay attention to the task at hand, while ignoring irrelevant information, is a highly valued "control process" in this domain. Unfortunately, few studies have been conducted by cognitive researchers on the attentional processes of athletes. This neglect is disappointing, because research in this field has implications for important theoretical and applied issues in contemporary cognitive psychology. For example, the study of how and when athletes discover that they have "lost" their concentration has implications for the study of everyday meta-cognitive awareness. Similarly, athletic performance in competition provides a convenient "natural laboratory" for research on the relationship between anxiety and self-focused attention. Furthermore, the apparent success of mental imagery ("visualization") as an attentional and performance-enhancement strategy among elite athletes offers insight into the issue of how automaticity develops through mental practice. Finally, the concept of attention as a mental skill has implications for the measurement of individual differences in cognitive abilities. The purpose of this paper, therefore, is to evaluate the principal theoretical and empirical challenges to cognitive psychology that are posed by the attempt to understand attentional processes in athletes.

4. 10:50–11:35 A.M.
Rita Kovordanyi
"Attention as an Inhibiting Force in 'Creative' Reinterpretation of Ambiguous Images"

One of the pressing issues in imagery research concerns the question of whether mental images can be reconstrued in the same way that pictures can. There is a consensus among cognitive scientists that focusing on attention plays a pivotal role in this matter. The claim put forward in our study is that focusing of attention *per se* is inhibiting reinterpetation for ambiguous images. The line of argumentation is based on a commmonly accepted "feedback loop" view of attention. This view, together with the assumption of a distinct, positionally triggered component of selective attention, predicts that focus of "attention" will stabilize itself in any triggered position, creating a vicious circle that must be actively broken. Besides accounting for experimental data on human attentional processes, this model of selective attention easily explains why reconstrual of images is facilitated by a reference frame realignment.

5. 11:45 A.M.–12:30 P.M.
Klaus Opwis
"Memory for Chess Positions: Analyses of Chunking Processes"

Two methods for the empirical analysis of chunking processes are discussed with regard to memory for chess positions: The examination of inter-response latency times in a chess-board reconstrucion task and cluster alieve, to expect, is one strategy to characterize systems and their behavior. This, however, implies the assumption of something relevant that is not observed. Conversely, scientific language should refer to well-defined observables. If intentional idiomered essential for characterization of cognite content and form of the experts' chunks can be interpreted as domain-specific knowledge structures, whereas the content and form of the novices' chunks are dominated by general perceptual features.

6. 12:30–2:00 P.M.: Lunch break

7. 2:00–2:45 P.M.
Eva Krall
"Putting Froggy Perspectives into Perspective: An Evolutionary System Theory Perspective on Intentional Systems"

Usage of intentional vocabulary, e.g., to know, to believe, to expect, is one strategy to characterize systems and their behavior. This, however, implies the assumption of something relevant that is not observed. Conversely, scientific language should refer to well-defined observables. If intentional idiomered essential for characterization of cognition, cognition, thus, seems to be out of reach for science. It will be argued that attribution of intentionality can be understood as implicit references to systematic relations between a system's (i.e. the apparently intentional system's) configuration and regularities in the environment it interacts with. These critical relations can be described in a scientific theory, namely evolutionary theory, that deals with stability conditions in the meta-system, within which populations of organisms with brains evolve — whereas they cannot be described in scientific terms by references to brains only.

8. 2:55–3:40 P.M.
Niels Taatgen
"Learning Problem-Solving: How to Cope with Intractable Problems"

Unified theories of cognition (UTCs), as conceived by Newell (*Unified Theories of Cognition*, Cambridge, MA: Harvard University Press, 1990) have the goal to unify the field of psychology. A UTC aims to provide a structure of mechanisms to account for every field of cogntion, that is, problem solving, memory, perception, routine action, imagining, and so on. This structure of mechanisms is called the architecture of cognition, and can be viewed as the core of the UTC research program. An important property of the

architecture is, that it can be simulated on a computer. Since the rest of the theory is specified in terms of the architecture, every part of the theory can be simulated, enabling the researcher to check the claims of the theory. To pursue the goal of unifica- tion of the field of cognition, known phenomena and existing theories must be accounted for in the UTC. Such an account must explain the theory or phenomenon in terms of the UTC's architecture.

3.2.6 JULY 23–24: WORKSHOP ON COGNITIVE AND ONTOLOGICAL FOUNDATIONS OF KNOWLEDGE ENGINEERING.

Director: Nicola Guarino

Days and Location: Saturday–Sunday, July 23–24, Park 280

Description:

The main purpose of this symposium is to assess the cognitive and ontological status of various notions used as primitives in knowledge-representation systems as well as in work on databases and on object-oriented systems, notions such as concept, object, individual, property, quality, attribute, part, role, relation, state, situation, event, process, action, etc. Related issues involve the development of adequate tools for domain analysis capable of improving the cognitive transparency of knowledge and data bases, and therefore their potential reusability. Expected topics include:

- Cognitive and ontological adequacy of knowledge-representation primitives
  - Primitives for knowledge structuring: intended meaning, formal semantics
  - Epistemological vs. conceptual primitives
- Ontological instruments in knowledge engineering
  - Ontological distinctions between kinds of knowledge
  - Ways of knowledge structuring: dependency analysis, role of mereology
  - The notion of ontological commitment for a knowledge base
- Natural-language instruments in knowledge engineering
  - Language as a privileged domain for conceptual analysis
  - The role of linguistic competence in knowledge engineering: ontological assumptions from lexical items or natural-language descriptions
  - Role of terminological choices in knowledge engineering; discipline for compound terms
  - Use of on-line linguistic resources in knowledge engineering
- Case analyses: concrete experiences of ontology design or reuse
  - Striving for reusability: task-oriented vs. domain-oriented analysis; experiences of ontology reuse
  - Top-level ontologies
  - Existing modeling methodologies and environments for domain analysis

Program:

Saturday, July 23: Session I: Methodology

1. 10:00 A.M.
   Nicola Guarino
   "Formalizing Ontological Commitment"
2. 11:00 A.M.: Break
3. 11:15 A.M.
   Graeme Hirst
   "Differentiae as First-Class Objects"
4. 12:30 P.M.: Lunch break
5. 2:00 P.M.
   Joel Muzard
   "An Ontology for Idea Processing and Knowledge Modeling"
6. 3.00 P.M.: Break

7. 3:15 P.M.
   Luca Pazzi
   "Towards an Ontological Foundation for Object-Oriented Databases"
8. 4:15 P.M.: General discussion

Sunday, July 24: Session II: Case Analysis

1. 10:00 A.M.
   Carola Eschenbach
   "An Ontological Framework for Measurement"
2. 11:00 A.M.: Break
3. 11:15 A.M.
   Steven Bayne
   "Modelling Causal Relations between Events"
4. 12:30 P.M.: Lunch break
5. 2:00 P.M.
   Natalya Fridman
   "An Ontology for Substances and Processes in Molecular Biology"
6. 3:00 P.M.: General discussion

3.2.7 JULY 24: WORKSHOP ON PHILOSOPHY AND COGNITIVE SCIENCE.

Moderator: Wojciech Zelaniec

Day and Location: Sunday, July 24, Baldy 653

Program:

1. 8:55 A.M.: Welcome and presentation
2. **Christine Lisetti**
   "Understanding Human Emotions: A Neuro-Linguistic Approach"
   9:00–9:40 A.M.

   In this essay, we start from Korbzybski's work on general semantics, which deals with the neuro-semantic and neuro-linguistic reactions of humans beings. We argue that the reactions of human beings should not be split into separate 'body', 'mind' perspectives, but should be treated holistically, from the perspective of an organism–as–a–whole–in–an–environment. We present a linguistic model of the maps that humans create through their sensory apparatus in order to operate in the world. Using this model, we can identify language patterns such as deletion, distortion, and generalization, which can lead to mis-evaluations when people orient themselves by verbal structures which do not fit the facts. We focus on the cognitive aspect of emotions and show how emotions are linked with neuro-linguistic patterns, belief systems, bodily sensations, and so on.
3. **Adam Kovach**
   "A Coherent Expression of Content Irrealism"
   9:40–10:20 A.M.

   One of the most influential and keenly debated views in the contemporary philosophy of mind is irrealism about folk psychology. Since irrealists claim that the sorts of things to which folk psychology is committed, such as beliefs, desires, and intentions, are not among the explananda of a good theory of behavior and cognition, the implications of an irrealism view for cognitive science are considerable. In "The Status of Content," Paul Boghossian issues a challenge to irrealists in the form of an argument that trades on certain notions of truth and truth conditions. The upshot of this argument is that irrealism about folk psychology, as it is ordinarily expressed, is incoherent. I respond to Boghossian's challenge by showing that irrealism about folk psychology is coherently expressible. The response focuses mainly on the issue of what kind of a conception of truth should be used in formulating irrealist claims about folk psychology and content.
4. 10:20–10:30 A.M.: Break
5. **Claire Hewson**
   "Empirical Evidence Regarding the Folk-Psychological Concept of Belief"
   10:30–11:10 A.M.

   This paper presents empirical evidence regarding the nature of our commonsense concept of belief. The findings have significant bearing upon claims made by authors concerned with the Folk Psychology Debate—in particular, they challenge Stephen Stich's (1983) claim that folk psychology is committed to a *broad* account of belief states. In contrast it is found that folk psychology favours a *narrow* account of belief. This result is important in refuting Stich's claim that the folk psychological concept of belief has no role to play in a developed cognitive science. The paper also presents evidence regarding the influence of several factors on folk psychological judgements of belief individuation (emphasised similarities/differences between the referents of beliefs, nature of past beliefs, goal of classification), and introduces a methodology by which to investigate further factors. It is argued that the observed conflict between individual speculations about

   likely folk psychological intuitions within the philosophical literature and actual empirical data regarding subjects' responses highlights the important contribution of experimental psychology in exploring such philosophical issues.
6. **Luis Antunes**
   "A Few Notes on the Concept of Intention"
   11:10–11:50 A.M.

   The discussion of intention has been arising more and more in the artificial intelligence and philosophy of mind literature. Among the several mental concepts used to model intelligent behavior, the concept of intention has gained a special relevance, and it is somehow central to most models of automatic reasoning. I support a model of mind in which the concept of intention lies in the kernel of decision-making and of action execution. Therefore, I relate the execution of an action to the intention that caused it. I defend the association of an intention with the state the agent wants to achieve, instead of the action that leads to that state. Finally, I describe the mechanisms that lead to the satisfaction of the agent's intention.
7. **Sean O'Nuallain**
   "The Search for Mind: A New Foundation for Cognitive Science"
   11:50 A.M. – 12:30 P.M.

   It is a measure of the maturity of cognitive science that, considered as the science of mind, it has developed sufficiently to be in crisis. The nature of this crisis is explored and a new foundation for the discipline is proposed. The new foundation comprises a set of new fundamental tenets with specific empirical consequences as well as a new basic orientation in approaching the search for mind.
8. 12:30–2:00 P.M.: Lunch Break
9. **Josefine Papst**
   "Is Introspection an Obsolete Notion?"
   2:00–2:40 P.M.

   In what sense is a special notion of introspection a fundamental element to characterize and interprete the identity of a person over time? In order to discuss this question I employ an example which I call "The Eckermann Paradox."
10. **Wojciech Zelaniec**
    "On Seeing That"
    2:40–3:20 P.M

    I argue with the assumption that discerning and identifying states of affairs is an essential component of human intelligence, but also of any intelligence worthy of this name. Then I argue that there may be more to this component of intelligence that just detecting ordinary objects and formulating grammatical sentences. There might be a special faculty of "apprehending" states of affairs. I lay out a program for investigating it.
11. 3:20–3:30 P.M.: Break
12. **Graham White**
    "A New Look at Lesniewski: Definitions"
    3:30–4:10 P.M.

    I examine the role of Lesniewski's theory of definitions in his logical theories (specifically, in his ontology and mereology) using the resources of modern constructive type theories. There is a surprisingly close fit between this aspect of Lesniewski's work and modern logic; by contrast, aspects of his work which have, in the past, been more emphasised (for example, his deviant semantics for "is a part of") seem less interesting and less fertile.

13. **Alan Clune**
"The Richard Paradox Undone"
4:10–4:50 P.M.

    In this paper I give a solution to the Richard Paradox which accounts for the very reason that the paradox is thought to arise. The reason is that in the statement of the paradox, a key element is twice misidentified. The non-enumerability of the real numbers plays an important role in these misidentifications. Once this is made clear and one comes to correctly understand the nature of this key element, then one can see that there really is no paradox. Towards the latter part of the paper, I speculate as to how it might look if there really were a paradox. I also discuss the implications of the Richard Paradox with respect to the adequacy of some symbol system in handling elementary number theory.

14. **Pawel Kawalec**
"Is the Turing Test Epistemologically Justifiable?"
4:50–5:30 P.M.

    The paper adresses the epistemological question: "Are there any characteristics essential to the human mind which computers can share and in virtue of which it would make sense to speak of a 'computer mind'?" I assume that the Turing test provides at least the starting point for deciding this question. What we are capable of saying about computers and other formal systems must be conceptualized in terms of the syntax-semantics distinction. I claim, however, that this distinction alone does not afford sufficient means for capturing specific characteristic features of the human mind. This claim follows from philosophical considerations about the nature of the human mind and of formal systems. I conclude that we are not in a position to say anything interesting about a 'computer mind'.

3.2.8 JULY 24: WORKSHOP ON LANGUAGE AND SPACE.

Director: Hubert Cuyckens

Day and Location: Sunday, July 24, Baldy 684

Description:

In the various disciplines of cognitive science, the past few years have seen a surging interest in the relation between language and space. For one thing, it has been assumed that, in tackling the relation between language and cognition, it would be easier to start with the spatial domain. Furthermore, spatial knowledge has been claimed to take up a privileged position in cognition in that "we typically conceptualize the nonphysical in terms of the physical" [Lakoff & Johnson, *Metaphors We Live By*, p. 59]. In cognitive linguistics, for instance, spatial knowledge is often analyzed as the source domain of many linguistic expression. This workshop brings together a number of papers highlighting the relation between language and spatial cognition from different angles.

Program:

1. 8:50–9:00 A.M.: Welcome and introduction
2. 9:00–9:40 A.M.
Jocelyne Fernandez–Vest
"Spatial Cognition and the Organization of Discourse: Evidence from the Sami Language (Lapland)"

    The Sami language, in its northern variety, is taken here as a prototype of orality. Some specific features of the language system seem to have an oral motivation, e.g., the rich spatio-temporal deixis (cf. the functional "mental maps" of reindeer-breeders as opposed to fishermen). The comparative study of discourse particles, often of spatial origin, furthermore suggests investigating conceptualization as anchored in physical experience and related to metaphorically structured processes. The recent accession of Sami to the written form implies a new relationship of the speakers (to their identity and) to their language: The Sami language, finding its way into new communication networks, is less contextualized.

3. 9:45–10:35 A.M.
Alan Cienki
"*Straight* and *Curved* as Image Schemas"

    Recent studies within several veins of cognitive linguistics have explored image schemas as a means by which we organize and understand our experience. Using Mark Johnson's (1987: xiv) definition, "[a]n image schema is a recurring, dynamic pattern of our perceptual interactions and motor programs that gives coherence and structure to our experience." I propose *straight* and *curved* as a pair of complementary image schemas that have not been recognized in previous cognitive linguistic research, and explore how our experience and understanding of them as Gestalts depends on both spatial and force-dynamic aspects of their structure. Supporting evidence comes from research in spatial perception and from the variety of metaphors in different languages that use *straight* and *curved* as source domains.

4. 10:35–10:50 A.M.: Break

5. 10:50–11:30 A.M.
Linda Forrest
"Syntactic Subject and Focus of Attention in Language Production"

When speakers map a mental representation onto a linguistic code, one fundamental problem is selection of syntactic subject. In choosing between 'the heart is above the star' or 'the star is below the heart,' speakers must take a perspective that seems to depend on which referent is focally attended. In two experiments, speakers produced locative sentences about pictures while their focus of attention was manipulated using visual cueing techniques developed in psychological research. Speakers chose attended figures as subject more frequently and produced utterances having attended figures as subject more quickly, providing strong evidence that English syntactic subject codes cognitive focus of attention.

6. 11:35 A.M.–12:15 P.M.
Hubert Cuyckens
"Family Resemblance Structure in the Dutch Spatial Prepositions 'Door' and 'Langs'"

I examine the semantic/conceptual information in the Dutch spatial prepositions 'door' and 'langs' and set up their family resemblance structure. These are the main lines of the analysis: Each of the uses of 'door' and 'langs' will be specified in terms of a bundle of co-occurring features (or, in other words, in terms of a featural configuration). Taken together, these uses constitute a network of interrelated featural configurations in which configurations either have features in common with one another or are transformationally linked (cf. Lakoff 1987: 425). Since the family resemblance structures I would like to present systematically characterize the semantic/conceptual relations between the various uses of 'langs' and 'door', they also shed some light on how one use might be derived from (or motivated by) the other.

7. 12:15–1:30 P.M.: Lunch

8. 1:30–2:10 P.M.
Chris Sinha
"Canonical Rules: The Role of Material Culture in Spatial Cognitive and Language Development"

This paper argues on the basis of developmental evidence that spatial cognition and language is not organized solely on the basis of an unmediated mapping from the innate properties of the human perceptual system, but also represents socio-culturally standard (canonical) rules correlating object functions with object forms. Such canonical rules partly canalize the development of the human infant's representations of proximal space. The ontology of proximal space as humanly cognitively represented is co-constituted by human biology, the nature of the physical world, and human culture.

9. 2:15–2:55 P.M.
Melita Kovačević and Milena Zic–Fuchs
"An Analysis of Spatial Relations in Croatian: A Cognitive Approach"

In Croatian, as in other similar languages, spatial relations are predominantly expressed by prepositions and other deictic expressions. Until now, no systematic attempt has been made to analyze language acquisition in Croatian, and this is especially felt in specific domains such as spatial relations, which are interesting not only linguistically but also cognitively. The preliminary analysis of a pilot study of metalinguistic knowledge and spatial relations showed that the subjects had difficulties in dealing with spatial prepositions in sentence production in Croatian. This triggered off further investigation on a broader range of subjects (starting from pre-school to college students) that tested both their linguistic and conceptual competence in dealing with spatial relations. We discuss the implications of these findings in terms of the relationship between linguistic and cognitive determinants expressing spatial relations.

10. 2:55–3:10 P.M.: Break

11. 3:10–3:50 P.M.
June Luchjenbroers
"Locations in Space"

My work looks at the process of on-line discourse comprehension and the establishment of mutual ground between discourse participants in terms of a schematic framework for cognitive (and linguistic) information processing. I have argued in my Ph.D. thesis (*Pragmatic Inference in Language Processing*, La Trobe University, Melbourne, 1993) that a conceptual construct of "mutual ground" is a necessary formalism in courtroom discourse as verbal interactions are performed between two parties for the benefit of a third party (the jury) who do not participate but are the ones the barristers need to convince. Therefore, verbal interactions proceed on the basis of what jurors are presumed to know (i.e., hold in conceptual space). Temporal and locative units as well as a new pattern identified in my thesis, 'x prep y' (head + postmodifier) pattern, are discussed in terms of their anchoring and spatial properties as strategies for pointing to discourse locations in cognitive space. The data are the court transcripts of a Supreme Court murder trial, held over 6 days in Melbourne (Australia) during 1986, and encompass 33 witness testimonies.

12. 3:55–4:35 P.M.
Klaus-Peter Gapp
"On the Basic Meaning of Spatial Relations: Computation and Evaluation in 3D Space"

Spatial relations play an important role in the research area of connecting visual and verbal space. In the last decade, several approaches to semantics and computation of spatial relations in 2D space have been developed. Presented here is a new approach to the computation and evaluation of basic spatial relations' meanings in 3D space. We propose the use of various kinds of approximations when defining the basic semantics. The vagueness of the applicability of a spatial relation is accounted for by a flexible evaluation component that enables a cognitively plausible continuous gradation. For validating the evolved methods, we have integrated them into a workbench. This workbench allows us to investigate the structure of a spatial relation's applicability region through various visualization methods.

13. 4:40–5:30 P.M.: Informal discussion

3.2.9 JULY 25: WORKSHOP ON DEIXIS IN NARRATIVE.

Director: Erwin Segal

Day: Monday, July 25

Description:

Narrative is found in all cultures. Usually it has a prominant role. One issue that we face is: Why? What is the nature of narrative that it can serve important functions for most societies, and what is it that people do cognitively in order that narrative can serve such functions? Narrative has properties from which readers or hearers can gain vicarious experiences in a variety of situations, and the readers can learn from such experiences. This workshop attempts to explore some possible cognitive bases of these experiences and learning opportunities. The research underlying this activity supplies information relevant to many issues in cognitive science, such as certain cognitive underpinnings of grammar, inference, comprehension, mental models, and attention.

The starting point of this workshop is the narrative. Naturally occurring narrative texts contain elements that seem at first blush to be out of place. Such texts contain sentences that are not straightforward assertions and expressions that are either literally incoherent or situationally inappropriate. Many of these misplaced elements involve deictic expressions. Temporal, spatial, and personal deictic terms in narrative only seldom index situationally based times, places, or people. We will explore some of the linguistic, conceptual, and computational issues that arise when a cognitive agent has to process referents indexed by a text without being present at the scene being indexed. We also will explore how these situational issues can be related to the comprehension of causal and inferential relations in narrative text. The talks will be surrounded by discussion from various perspectives of the topics generated.

Program:

1. **Erwin M. Segal**
   "The Representation of Deixis in Narrative Text"

   It has been argued that in order to understand perception one must consider the properties of the stimuli which are to be perceived. The same holds true for connected discourse. In order to understand how connected discourse is comprehended, one must consider what needs to be comprehended. I will begin the workshop by presenting some examples of narrative text to illustrate some of the problems that we need to solve, and briefly outline a direction for solution.

2. **William J. Rapaport**
   "Can Computers Understand Language? A Cognitive Science Approach to Understanding Narrative Text"

   I present an example of a research program that considers cognitive science to be a single cohesive discipline that applies diverse methodologies of several disciplines to a common problem. The research program consists of a group of projects whose goals are to develop a psychologically real model of a cognitive agent's comprehension of deictic information in narrative text. We are testing the hypothesis that the construction and modification of a "deictic center"—the location in conceptual space-time of the characters, objects, and events depicted by the sentences currently being perceived—is important for comprehension. To test this hypothesis, we are developing a computer system that will "read" a narrative and answer questions concerning the agent's beliefs about the objects, relations, and events in the narrative. The final system will be psychologically real because the details of the algorithm and the efficacy of the linguistic devices will be validated by psychological experiments and observations of normal and abnormal comprehenders.

3. **Arthur C. Graesser**
   Title to be announced.

   This talk will be related to Graesser's work on the process of on-line inferencing while reading narrative text. He has a constructionist theory of knowledge-based inferencing arguing that some, but not all, possible inferences are made on-line. He will explore the relation between on-line inferencing and on-line perspectival or point-of-view shifts.

4. **Andrea Carol Siegel**
   "Whose Mind Is in Mind: On-Line Processing of Point of View"

   Psycholinguistic research has shown that expert readers use both textual and background knowledge to construct a mental model of the narrative world. Although constructing and updating information in the model may require attention and effort, maintaining and tracking well-established model components may be relatively automatic during comprehension. Results of two experiments designed to assess the processing of stable versus shifting point of view will be presented. Thirty-five pages of text excerpted from Saul Bellow's *Seize the Day* were rapidly (up to 18 words a second) presented to subjects, who were given a variety of tasks in an attempt to measure attention, awareness, and comprehension on-line.

5. **Joachim Knuf**
   "Salience and Reference in the Talk of Alzheimer's Sufferers"

   This paper explores differences in the pragmatics of deictic expressions in the talk of Alzheimer's patients. Whereas patients remain able to represent situationally salient information quite adequately well into the development of their disease, reference to events presented in narrative deteriorates much more quickly. The paper will provide examples for time, space, and person deixis.

6. **Judith Felson Duchan and Lynne E. Hewitt**
   "Deictic Centering of Children's Narratives"

   Analysis of stories produced by young children reveal their abilities to conceptualize a deictic center other than the "here and now" of the story teller and listener. Preschool children were found to successfully use deictic terms in their stories. Their success reflects a coherent representation of the story world from an objective deictic center. Evidence of children's abilities to switch from objective to subjective perspectives within the story world were also found. Detailed analyses of stories told by a creative five-year-old indicated her employment of a full range of devices that express various renditions of her story characters' subjective states.

7. **Andrej A. Kibrik**
   "Cognitive Roots of Pronominal Anaphora"

   As is well known, pronominal anaphora is in a certain sense derived from deixis. This paper provides a cognitive interpretation of this dependency. To do this, we integrate facts from neurophysiology of vision, cognitive psychology, cognitive linguistics, and the Lakoff and Johnson metaphor-based semantic theory of linguistic meaning.

8. **Riitta Välimaa–Blum**
   "Definiteness: Deixis in a Mental Space"

   Grammar enables us to transcend linguistically the "here and now" and recreate in a mental space the events and entities of a concrete but absent space. The expressions of definiteness typically belongs to the grammatical aparatus and its fundamental function. Such expressions enable us to do cognitively what speakers do with indexicals in material circumstances; definite determination means pointing in a mental space.

9. **David A. Zubin**
   "Discussion on Deixis in Reference"

3.2.10 JULY 25–26: WORKSHOP ON CONNECTIONISM

Director: Paul Smolensky

Days: Monday–Tuesday, July 25–26

Description:

The tutorials will present current techniques in connectionist research as well as the theoretical contributions to the understanding of various cognitive domains which these techniques have given rise to. The techniques discussed will include distributed representation (e.g., of recursive symbolic information), harmonic analysis of distributed processing, several approaches to unsupervised learning, and computation in structured connectionist networks. The cognitive domains addressed will include perception, memory, and language, studied from linguistic, psychological, developmental, and neuropsychological perspectives.

Monday, July 25:

1. 9:00–10:30 A.M.; 10:45 A.M.–12:00 NOON
   Paul Smolensky
   "Connectionism and Higher Cognition: From Neural Computation to Universal Grammar"

   Connectionism is often regarded as antithetical to symbolic representations, and thus is regarded by many as incapable of handling the challenges of higher cognition, particularly in domains whith rich symbolic theories, such as reasoning and language. In recent years, however, a considerable body of research has developed interesting relations between symbolic and connectionist processing. This tutorial will present some of this research, with an emphasis on methods of truly integrating symbolic and connectionist computation within a coherent cognitive architecture. These techniques have had a significant impact on research in one area of higher cognition, the theory of universal grammar, through a grammatical theory called Optimality Theory. This theory will be presented, and its way of combining symbolic and connectionist features explored. Philosophical arguments concerning the capabilities of connectionism in higher cognition will be briefly considered.

2. 1:00–2:45 P.M.; 3:00–4:30 P.M.
   Geoffrey Hinton
   "Unsupervised Learning"

   Learning in connectionist networks is most commonly thought of as "learning with a teacher" or "supervised learning", where some external "teacher" instructs the network on the correct output for each input. In recent years, however, much of the progress in connectionist learning research concerns *unsupervised learning*, in which a network observes some environment and, with no external guidance from a teacher, learns to categorize stimuli or otherwise represent regularities extracted from the environment. The tutorial will start with the basic methods, e.g., Principal Components Analysis, Autoencoder Networks, Vector Quantization, Competitive Learning, and Expectation Maximization. It will then move to recent methods based on the Minimum Description Length Principle.

Tuesday, July 26:

1. 9:00–10:30 A.M.; 10:45 P.M.–12:00 NOON
   James L. McClelland
   "Parallel Distributed Processing and Human Cognition"

   I will consider several of the ways the Parallel Distributed Processing approach has impacted our understanding of human perception, memory, and language; the development of these cognitive capacities; and the disorders of these processes that arise from the effects of brain damage or other biological abnormalities. Several example models will be presented to illustrate the breadth of the impact of Parallel Distributed Processing within the fields of cognitive psychology, linguistic and cognitive development, and cognitive neuropsychology.

2. 1:00–2:45 P.M.; 3:00–3:45 P.M.
   Jerry Feldman
   "Structured Connectionist Models"

   Connectionist computation provides many advantages for modeling in cognitive science. By far the most heavily exploited feature is "learning" by weight adaptation. This has led to many nice results, but does have its limitations. In particular, many connectionist modelers have assumed that any prior structure in a model limits the range of discovery by the weight adaption mechanisms and should be avoided. But the brain has a vast intricate pre-existing structure on which learning is superimposed, and any cognitive model either explicitly or implictly assumes a substrate. This tutorial will present some of the techniques used in structured connectionist models and how they can be combined with weight adaptation when that is desirable. A number of specific examples will be presented.

3. 3:45–4:30 P.M.
   Panel Discussion
   Jerry Feldman, James McClelland, Paul Smolensky, and others to be invited

3.2.11 JULY 26: WORKSHOP: TOWARDS AN EMBODIED AND UNIFIED COGNITIVE SCIENCE.

Convener: Jerome A. Feldman

Day and Time: Tuesday, 26 July, 9:00–11:00 P.M.

Panelists:

- **Thomas G. Bever**
- **Jerome A. Feldman**
- **George Lakoff**
- **Donald A. Norman**

Description:

Cognitive Science, like other sciences, should be grounded, and the base for the reduction must be the co-evolving physical and biological sciences. The ultimate determiner of our minds is the situation of our existence, co-existence, and evolution on the planet. The paradigm example of this is the work that shows that color-terms in the world's languages are similar in ways that can be predicted from physiology and psychophysics. Decades of work in a wide range of disciplines has produced an understanding of this (admittedly very narrow) aspect of cognition that seems as solid and incontestable as any in the sciences. Our belief is that this paradigm can be extended to yield a cognitive science that will establish a continually growing body of accepted scientific knowledge.

The driving idea is to take very seriously the notion that all of our concepts and cognitive processes have their roots in the nature of our bodies and brains. The color story provides a clear, albeit deceptively simple, version of the fruitfulness of this approach. There are a variety of existing projects that are providing pieces of similar stories in other basic domains. The central issue is the intertwined learning of skills, concepts, and language. Connectionist models provide a scientific language for linking concrete concepts to the body. Terry Regier's thesis shows how spatial relation terms can be learned from examples with a network that includes a simple model of the visual system. The path to treating more abstract domains is being explored in studies of metaphor and other mappings from abstract to concrete concepts.

The envisioned Unified Cognitive Science would have disciplines from biology to anthropology cooperate in studying how universals of conceptual organization are constrained by nature and how they develop.

3.2.12 JULY 26–27: WORKSHOP ON ONTOLOGY OF SPACE.

Directors: Barry Smith (26 July), **Leonard Talmy** (27 July)

Days: Tuesday–Wednesday, July 26–27

Tuesday, July 26:

1. 9:00 A.M.
   Roberto Casati
   "Holes and Other Superficialities"

   This talk will develop material that recently appeared in a joint work of the same title published by MIT Press. Do holes exist? What are they? What are they made of? How can we identify them, count them, compare them? What kind of relations do they bear with the things that host them and with the things they can host? What happens when two holes meet? And how do holes come into existence, and how do they die? All of these questions are posed from a realist perspective: If there is an ontology inherent in our everyday reasoning about the world, then this ontology, we shall argue, comprises holes (and other spatial nothingnesses such as cavities, grooves, cracks, cuts, fissures) along with stones and chunks of cheese.

2. 9:45 A.M.
   Christian Freksa
   "Spatial Relations in Artificial Worlds"

   We can distinguish at least two different and partially complementary approaches to the study of cognitive processes in the "real world": (1) direct empirical investigation of natural cognitive systems, and (2) (a) representation of a natural cognitive system in another medium, (b) experimentation with (artificial) cognitive processes in that medium, (c) comparison of the result with the corresponding result of natural cognitive process. The second approach is attractive for computer scientists, since it allows for exploiting computers as "cognitive media". However, the approach causes fundamental problems, since it involves three important phases that must harmonize in many respects. Thus, most research projects pursuing this approach have focussed on one of the phases and neglected the relevance of the others. In order to avoid this problem, we propose an alternative complementary strategy: In the spirit of Braitenberg's synthetic psychology approach to studying cognitive beings, we study properties of artificial environments and their role for cognitive processes. By studying artificial realities in their own right, we are justified for the time being in factoring out the representation issue, The domain we are addressing using this approach is the domain of spatial reasoning.

3. 10:30 A.M.: Break

4. 10:45 A.M.
   Tony Cohn
   "Representing and Reasoning with Non-Convex Spatial Regions"

   Much current work concerning qualitative spatial reasoning assumes that regions are convex (not only one piece but also without holes or concavities). Here we show how a logic of space for convex regions based on the single relation of "connection" (C(x,y), which is reflexive and transitive) can be extended to yield a rich taxonomy of relations for distinguishing many kinds of non-convex regions and their relationships using just one additional primitive, that of the convex hull of a region. We also briefly consider an alternative primitive, based on the notion of Voronoi regions. Reasoning mechanisms for the calculus will be discussed.

5. 11:30 A.M.
Max Egenhofer
Formal Models of Geographic Space

Geographic information systems necessarily have data models, structures, and schemas for representing geographic space. It is difficult, and probably undesireable, to hide the underlying representations from the users of GISs. The fact that many thousands of people use current commercial GISs to manage geographic information, analyze geographic processes, and support spatial decision-making seems to indicate that there is a reasonable correspondence between the GIS representations and the cognitive models of the users. For consistent and effective implementations on digital computers, mathematically-sound formal models of spatial entities, spatial relations, and geometry are highly desireable. This presentation will provide an overview of formal models of geographic space from current GISs and the GIS literature.

6. 12:15 P.M.: Lunch break

7. 1:15 P.M.
David M. Mark
"Geographic Information Systems as Claims about the Ontology of Geographic Space"

A Geographic Information System (GIS) is a claim (normally implicit) about the ontology of geographic space. If GISs are equally appropriate for all linguistic and cultural views of geographic space, then GISs contain cross-cultural universals about cognition of geographic space. This would be very interesting, since cognitive universals seem rare or at least are rarely agreed upon. On the other hand, if GISs do not contain cultural universals, that presents interesting theoretical and practical challenges to GIS developers and theoreticians. If the agenda to remove these impediments to the cross-cultural diffusion of GIS is to succeed, it must produce results that will also be of interest to cognitive science. Lastly, the fact that very different software is needed to handle geographic spaces (GIS) and manipulable spaces (CAD/CAM) is further evidence that the ontologies of these two scales of spaces are fundamentally different. These issues will be discussed in the presentation.

8. 2:00 P.M.
Christopher Habel
"Structures of Spatial Theories in Common-Sense Reasoning"

There is theoretical and empirical evidence from investigations on reasoning, memory, and language processing that humans use "spatial representations" that have some of the characteristics of mental images. From a formal point of view, theories can be seen as sets of sentences of a formal language (the axioms) over an alphabet of concepts; from this perspective, a Naive Spatial Theory (NST) is a set of propositional expressions (the axioms) that specify some geometrical or topological theory. From a cognitive point of view, the NST can be interpreted as a set of principles the "believer who holds a NST" is committed to. Different NSTs can be defined by taking different sets of axioms. The (strict) set-inclusion relation between NSTs can be re-interpreted in the following way: NST–1 is a proper subset of NST–2; therefore, every model of NST–2 is a model of NST–1. Thus, the lattice structure on NSTs induced by inclusion can be seen as characteristic of the structure of "is committed more strongly than". From this point of view, a picture (or mental image) is annotated by NSTs that describe the commitments that one brings in interpreting the picture.

9. 2:45 P.M.
Barbara Tversky
"Spatial Metaphors in Graphic Displays"

Visualizations of abstract ideas, such as those conveyed in graphs and diagrams, are based on spatial metaphors, including proximity, direction, proportion, enclosure, salience, and similarity, depending in part on the relations being conveyed.

10. 3:30 P.M.: Break

11. 3:45 P.M.
Geoff Simmons
"Knowledge of Shape between Language and Perception"

Landau and Jackendoff (1993) have proposed a level of knowledge of object shapes that is accessed by both linguistic and perceptual systems. We present a frame-like knowledge representation for shape that constitutes a more precise, slightly modified version of their approach. It supports model-based object recognition on the one hand, and accounts for interpretations of a number of linguistic expressions on the other, such as dimensional adjectives, some local prepositions, and verbs of position and rotation.

Reference: Landau, B., & Jackendoff, R. (1993): "'What' and 'Where' in Spatial Language and Spatial Cognition," *Behavioral and Brain Sciences* 16: 217–265.

Wednesday, July 27:

Session 1: 9:00–10:30 A.M. and 10:45 A.M.–12:00 NOON

Cultural Variation in Spatial Conceptualization

Group presentation by participants from the Cognitive Anthropology Research Group, Max Planck Institute for Psycholinguistics, Nijmegen, the Netherlands.

Participants:

1. **Eve Danziger**
2. **Kyoko Inoue**
3. **Sotaro Kita**
4. **Stephen Levinson**
5. **Paulette Levy**
6. **Eric Pederson**
7. **David Wilkins**

Spatial cognition has always been an understandably central part of cognitive science. However, the categories postulated for spatial conceptualization and in particular their coding in language are all too often assumed to be universal and more or less intuitively available to the researcher independent of the researcher's own cultural background.

The Cognitive Anthropology Research Group of the Max Planck Institute for Psycholinguistics has operated from the premise that the basic categories of spatial representation in language and other aspects of cognition (and the degree to which such categories can be considered universal) have yet to be determined. The group takes a fundamentally anthropological approach, which (1) explores semantic parameters from a language specific point of view, (2) explores the full range of usage of relevant linguistic expressions in verbal interaction, (3) investigates associated cultural phenomena, and (4) explores correlated non-linguistic cognitive preferences. This exploratory research into spatial cognition demonstrates considerable cross-linguistic and cross-cultural variation in seemingly basic spatial categorization.

The variation correlates not just with the linguistic system available to the subjects, but also with their language use in specific social contexts, with their gestural representations of space, and with the other semiotic systems found in the culture,

During the presentation, we will demonstrate both some linguistic elicitation techniques and various non-linguistic cognitive experiments that were developed in turn. The co- ordinated results from these elicitations and cognitive experiments allow us to better determine the categories of human spatial reasoning and the degree of variation across individuals and cultures.

Session 2: 1:00–2:45 P.M. and 3:00–4:45 P.M.

Cognitive and Computational Approaches to Linguistic Spatial Structure

1. 1:00 P.M.
   George Lakoff
   "Spatial Inference, Metaphor Systems, and Abstract Inference: The Role of Spatial Relations in the Embodiment of Mind"

   One of the fundamental ideas of embodied cognitive science is that abstract inference is grounded in perceptual-motor inference, and that conceptual metaphorical mappings are what link such body-based inferential mechanisms to "abstract reason". I will begin with some of Talmy's fundamental insights on the properties of spatial relations concepts, then discuss the inferential properties of "image-schemas", and then go on to talk generally about metaphor systems and how metaphorical mappings preserve inferential structure.

2. 1:55 P.M.
   Annette Herskovits
   "'Across' and 'Along': Lexical Organization and the Cognitive Geometry Underlying Language"

   To understand the interface between language and spatial cognition, we must first provide a fine-grained account of the cognitive geometry underlying language. The talk will present a detailed semantic analysis of 'across' and 'along' and some experiments testing their use, which together illuminate some aspects of this cognitive geometry and of its relation to perception and conceptual capacity. It will also discuss recent hypotheses about the access of the language system to various spatial representations.

3. 3:00 P.M.
   Terry Regier
   "Modeling the Human Capacity for Categorizing Spatial Relations"

   Languages vary dramatically in their structuring of space. Despite this wide variation, however, the search for universals in spatial semantics is well motivated by the fact that all linguistic spatial systems are based on human experience of space, which is in turn constrained by the nature of the human perceptual system. I will be presenting a connectionist model that contributes to the search for universals in this domain. Its design incorporates a number of structural devices motivated by neurobiological and psychophysical evidence concerning the human visual system; these provide a universal perceptual core that constrains the process of semantic acquisition. Using these structures, the model learns the perceptually grounded semantics for closed-class spatial terms from a range of languages, providing at least a preliminary model of the human capacity for categorizing spatial events and relations. The model gives rise to two predictions concerning the manner in which one can expect to find motion encoded in closed-class spatial terms in the world's languages.

4. 3:55 P.M.
   Jerome A. Feldman
   "Space is Not the Final Frontier"

   For the last several years, our group has been working on the task of learning simple subsets of an arbitrary natural language from examples of sentence-picture pairs (the L_0 task). Terry Regier's thesis was a great advance in several directions, but we have had difficulty extending the results to support inference or to cover a wider range of situations. The talk will describe our latest ideas on embodied concepts, their representation, and how they can be learned and used. It appears that active schemas will play a central role and need to be much better understood.

3.2.13 JULY 27: WORKSHOP ON APPLIED COGNITIVE SCIENCE: COGNITIVE SCIENCE IN THE WORKPLACE.

Director: Valerie Shalin

Day: Wednesday, July 27

Description:

This workshop addresses applications of cognitive science for the purpose of enhancing human performance in workplace settings. This workshop will be conducted in four sessions. Three of these sessions will include demonstrations, presentations, and hands-on exercises on selected topics. The fourth session is devoted to special problems, submitted in advance by workshop participants.

Program:

1. 8:00–8:30 A.M.: Registration and orientation
2. 8:30–10:00 A.M.: **Session I:**
   Making Technology Useable
   (enhancing product design for human-machine compatibility)
3. 10:00 A.M.: Break
4. 10:15–11:45 A.M.: **Session II:**
   The Problem of Describing Work with Words
   (the roles of task context, knowledge and culture in the intepretation of verbal job instructions)
5. 11:45
   footnotesize A.M.–12:45 P.M.: Lunch
6. 12:45–2:15 P.M.: **Session III:**
   Training for the Workforce of the Future
   (the problem of transfer and generalization, new approaches and technologies)
7. 2:15 P.M.: Break
8. 2:30–4:00 P.M.: **Session IV:**
   Participant Case Studies
9. 5:00–7:00 P.M.
   Donald A. Norman (plenary speaker series, Knox 20)
   "Applied Cognitive Science"

3.2.14 JULY 27: WORKSHOP ON THE ROLE OF METAPHOR SYSTEMS IN EMBODIED COGNITIVE SCIENCE.

Presenter: George Lakoff

Day and Time: Wednesday, 27 July, 9:00–11:00 P.M.

Description:

The discovery of the embodiment of conceptual systems in the mid-to-late 1970s utterly changed our conception of what thinking was about. Until then, it was thought to be logic-like and disembodied, describable by symbol-manipulation systems and model theory. But the discovery of basic-level concepts, prototypes, image-schemas, frame semantics, mental spaces, and conceptual metaphor changed all that. Over the past decade, the study of conceptual systems has been one of the fastest growing and most interesting aspects of cognitive science. And the most systematically studied aspect of our conceptual system has been our metaphor system.

This talk will go over the basic concepts of metaphor systems: mappings, invariance, grounding, duality, inheritance, alignment, families, compositionality, and blending. It will also review some basic subsystems: the metaphor systems for Time, Event Structure and Causation, the Self, and Morality.

3.2.15 JULY 28: WORKSHOP ON THE EVOLUTION OF COGNITION.

Directors: Leonard Talmy, Patricia Fox

Day: Thursday, July 28

Description:

The view has been largely accepted, and in some quarters specifically promoted, that any claims made in the area of cognitive science must be evolutionarily viable. However, acknowledgment of the legitimacy and necessity of this still-nascent subfield, Cognitive Evolution, carries with it attendant empirical problems that some of the older branches of evolutionary theory did not. Specifically, the stuff of cognitive science is such that direct empirical evidence bearing on evolution is scant and, hence, theoretical speculation plays all the more important a role.

The speakers in this Workshop represent diverse positions within the field, both in the sense of having expertise in differing areas of cognitive science as well as in the sense of holding differing views on questions relating to evolution. Given the newness of this field, the hope is that such a diversity of positions will contribute to identifying the most pressing issues and clarifying points of disagreement.

Program:

1. 9:00–10:20 A.M.
   Martin Daly and Margo Wilson
   "Natural Selection Theory and the Investigation of Cognitive Phenomena"

   Behavioral biologists customarily distinguish between "proximate" causal analyses of the mechanisms underlying action and "ultimate" (selectionist) analyses that invoke the adaptive functions (fitness-promoting consequences) for which the mechanisms of information processing and behavioral control have evolved. This distinction is crucial, but it is misused when invoked to justify ignoring one or the other mode of analysis. Proximate causal research is inevitably guided in part by implicit assumptions about adaptive function; selectionist theories, which make such assumptions explicit and develop their implications, can be important aids in discovering otherwise unsuspected mental mechanisms. We illustrate this thesis with reference to theory and research on social cognition and behavior in people and other animals.
2. 10:20–10:35 A.M.: Break
3. 10:35–11:45 A.M.
   Marc Hauser
   "The Design of Animal Minds"

   If we are to understand the evolution of human cognition, including the functional significance of its design features, then we must examine the cognitive capacities of nonhuman animals. The approach adopted in this presentation is to argue that the mental abilities of nonhuman animals have been designed to meet biologically salient properties of their species-typical environments. Consequently, it is important to conduct experiments that allow the animal to reveal such abilities and that are sensitive to evolved specializations. The point here, contra numerous studies in psychology and neurobiology, is that there is no such thing as "the monkey" or "the bird" with a specific ability, but different species of monkeys and birds, each species exhibiting mental capacities suited to environmental problems. Such specializations often lead to what I will call "laser beam intelligence", a form of intelligence that is domain specific. In comparison, I will argue that human cognition differs fundamentally from nonhuman animal cognition in that humans possess multiple laser beams. To buttress these arguments, I review the results of observations and experiments on nonhuman animal facial expression, deception, and knowledge of the physical world.

4. 11:45 A.M.–12:45 P.M.: Lunch break
5. 12:45–1:55 P.M.
   Steven Pinker
   "Evolution and Cognitive Science"

   Cognitive science is the scientific study of one biological system of one organism: the cognitive functions of the brain in humans. Curiously, it is unique among biological subdisciplines in being entirely divorced from evolutionary thinking, particularly adaptationist analysis. I discuss the logic of adaptationist reasoning from mainstream evolutionary biology, show why objections to applying it to the human mind are spurious, and emphasize the crucial connection between natural selection and cognitive science: Natural selection is the explanation for complex functional machinery in organisms, and the fundamental discovery of cognitive science is that even the most basic mental processes require complex functional machinery. I illustrate some of these points with reference to human language.
6. 1:55–2:05 P.M.: Break
7. 2:05–3:15 P.M.
   Peter M. Todd
   "Studying the Evolution of Cognition through Computer Simulations"

   Evolutionary and selectionist thinking is beginning to gain acceptance in some areas of cognitive science as an important way of understanding cognitive abilities in light of the functions they were adapted to perform. But our ability to make evolutionary arguments is somewhat hindered by the kinds of data we have access to. Historical (fossil) evidence of the evolution of most specific behaviors is indirect and usually sketchy; comparative cognition studies of currently diverged lineages can be problematic to apply to the reconstruction of the evolution of a single species; reverse-engineering cognitive mechanisms through careful analysis of the adaptive problems they were probably meant to solve is restricted by our lack of knowledge of ancestral conditions; and ongoing evolution is difficult to observe and experimentally manipulate at the scale of organisms whose cognition most interests us. To this set of important but incomplete tools has recently been added a fifth complementary approach to studying the evolution of cognition: computer simulations that allow us to study and test evolutionary processes in manageable time-frames. By constructing artificial environments in which simulated creatures behave and evolve over days rather than millenia, we can investigate the relationships between environmental characteristics and behavioral adaptations as they change through time, and uncover details of these processes that can guide our thinking about the evolution of cognition in real organisms. I discuss the methods employed by researchers in this area, and present some recent results, including the evolution of learning, cooperation and trust, and critical periods for language, that illustrate the usefulness of the simulation approach.
8. 3:15–3:25 P.M.: Break
9. 3:25–4:45 P.M.
   Massimo Piattelli–Palmarini
   "Evolution and Cognition, without Adaptation"

   It is perfectly correct, though unilluminating, to state that human cognition must ultimately find roots in biological evolution. It is quite another matter to claim that this evolutionary process must have been governed by adaptations to transparent utilities of the species. This line of argument leads sometimes to banalities, sometimes to unsupported "just so" stories, and the rest of the times to latent or patent contradictions. This is not surprising, because the role of adaptationism in biological evolution in general has been drastically sized down by the theory of punctuated equilibrium, and by the discovery of mechanisms such as genetic recruitment, genetic hitchhiking, and generalized transduction. Just a few months ago, it was determined (by Labandeira and Sepkoski)

that a variety of sophisticated mouthpieces in insects evolved 100 million years before there were any flowers on earth. These elaborate organs had been universally explained, until then, as "obvious" results of the adaptation of insects to their feeding habits. I explore the devastating consequences that these modern conceptions of biological evolution have for the adaptationist theory of cognition, and in particular for the much-advertised program of an "evolutionary psychology."

10. Evening: Panel Discussion
(time to be announced)

3.2.16 JULY 28–29: WORKSHOP AND TUTORIAL ON THE SNePS KNOWLEDGE REPRESENTATION AND REASONING SYSTEM.

Directors: Stuart C. Shapiro, Hans Chalupsky

Days: Thursday–Friday, July 28–29

Description:

This will be the Third International SNePS Workshop. The first day of the two-day workshop will be devoted entirely to a hands-on SNePS tutorial for people interested in learning about SNePS. The second day will be used for the presentation and discussion of SNePS-related papers.

The Semantic Network Processing System (SNePS), developed by Stuart C. Shapiro et al., is the implementation of a fully intensional theory of knowledge-representation and reasoning. Since its first incarnation in the early 1970s, the main goal driving its development has been the construction of an artificial or computational cognitive agent capable of communicating intelligently with other cognitive agents in natural language. In the last several years, many laboratories and individuals all over the world have obtained copies of SNePS, and have been using it as a tool for their own research or as part of implementations of applied AI systems.

SNePS is implemented in Common-Lisp and is available free of charge (via anonymous ftp) under the terms of the GNU General Public License. Here is a short summary of the major features and components of the current version, SNePS–2.1:

- Creation of and access to propositional semantic networks
- Path-based inference (a generalized form of inheritance)
- Node-based inference based on SWM (a relevance logic with quantification that uses natural deduction and can deal with recursive rules)
- Forward, backward, and bi-directional inference
- Generalized forms of logical connectives and quantifiers
- An assumption-based truth maintenance system for belief revision
- A morphological analyzer and a generalized ATN parser for parsing and generating natural language
- SNePSLOG, a predicate-logic-style interface to SNePS
- XGinseng, an X-based graphics interface for displaying, creating and editing SNePS networks
- SNACTor, a preliminary version of the SNePS Acting component
- SNIP 2.2, a new implementation of the SNePS Inference Package that uses rule shadowing and knowledge migration to speed up inference.

Thursday, July 28: The SNePS Tutorial

This is intended to be a one-day, hands-on learning session for people interested in how to use SNePS. The tutorial will be taught by **Stuart C. Shapiro** with the assistance of **William J. Rapaport**, **Hans Chalupsky**, and members of the SNePS Research Group. Participants will receive a set of "classic" SNePS papers and a complete SNePS bibliography.

The tutorial will be held in a computer laboratory equipped with SPARC workstations. Participants will work in small groups on individual workstations where they will be able to follow how things are done by the instructors, and where they will work individually on exercises to test what they have learned.

At least the following topics will be discussed:

- Building networks
- Retrieving nodes

- Path-based inference
- Rules and node-based inference
- Belief revision
- Natural language processing
- SNePSLOG
- XGinseng

Friday, July 29: The Workshop

This is dedicated to the presentation and discussion of SNePS-related research papers. One purpose of this workshop is to bring together researchers who are using SNePS in their ongoing research or for the development of applied AI systems, to further communication and cooperation with other SNePS researchers, and to promote the integration of independent developments. However, the workshop is not exclusively aimed at users of SNePS. The knowledge representation and reasoning issues that SNePS tries to address are genuine problems which are also tackled by many researchers outside the SNePS community.

Program:

1. 9:00 A.M.: Opening remarks (Stuart C. Shapiro)
2. 9:05 A.M.
   H. Sofia Pinto and João P. Martins
   "Inheritance in SNePS"

   We discuss two problems of inheritance theories in general, namely the confusion between classes and properties, and the inability to distinguish just by looking at a link if it was derived or introduced by the user. We present a solution to these problems using SNePS. SNePS's inheritance system can be classified as a credulous, mixed-inheritance system using off-path pre-emption and in which paths are built bottom-up.
3. 9:35 A.M.
   Pedro Moniz, Miguel Correia, and Nuno J. Mamede
   "Reasoning about Space in SNePS"

   The development of non-trivial domain knowledge representation and reasoning, such as naive physics, is becoming an important task of AI. One of the challenges that emerges in this domain is the simulation of physical systems, which requires a lot of theorem proving, planning, constraint satisfaction, and consistency checking. We have used a general-purpose semantic-network system to implement a spatial logic based on connectivity, and outlined a basic support for qualitative simulation.
4. 10:05 A.M.: Break
5. 10:20 A.M.
   Pedro A. Matos and João P. Martins
   "Parsimonious Diagnosis in SNePS"

   Kernel Diagnosis was developed to overcome some problems that were found in the Theory of Diagnosis from First Principles. Although Kernel Diagnosis doesn't give wrong answers as the Theory of Diagnosis from First Principles sometimes does, it is not parsimonious in the sense that all possible diagnoses must be generated. It does not use the parsimony criteria introduced in Reiter's Theory of Diagnosis from First Principles. We developed a method that reintroduces the parsimony criteria. The result is that we no longer have to generate all possible diagnoses, and therefore the computation of diagnoses may become greatly simplified. After presenting the method, we discuss an implementation based on SNePS.

6. 10:50 A.M.
   Stuart C. Shapiro
   "SNePS as a Database Management System"
7. 11:20 A.M.
   Michael J. Almeida "Aspect and the Aspectual Classes in Situation-Centered Representations"

   In the last few years, the use of situation-centered representations for natural-language semantics has become increasingly popular. Parsons and Wilensky, e.g., give many compelling arguments for this representational style. The basic idea is that in the semantic representation of a sentence such as *John threw a ball*, we have a token that denotes an event or situation of type throwing, and the entities that play roles in that situation, in this case, John and a ball, are related to the situation-token by assertions. The concern of this paper is with the implications of the situation-centered approach with respect to the characterization and representation of (1) the aspectual classes, (2) the perfective/imperfective aspectual distinction, (3) adverbials of duration, and (4) the progressive. It will be shown that all of these notions can be given useful and consistent formulations within this representational style.
8. 11:50 A.M.: Discussion
9. 12:00 NOON: Lunch break
10. 1:00 P.M.
    Anthony S. Maida
    "Predicate Calculus as a Tool to Study SNePS Ontology"

    This paper attempts to clarify some of the claims, and respond to one of the criticisms, of Maida & Shapiro's 1982 "intensional concepts" paper. We do this by amending some of the particular claims in the 1982 paper, suggesting more explicit terminology, and by translating the SNePS belief representations into predicate calculus. The translation shows that the ontology is not hardwired into SNePS. It can be revised without revising the SNePS language. Therefore, criticisms of the ontology are not necessarily criticisms of the language.
11. 1:30 P.M.
    Deepak Kumar and Syed S. Ali
    "Representing Plans and Acts using Structured Variables"
12. 2:00 P.M.
    Susan M. Haller
    "Interactive Generation of Plan Descriptions and Justifications"
13. 2:30 P.M.: Break
14. 2:45 P.M.
    J. Terry Nutter (tentative)
    Title to be announced.

3.2.17 JULY 29: WORKSHOP ON COGNITION AND BILINGUALISM.

Directors: Wolfgang Wölck and Lynne Yang

Day: Friday, July 29

Description:

Can the study of bilingualism help to understand general cognitive and linguistic processes? To answer this question, our workshop will examine the following issues:

- The influence of binlingualism and language contact on language development and change.
- Bilingual memory
- Translation and interpretation
- Cognitive and semantic relationships
- Models of bilingualism

Contributions from researchers working with fluent bilinguals and from those investigating the acquisition of bilingualism will be presented and discussed.

Program:

1. **Ellen Bialystock**
   "Bilingualism and Emerging Literacy"
2. **Annick DeHouwer**
   "Separate Development in Early Bilingual Acquisition: Cognitive Implications"
3. **Michael Harrington**
   "Development and Representation of the L2 Mental Lexicon"
4. **John Schumann**
   "Stimulus, Appraisal, Motivation, and Second Language Acquisition"
5. **Eta Schneiderman**
   Title to be announced
6. **Russell Tomlin**
   "Modeling Dynamic Processes in Second Language Acquisition: The Interplay of Social Interaction and Cognitive Change"
7. **Lynne Yang and Tom Givon**
   "Grammar Processing, Memory, and Comprehension in Early Second Language Acquisition"

4 PARTICIPANTS

This list includes all active participants in the Institute, including faculty, plenary speakers, and workshop participants.

- **Syed S. Ali**
  Computer Science, Southwest Missouri State University, Springfield, MO, USA
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  WORKSHOP ON THE SNePS KNOWLEDGE REPRESENTATION AND REASONING SYSTEM
  Syed S. Ali received his Ph.D. in computer science from SUNY Buffalo. He has published in *Minds and Machines*.

- **Michael J. Almeida**
  Mathematics and Computer Science, University of Maryland/Eastern Shore, Princess Anne, MD, USA
  WORKSHOP ON THE SNePS KNOWLEDGE REPRESENTATION AND REASONING SYSTEM
  Michael J. Almeida received his Ph.D. in computer science from SUNY Buffalo, where he was a member of the Graduate Group in Cognitive Science. He has taught at Pennsylvania State University and the University of Northern Iowa. He has published articles on tense and aspect in the AAAI and Cognitive Science Society Proceedings.

- **Luis Antunes**
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- **Steven Bayne**
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- **István S. N. Berkeley**
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  WORKSHOP ON CONNECTIONISM AND NEUROSCIENCE
  István S. N. Berkeley received the M.A. in philosophy from Alberta in 1990, where is currently a Ph.D. student in philosophy and cognitive science, and a member of the Biological Computation Project. He has publications and presentations in the fields of connectionism, philosophy of language and mind, history of philosophy, and epistemology.

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WORKSHOP ON LANGUAGE AND THOUGHT
Daniel Campos received his M.S. in computer science from SUNY Buffalo. He is the head of the Multimedia Program at the University of Concepcion, Chile. His research interests are related to knowledge-based, man-machine interfaces.

- **Roberto Casati**
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.28: PHILOSOPHY OF PERCEPTION
WORKSHOP ON ONTOLOGY OF SPACE
Roberto Casati studied philosophy at the Universities of Milano, where he got a Ph.D. with a dissertation on events, and Geneva, where he got a Ph.D. with a dissertation on sensory qualities. He was researcher for the Swiss National Science Foundation on two projects: Philosophy of Perception and Formal-Ontological Foundations of Artificial Intelligence Research. He presently teaches at the University of Neuchatel (Switzerland) and is research associate at the Ecole Polytechnique (France). Beginning in 1994, he will be with the CNRS, France. He is the author of several articles on metaphysics and the philosophy of perception, and co-authored with Achille Varzi the book *Holes and Other Superficialities* (Cambridge, MA; MIT Press, 1993). Together with Jerome Dokic, he is writing a book on sounds and auditory perception.

- **Oscar Castillo**
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WORKSHOP ON INTELLIGENCE, ATTENTION, AND INTENTION
Oscar Castillo is a professor in the Department of Computer Science of the Tijuana Institute of Technology in Mexico. His research interests include expert systems, machine learning, and natural-language processing.

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Hans Chalupsky is a Ph.D. student in computer science, conducting research on belief representation and simulative reasoning.

- **Alan Cienki**
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WORKSHOP ON LANGUAGE AND SPACE
Alan Cienki is an Assistant Professor in the Department of Russian Studies at Emory University in Atlanta. He received his Ph.D. from Brown University in 1988. One of his major research interests involves the application of different types of cognitive linguistic approaches to semantics in comparative linguistic study, especially of the Slavic languages.

- **Eve V. Clark**
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PLENARY SPEAKER SERIES
.22: FIRST LANGUAGE ACQUISITION
Eve V. Clark studied French at Aix-en-Provence and Edinburgh, and received her Ph.D. in linguistics from the University of Edinburgh. After working on the Language Universals Project, she joined the Linguistics Department at Stanford, and is currently Professor of Linguistics and Chair of the Department at Stanford University. She has also held visiting appointments at the University of California,

Santa Cruz; University College London; and the Max Planck Institute for Psycholinguistics in the Netherlands. She has worked extensively on first language acquisition, with emphasis on the acquisition of meaning and lexical development. She has also worked on lexical structure more generally, and on the semantics of word-formation. In addition to research on English, she has worked on the acquisition of French and done comparative studies of Hebrew and English acquisition. Her interests have ranged from the role of nonlinguistic information in the mapping of meanings, to mechanisms for change during acquisition, to the place of semantic information in word formation, and to pragmatic constraints on lexical development. Among her recent publications are "The Notion of Source in Language Acquisition" (*Language* 1989), "The Pragmatics of Contrast" (*Journal of Child Language* 1990), "Acquisitional Principles in Lexical Development" (in Gelman & Byrnes 1991), and *The Lexicon in Acquisition* (Cambridge University Press, 1993). She is currently on the editorial boards of *Cognition*, *Journal of Child Language*, *Journal of Memory and Language*, *Language and Mind*, *Linguistics*, and *Cahiers de Psychologie Cognitive*. She has been a Fellow at the Center for Advanced Study in the Behavioral Sciences (1979–1980) and a Guggenheim Fellow (1983–1984). She is a Member of the Royal Netherlands Academy of Sciences.

- **Herbert H. Clark**
Psychology, Stanford University, Stanford, CA, USA
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.30: PSYCHOLOGY OF LANGUAGE USE
Herbert H. Clark is Professor of Psychology at Stanford University. He received his B.A. in psychology from Stanford and his Ph.D. in psychology from the Johns Hopkins University. He taught at Carnegie Mellon University for three years and has been at Stanford ever since. He has taught at special institutes in Santa Cruz, Münster, Stanford, Goteborg, and Edinburgh; he was a visiting scholar for a year at University College London and for two years at the Max Planck Institute for Psycholinguistics in Nijmegen, the Netherlands; and he was a fellow for a year at the Center for Advanced Study in the Behavioral Sciences. Clark's primary interests are in language use broadly construed. He has worked on understanding, lexical semantics, indirect speech acts, politeness, reference, background knowledge or common ground, and disfluencies. Today, his main emphasis is on interactive processes in language use and their consequences for understanding, lexical semantics, indirectness, politeness, reference, and common ground. He is co-author with Eve V. Clark of *Psychology and Language: An Introduction to Psycholinguistics* (1977) and author of *Arenas of Language Use* (1992). His recent papers include "Referring as a Collaborative Process" (1986, with Deanna Wilkes-Gibbs), "Contributing to Discourse" (1989, with Michael F. Schober), and "Quotations as Demonstrations" (1991, with Richard Gerrig). Clark is past chair of the Department of Psychology at Stanford, fellow of the American Academy of Arts and Sciences, and fellow of the Society of Experimental Psychologists.

- **Alan Clune**
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Presently a Ph.D. student in philosophy at SUNY Buffalo. Earned M.S. in philosophy at Rensselaer Polytechnic Institute. Earned B.S. in Electrical Engineering at WPI. Areas of interest include philosophy of mind, epistemology, cognitive psychology.

- **Christopher Cohan**
Anatomical Sciences, SUNY Buffalo, NY, USA
.12: INTRODUCTION TO COGNITIVE NEUROSCIENCE
Christopher Cohan is Associate Professor of Anatomical Sciences at SUNY Buffalo.

- **Anthony Cohn**
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Anthony Cohn is a Reader in Automated Reasoning in the Division of AI, School of Computer Studies at the University of Leeds. He leads a research group working on Automated Reasoning with a particular

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- **John Corcoran**
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  .15: INTRODUCTION TO PHILOSOPHY FOR COGNITIVE SCIENCE
  John Corcoran in Professor of Philosophy and director of the Buffalo Logic Colloquium at SUNY Buffalo. He received his Ph.D. in philosophy from Johns Hopkins University and has taught philosophy and logic at the University of California at Berkeley, the University of Michigan, and the University of Santiago de Compostela (Spain), and linguistics at the University of Pennsylvania. His research interests are in history and philosophy of logic, mathematical logic, linguistic syntax and semantics, and philosophy of mathematics. He is the editor of the revised edition of Tarski's *Logic, Semantics, Metamathematics* (Hackett, 1983), and has published articles in *Argumentation*, *History and Philosophy of Logic*, and *Journal of Symbolic Logic*, among others.

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- **Hubert Cuyckens**
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  Martin Daly is Professor of Psychology and Biology at McMaster University, Past-President of the Human Behavior and Evolution Society, and a former Guggenheim Fellow. He has been a Fellow of the Center for Advanced Study in the Behavioral Sciences and Resident Scholar of the Rockefeller Foundation. He is the co-author, with Margo Wilson, of *Sex, Evolution and Behavior* (1978, 1983) and *Homicide* (1988).

- **Eve Danziger**
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- **Nina Dronkers**
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  .12: INTRODUCTION TO COGNITIVE NEUROSCIENCE
  .20: HEMISPHERIC MECHANISMS OF LANGUAGE AND COGNITION
  Nina Dronkers is the Acting Chief of the Audiology and Speech Pathology Service at the VA Northern California System of Clinics. She is also an Adjunct Assistant Professor at the University of California at Davis in the Departments of Neurology and Linguistics. She received her Ph.D. degree in Neuropsychology at the University of California, Berkeley. Since that time, she has conducted research at the VA Martinez in the areas of aphasia and other cognitive deficits resulting from brain injury, the cerebral localization and lateralization of language, and studies of semantic priming in aphasic and normal individuals. She has received a number of grants to support this research, primarily from the National Institutes of Health, the VA Department of Medical Research, and the National Science Foundation. Her publications cover several issues in aphasiology and the application of new techniques to study the effects of brain injury on the linguistic system. She is an active member of the Academy of Aphasia and the International Neuropsychological Society and reviews for *Brain and Language*, *Aphasiology*, and *Journal of Cognitive Neuroscience*.

- **Matthew S. Dryer**
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  .14: INTRODUCTION TO LINGUISTICS IN COGNITIVE SCIENCE
  Matthew S. Dryer is Associate Professor of Linguistics and a member of the Center for Cognitive Science at SUNY Buffalo. He received an M.Sc. in Computer Science from the University of Toronto, specializing in discourse generation, and his Ph.D. in Linguistics from the University of Michigan. He came to UB in 1989 after ten years at the University of Alberta. He has held visiting positions at UCLA and at the Max Planck Institute in Nijmegen. His primary research interest is in linguistic typology; since 1983 he has been working on an NSF-funded project establishing a large cross-linguistic database on word order and related typological characteristics, and he has produced a number of publications in this area. His other research interests include discourse, American Indian languages (particularly Kutenai), and syntactic theory. Recent papers include "Primary Objects, Secondary Objects, and Antidative" (*Language* 1986), "Discourse-Governed Word Order and Word Order Typology" (*Belgian Journal of Linguistics* 1989), "The Greenbergian Word Order Correlations" (*Language* 1992), and "The Discourse Function of the Kutenai Inverse" (to appear). He is a member of the Editorial Board of the *Canadian Journal of Linguistics*.

- **Judith Felson Duchan**
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  .21: LANGUAGE DISORDERS IN CHILDREN
  WORKSHOP ON DEIXIS IN NARRATIVE
  Judith Felson Duchan is Professor and Chair of the Department of Communicative Disorders and Sciences, and a member of the Center for Cognitive Science, at SUNY Buffalo. She received her Ph.D. in Speech–Language Pathology from the University of Illinois in 1972 and has been a visiting professor at Harvard University, Southern Illinois University, the Graduate Center of the City University of New York, and Tel Aviv University in Israel. Her research interests have been concentrated in language acquisition and language disorders, with a special emphasis on the area of pragmatics. Her recent focus is on autistic children's use of facilitated communication, and the role of discourse markers in children's and adults' narratives. Her publications include *Assessing Children's Language in Naturalistic Contexts* (co-authored with Nan Lund), an edited journal issue of *Topics in Language Disorders* on Communication with Children with Autism, "Interclausal Connectives as Discourse Continuity Markers" (with E. Segal & P. Scott), "Everyday Events: Their Role in Language Assessment and Intervention," and "Functionalism: A Perspective on Autistic Communication." She is a frequent presenter at state and national conferences on theoretical and clinical issues related to language disorders in children. She currently serves as coordinator of Division 1, Language Acquisition and Disorders, of the American Speech–Language–Hearing Association.

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  Carola Eschenbach studied computer science and mathematics in Hamburg University. Since 1988 she has been research assistent at the computer science department. Her thesis on natural language expressions involving numerals was finished in 1993. Her current research topic is natural and formal ontology.

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- **Jocelyne Fernandez-Vest**
  CNRS, France
  WORKSHOP ON LANGUAGE AND SPACE
  Jocelyne Fernandez-Vest is a Research Professor at the French CNRS. She is in charge of the European Department of the Laboratory of Languages and Civilisations with Oral Traditions (LACITO) and the head of a project about "Orality and Cognition" within the French network of Cognisciences.

- **Janet Dean Fodor**
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  Janet Dean Fodor is Distinguished Professor at the City University of New York Graduate Center. Her B.A. is from Oxford University, her Ph.D. from MIT. She taught for 13 years at the University of Connecticut before moving to New York. Over the years, she has worked on syntax, semantics, sentence processing, and learnability theory. Current projects include experiments on the psychological reality of empty categories, research on Japanese parsing, comparison of parameter setting with phrase structure learning, and a defense of defaults in linguistics and learning models.

- **Jerry Fodor**
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  [In reply to our request for a two-line bio, he writes:] "I don't need two lines for a bio; nothing has ever happened to me. I'm a Professor of Philosophy and a member of the Center for Cognitive Science at Rutgers. My most recent book is: *The Elm and the Expert* (MIT Press, 1994)." In addition, he is on the editorial board of *Minds and Machines*.

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  Linda Forrest is presently working towards a Ph.D. in Linguistics at the University of Oregon.

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- **Scott M. Freundschuh**
  Geography, Memorial University, Newfoundland, Canada
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  .08: GEOGRAPHIC ORGANIZATION OF SPACE
  Scott M. Freundschuh is Assistant Professor of Geography at Memorial University of Newfoundland, Canada, where he teaches courses in map use and function, map design, and geographic information systems. He spent the 1993–1994 academic year as a Postdoctoral Research Associate with the National Center for Geographic Information and Analysis at the University of Maine, Orono. While with the NCGIA, Freundschuh is pursuing research with Max Egenhofer and Reginald Golledge on spatio-temporal reasoning. In addition, Freundschuh is working on research involving spatial image schemas, locatives, and the kinds of spaces expressed in children's literature, and is exploring the effect of color and map context on perceived spatial relationships between 1D and 2D map features. Freundschuh received his Ph.D. in Geography from SUNY Buffalo in 1992. His thesis focused on models of spatial knowledge acquisition and the influence of the pattern of the environment on the acquisition of spatial knowledge. Further work on this topic has included the comparison of spatial knowledge acquired from maps and narrative, and the acquisition of spatial knowledge over time.

- **Natalya Fridman**
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- **Brian Funt**
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  .02: ARTIFICIAL INTELLIGENCE APPROACHES TO VISION
  Brian Funt studied Artificial Intelligence at the University of British Columbia, where he received his Ph.D. in Computer Science in 1976 for work on the use of vision in diagrammatic reasoning. He then was a postdoctoral fellow at Stanford, a member of the SUNY Buffalo Computer Science faculty, and is now a Professor of Computing Science at Simon Fraser University where he has been since 1980. His research focusses on computational vision, in particular color vision. At ICCV–2, he and co-author Jian Ho were presented the Marr prize for "Color from Black and White."

- **Klaus–Peter Gapp**
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  WORKSHOP ON LANGUAGE AND SPACE
  Klaus-Peter Gapp studied Computer Science at the University of Saarbrücken, Germany. In 1993 he started research toward a dissertation on the "Referential Semantics of Natural Language Spatial Descriptions" in the Graduate Program on Cognitive Science at the University of Saarbrücken.

- **Dedre Gentner**
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  Dedre Gentner is Professor of Psychology at Northwestern University and Chair of the Cognitive Science Society. She is noted above all for her work on mental models. She is on the editorial boards of *Cognitive Development, Journal of Learning Sciences, Journal of Metaphoric and Symbolic Behavior, Journal of Experimental and Theoretical Artificial Intelligence*, the *Learning Development and Conceptual Change* series and the Oxford University Press *Counterpoint* series.

- **LouAnn Gerken**
  Psychology and Cognitive Science, SUNY Buffalo, NY, USA
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  .13: INTRODUCTION TO COGNITIVE PSYCHOLOGY
  .27: PERCEPTION AND PRODUCTION OF SPOKEN LANGUAGE
  LouAnn Gerken is Assistant Professor of Psychology and a member of the Center for Cognitive Science at SUNY Buffalo. She received her B.A. in Psychology from the University of Rochester and her Ph.D. in Psychology from Columbia University. Professor Gerken studies how young children learn language. Her work focuses on three main areas: First, she has been creating a model of speech production in children, with a major goal being to determine how much the form of their utterances reflects what they know about language and how much it reflects constraints on production. Second, she has been examining the role of prosody in helping young children locate linguistic units in the speech stream and infer syntactic structure. Third, she has begun to study comprehension and production processes in children with Specific Language Impairment and to compare these to processing models developed with respect to normal children. Recent papers include: "Function Morphemes in Young Children's Speech Perception and Production" (*Developmental Psychology* 27: 204–216); "The Metrical Basis for Children's Subjectless Sentences" (*Journal of Memory and Language* 30: 431–451); "Phonological Development" (in M. A. Gernsbacher (ed.), *The Handbook of Psycholinguistics*).

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  WORKSHOP ON LANGUAGE AND SPACE
  Milena Zic–Fuchs teaches linguistics at the English Department, University of Zagreb; her research interests are in cognitive linguistics, primarily English verbs of motion.

- **David A. Zubin**
  Linguistics and Cognitive Science, SUNY Buffalo, NY, USA
  `linzubin@ubvms.cc.buffalo.edu`
  .09: INFERENCE IN DISCOURSE
  WORKSHOP ON DEIXIS IN NARRATIVE
  David A. Zubin is Associate Professor of Linguistics and a member of the Center for Cognitive Science at SUNY Buffalo. He received his Ph.D. in Linguistics from Columbia University, and taught at Southern Illinois University before coming to Buffalo. His research interests include categorization

South Campus

1. CHEMISTRY/MATHEMATICS LIBRARY: 829-2165
2. HEALTH SCIENCES LIBRARY, Abbot Hall: 829-3335

MINISTRIES: 854-2920

PARKING

Parking on campus requires a permit between 7:00 a.m. and 3:00 p.m., except for visitors lots and metered spaces (see UB North Campus map). Parking in the visitors lots costs $3.24/day.

Campus Parking Office
102 Spaulding Quad
North Campus (645-3943)

POSTAL SERVICES

The Post Office is in the University Bookstore, 200 Lee Entrance, North Campus (645-3131). The services include Express Mail (including international), stamps and domestic money orders. 3:30 p.m. is the last mail drop of the day, and stamps and money orders are sold until 4:00 p.m. CASH ONLY is acceptable for payment.
***Note**: the following services are **not** available:
passports, holding of mail, receipt of mail, shipping of suitcases, postal coupons.

Common costs for international mailings:
$ .40 postcard
.50 1/2 oz. letter (1 page in a standard envelope)
.95 standard greeting card
A vending machine with various denominations of stamps (coins or bills may be used) is located in the CAPEN lobby.

MAILBOXES are located in the entrance to the ground floor of Capen Hall.
EXPRESS MAIL and **FEDERAL EXPRESS** drop-off boxes are located in the CAPEN lobby. **DHL** drop-off boxes are located outside of Bell Hall.

UNIVERSITY BOOKSTORES

North Campus: Adjacent to lake La Salle
200 Lee Entrance (645-3131)
South Campus: 3610 Main Street (across from South Campus) (833-7131)

UB COMMONS SHOPPING CENTER:
First Floor:

1. UNIMART (general store)
2. CAMPUS TEES AND SWEATS
3. MURRAY TRAVEL AGENCY
4. COPY STOP
5. CVS PHARMACY
6. UB MICRO SALES CENTER
7. PIZZA HUT
8. THE SUB SHOPPE
9. BRADENS - COFFEE AND PASTRIES
10. BURGER KING
11. DOWNTOWN RENT-A-CAR
12. GPA INSURANCE SERVICES

Second Floor:

1. OPTICAL IMAGE
2. D'ANGELO HAIR & COSMETICS

VENDING MACHINES

Food vending machines are located in most of the buildings. The easiest ones to reach from the Student Union are the following:

1. BALDY HALL, 2nd floor (in front of the Lockwood Library indoor entrance)
2. BELL HALL, 1st floor
3. CAPEN HALL, 2nd floor (in front of the Office of Records and Registration)
4. CLEMENS HALL, 2nd floor (in the walkway towards BAIRD HALL)
5. STUDENT UNION, 2nd floor (from the entrance in front of UB COMMONS)

***Note**: some machines accept coins only. A coin exchange machine is available at some vending machines locations (ex.: CAPEN).

*****HEALTH CARE*****

*** **For emergencies:** dial '**0**' (Operator), if you are off-campus, or **2222** if you are on-campus (from both campuses).

*** **EMERGENCIES BLUE PHONES, WITH A DIRECT LINE TO PUBLIC SAFETY, ARE AVAILABLE AT SEVERAL LOCATIONS ON CAMPUS.**

*** **24 Hour First Aid: Michael Hall (South Campus)**

*** **Walk-in Fist Aid, Urgent Care: Michael Hall (829-2579)**
Note: to be treated in Michael Hall the payment of $12.50 fee is required (it covers the whole month of July).

AMERICAN RED CROSS
786 Delaware Ave.
BUFFALO (886-7500)

BUFFALO GENERAL HOSPITAL
100 High Street
BUFFALO (845-5600)
***Out-Patient Clinic**
338 Harris Hill Rd.
Williamsville, NY (634-4023)

ERIE COUNTY MEDICAL CENTER
462 Grider Street
BUFFALO (898-3000)

MILLARD FILLMORE HOSPITAL
3 Gates Circle
BUFFALO
***Out-Patient Department**: 887-4690

MILLARD FILLMORE SUBURBAN
1540 Maple Road
WILLIAMSVILLE (688-3100)

*****DENTAL CARE CENTERS*****

ARTISTIC DENTAL CENTER
Dr. Richard Genau
1410 Millesport Hwy (across from Marriot Hotel)
AMHERST (688-5046)

DENTAL EMERGENCY SERVICE
Erie County Dental Society
876-2117

*****CHILD CARE*****

AUDUBON CHILD DEVELOPMENT CENTER
4625 Harlem Rd.
AMHERST (839-2663)

KIDS WORLD DAYCARE CENTER
785 Millersport HwY
AMHERST (832-4910)

LITTLE PEOPLES PARK
2153 Niagara Falls Blvd.
AMHERST (691-5956)

RIPEN WITH US CHILD CARE
2148 Niagara Falls Blvd.
AMHERST (692-7199)

WHEATFIELD DAY CARE
3050 Niagara Falls Blvd.
TONAWANDA (694-1695)

*****HELPFUL HINTS*****

CANADIAN CONSULATE
3000 Marine Midland Center
Buffalo (858-9500; 852-1252; hours: 8:30-4:30, M-F)

***Documentation needed for entry into Canada:**
US citizens - one of the following is **REQUIRED**:
+ valid US passport
+ original birth certificate (or certified copy)
+ voter registration card
+ draft card

It is also recommended to carry photo identification.
Non-US citizens, not permanent residents - a visa may be required; contact the Consulate for more information.

TELEPHONE
1. Local Calls: (minimum cost $ .25) dial the 7-digit number

2. Long distance Calls:
Outside 716 area, dial: '1 - (Area Code) - (7-digit number)'
Outside Regional Calling Area, but within 716 area, dial: '1 - 7-digit number'

3. International Calls, dial: '011 - (Country Code) - (Area Code) - (number)'

Important numbers:
EMERGENCIES: dial **911**
OPERATOR: dial '0'

***Note**: for Operator assisted calls from a public phone no coin is needed. For '1-800' numbers there is no charge. Most of them are nationwide numbers.

TRANSPORTATION
City Transportation:

City public transportation is provided by **METRO-BUS** and **METRO-RAIL**. Routes and Schedules are available in the Student Union and in the Science & Engineering Library (SEL).

METRO-BUS
It covers most of the city areas. Cash fare is paid to the bus driver upon boarding the bus. The bus fare is $ 1.10 for rides within Zone 1. (For inter-Zones fares look in the back of the bus

schedule.) If a transfer to a second bus is needed, a $ .20 transfer charge is paid upon boarding 2nd bus and showing the driver the ticket purchased on the 1st bus.

South Campus Station (**SCS**) is the terminal for most of the city bus lines.

***To go Downtown**: take bus **#8** or **train at SCS**.

METRO-RAIL

There is only one train line to-and-from Downtown Buffalo. Terminal: SCS. Tickets may be purchased from the machines at the station.

***To go to the South Campus Station** take the **Shuttle bus** (Blue Bird) at one of the North Campus stops **or** the **Metro bus #44** at the Flint Loop stop (it runs approximately every hour).

***To go to the Buffalo Airport** take **Metro bus #30** at the South Campus Station.

Out-of-city Transportation:

Bus lines Terminal is at 181 Ellicot Street, Buffalo.
Metro-Rail stop: **Church**.

Bus Lines:

GREYHOUND BUS LINES
181 Ellicot St.
BUFFALO, NY 14203
Toll free dial: 1-800-231-2222

EMPIRE TRAILWAYS
181 Ellicot St.
BUFFALO, NY 14203
852-1750

NIAGARA FRONTIER TRANS AUTHORITY
181 Ellicot St.
BUFFALO, NY 14203 (855-7211)

Train lines:

AMTRAK (1-800-872-7245)
55 Dick Rd.
DEPEW, NY (683-8440)

or:

75 Exchange, BUFFALO, NY (856-2075)
(Metro rail stop: AUDITORIUM)

** **TO GO TO THE NIAGARA FALLS** (American side): take bus route **#40** at 181 Ellicot St. Bus Station. Fare is $1.70 one way. One hour trip. A Passport is needed to go the Canadian side of the Falls.

GENERAL

BANKS AND FOREIGN EXCHANGE SERVICES

KEY BANK
TOPS INT'L Branch
3134 Bailey Ave. AMHERST (831-9047)
General number: 1-800-825-4539

MARINE MIDLAND BANK
5556 Main Street
BUFFALO, NY
General number: 833-6333

M & T BANK
One M&T Plaza (Downtown)
BUFFALO, NY
General number: 639-6000

AMERICAN EXPRESS
Travel Service Office
440 Main Street
BUFFALO (856-7373)

THOMAS COOK
47 Court - Buffalo 856-6747; Factory Outlet Mall - Niag. Fls. 297-0876
732 Alberta Drive - Amherst 836-8856; Rainbow Centre - Niag. Fls. 284-0642

BOOKSTORES

BARNES & NOBLES
1089 Niagara Falls Blvd.
AMHERST, NY (834-0626)

BROWSERS'
Used Bookstores
2840 Delaware Ave.
BUFFALO, NY

EAST WEST BOOKS
3588 Main Street
BUFFALO, NY (across from South Campus) (834-9000)

TALKING LEAVES BOOKSTORE
3144 Main Street
BUFFALO, NY (837-8554)

VILLAGE GREEN BOOKSTORE
1. 765 Elmwood Ave.
   BUFFALO, NY 14222 (884-1200)
2. 2309 Eggert Road.
   TONAWANDA, NY (836-8960)

WALDENBOOKS
1. Main Place
   BUFFALO (852-0806)
2. Boulevard Mall , AMHERST (833-8820)

MEDIA PLAY
3054 Sheridan Drive
AMHERST, NY

FLEA MARKETS
ANTIQUE WORLD MARKETPLACE
10995 Main Street
CLARENCE (759-8483)

HOTELS

MARRIOT HOTEL
1340 Millersport Highway
AMHERST (689-6900)

UNIVERSITY INN
2401 North Forest Road
AMHERST (636-7500)

HOLIDAY INN
1881 Niagara Falls Boulevard
AMHERST (691-8181)

LORD AMHERST MOTOR HOTEL
5000 Main St.
AMHERST (839-2200)

MOTEL 6
4400 Maple Road
AMHERST (834-2231)

RED ROOF INN
I-290 & Millersport Highway
NORTH WILLIAMSVILLE (689-7474)

RENTAL CARS
Downtown Rent-A-Car
104 The Commons (at UB)
AMHERST (632-8222)

Budget Car & Truck Rental
1340 Millersport Highway (in the Marriott)
AMHERST (689-4535)

MARKETS (24 hours service)

TOPS INTERNATIONAL PHARMACY
Maple Rd. at N Bailey AMHERST (834-2955)

TOPS FRIENDLY MARKETS
3500 Main Street (across from South Campus)
AMHERST (837-8470)

WEGMANS 'S FOOD PHARMACY
575 Alberta Drive (across from TOPS Int'l)
AMHERST (835-4233)

SHOPPING CENTERS

BOULEVARD MALL
Niagara Falls Blvd.
AMHERST (834-8600)

MAIN PLACE MALL
Liberty Building (Downtown, Metro Rail stop: Church)
BUFFALO (855-1900)

NORTHTOWN PLAZA
3097 Sheridan Drive
AMHERST (836-6603)

RAINBOW CENTER FACTORY OUTLET MALL
302 Rainbow Blvd. (One block from the Falls)
NIAGARA FALLS (285-9758)

THE NIAGARA FACTORY OUTLET MALL
1900 Military Road
NIAGARA FALLS (297-2022)

WALDEN GALLERIA
NAYS Thruway Exit 52 to Warden Ave. & Union Rd.
CHEEKTOWAGA (681-7600)

*****AROUND THE CITY*****

MUSEUMS AND PLACES OF INTEREST

**** **ALBRIGHT KNOX GALLERY**
1285 Elmwood Av.
BUFFALO (882-8700)
Admission Fee: Adult $4, Student $3, Senior and under 12 is free. **Free Saturdays: 11.00am - 1:00pm.**

*** **AMHERST MUSEUM & HISTORICAL PARK**
3755 Tonawanda Creek Rd.
EAST AMHERST (689-1440)

*** **BUFFALO & ERIE COUNTY HISTORICAL SOCIETY**
25 Nottingham Court
BUFFALO (873-9644)
Admission Fee: Adult $3.50, Children (age 7-15) $1.50, (Children under 7: free), Senior $2.
Free: last Sunday of every month.

*** **BUFFALO MUSEUM OF SCIENCE**
1020 Humboldt PKWY
BUFFALO (896-5200)
Admission fee: Adult $5.25, Children (age 3-18) $3.25, (Children under 3: free) Senior $3.25. **Free: Fridays and Saturdays.**

**** **CHAUTAUQUA INSTITUTION** (Open June 25 - August 28)
1 Ames Street
Chautauqua, NY
(716) 357-6200
Admission fee: varies according to the events included in the day schedule.

*** **OLD FORT NIAGARA**
Fort Niagara State Park
Youngstwon, NY
(716) 745-7611

*** **BUFFALO CITY HALL OBESERVATION TOWER**
65 Niagara Square (Downtown, Metro Rail Stop: Lafayette)
BUFFALO
(Elevator to the 28th floor deck. Open: Monday through Friday. **Admission: free**)

**** **Darwin D. Martin House** (designed by **FRANK LLOYD WRIGHT**)
125 Jewett PKWY (off Main Street, east of Delaware Park)
Buffalo, NY 14214
&:
Gardener's cottage (Darwin D. Martin House) (by **F.L.WRIGHT**)
285 Woodward Av. (back of Martin's House)
Buffalo, NY 14214

** **Theodore Roosevelt Inaugural National Historical Site**
641 Delaware Ave.
BUFFALO (884-0095)
Admission fee: Adult $2, Children $1.

*** **BUFFALO ZOO**
300 Parkside Ave.
BUFFALO (837-3900)
Admission fee: Adult $5.25, Children (age 4-16) $3.15, (Children under 4: free), Senior $2.10
Free: Wednesdyas and Thursdays: 20% discount.

*** **BUFFALO BOTANICAL GARDENS**
2655 South Park Ave.
BUFFALO (828-1040)
Admission is free. Donations are welcome.

PARKS

DELAWARE Park (Downtown)
ELLICOT CREEK Park (NE of North Campus)
BEAVER ISLAND STATE Park (Beaver Island, beach)
EVANGOLA STATE Park (South of Buffalo, beach)

SPECIAL EVENTS IN JULY

BURGERFEST '94 (July 16-17)
HAMBURG (649-7917)
** celebrate the birth of the hamburger **

GOSPELFEST (July 23)
War Memorial Stadium
BUFFALO (854-4FUN)
** gospel music **

JAZZ AT THE ALBRIGHT KNOX (Starting July 9: every sunday 2:00P-4:30P)
Abright Knox Gallery (outside, Delaware Park entrance)
BUFFALO (882-8700)
** jazz music **

SHAKESPEARE IN THE PARK
681 Main Street
BUFFALO (852-6638)
** theatre performances**

TASTE OF BUFFALO (July 9-10)
Downtown Buffalo: 11:00A - 8:00P
(835-0643)
** food extravaganza **

WATERFRONT FESTIVAL SUMMER (July 5, 12, 19, 26: 7:00P)
LaSalle Park
BUFFALO (884-8865)
** musical entertainment **

THEATERS AND MOVIE THEATERS(*)

ARTPARK
150 S.Fourth St. LEWINSTON (1-800-659-7275)

KLEINHANS MUSIC HALL
370 Pennsylvania Ave. Downtown BUFFALO (885-5000)

PFEIFER THEATER
681 Main Street (Downtown, Metro Rail Stop: THEATER)
BUFFALO (847-6461)

STUDIO ARENA THEATER
710 Main Street (Downtown, Metro Rail Stop: THEATER)
BUFFALO (856-5650)

SHEAS' PERFORMING ARTS CENTER
646 Main Street (Downtown, Metro Rail Stop: THEATER)
BUFFALO (847-0850)

MARQUEE AT THE TRALF (Nightclub)
100 Theater place (Downtown, Metro Rail Stop: THEATER)
BUFFALO (852-0522)

AMHERST THEATER
3500 Main Street (across from South Campus)
BUFFALO (834-7655)

BUFFALO DRIVE-IN THEATER
3085 Harlem Rd.
CHHEKTOWAGA (893-0406)

MAPLE RIDGE 8 THEATERS
4276 Maple Rd. (Close to North Campus, South East)
AMHERST (833-9500)

MARKET ARCADE
639 Main Street (Downtown, Metro Rail Stop: THEATRE)
BUFFALO (855-3022)

NORTH PARK THEATER (Art Movies)
1428 Hertel Ave.
BUFFALO (836-7411)

UNIVERSITY CINEMA
4100 Maple Rd.
AMHERST (837-8373)

(*) Reductions applied to students.

Titles in Cognitive Science from Ablex Publishing Corporation

BEYOND UNIVERSALS IN COGNITIVE DEVELOPMENT, SECOND EDITION
David Henry Feldman, Tufts University
Published 1994 / 232 pages
Cloth: 1-56750-031-5 / $47.50
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MINDS, BRAINS AND COMPUTERS: PERSPECTIVES IN COGNITIVE SCIENCE AND ARTIFICIAL INTELLIGENCE
Editors: *Ralph Morelli, W. Miller Brown, Dina Anselmi, Karl Harberlandt and Dan Llyod*
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Paper: 0-89391-962-4 / $24.95

COGNITION AND COMPUTER PROGRAMMING
Editors: *Karl F. Wender, Franz Schmolhofer, and Heinz-Dieter Bocker*
1994 In Preparion
Cloth: 1-56570-094-3 / Call for price.
Paper: 1-56750-095-4 / Call for price.

MACHINATIONS: COMPUTATIONAL STUDIES OF LOGICS, LANGUAGE, AND COGNITION
Editors: *Richard Spencer-Smith and Stephen Torrance*
Published 1992 / 240 pages
Cloth: 0-89391-655-2 / $55.00
Paper: 0-89391-909-8 / $32.50

A PRACTICAL GUIDE TO USABILITY TESTING
Joseph S. Dumas and Janice C. Redish, both, American Institutes for Research
Published 1994 / 336 pages
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Greg Kearsley, The George Washington University
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mit's dynamic theories

THE COGNITIVE NEUROSCIENCES
edited by Michael S. Gazzaniga

The Cognitive Neurosciences is a major new reference that documents and defines the emerging field of cognitive neuroscience. The ninety-two original contributions provide comprehensive coverage — from the molecular level right up to human conscious experience — of one of the most interesting areas of modern science, namely the relationship between the structural and physiological mechanisms of the brain/nervous system and the psychological reality of mind.

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A Bradford Book 1,296 pp., 555 illus., 8 pp. color $95.00 (January 1995)

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Jerry A. Fodor

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Jean Nicod Lectures (The inaugural volume in an effort to develop the interdisciplinary field of cognitive science in France)

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A Developmental Perspective on Cognitive Science
Annette Karmiloff-Smith

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Proceedings of the Fourth International Workshop on the Synthesis and Simulation of Living Systems, July 6-8, 1994, the Massachusetts Institute of Technology
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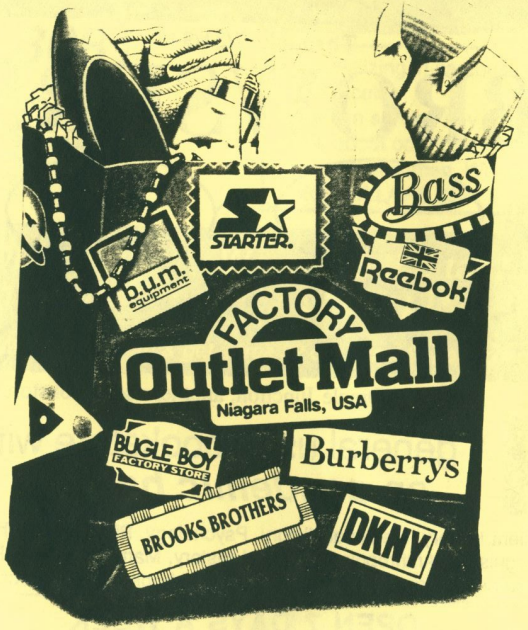

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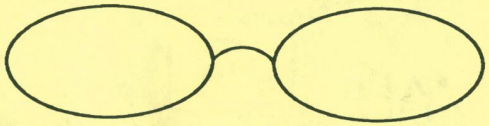

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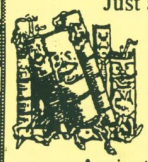

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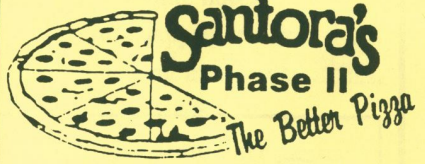

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