Department of Cognitive Science (https://cognitivescience.case.edu/)

Past Colloquia: 2008

Capstone Presenters. Wednesday, 10 December, 4-6 pm. 618 Crawford Hall.

Ryan Kulp: Do Interviewer Gestures Influence Recall?

Amanda Dewitt: Gesture Comprehension in Individuals With and Without Asperger's Syndrome.

Rahul Sharma: Effects of Glioma and Similar Deep-Seated Brain Tumors on Cognitive Functioning.

Viyan Udawatta: Perceptions of Mindedness and Moral status: A Cross-Cultural Study.

William Deal. Wednesday, 19 November 2008, 4-5pm. 618 Crawford Hall. Title: Framing the Bodhisattva: Cognitive Semantic Perspectives on Japanese Buddhism. William Deal is the Severance Professor of the History of Religion at Case Western Reserve University. Website (http://www.williamdeal.org/).

Abstract: Religious studies scholars have shown increasing interest in the cognitive science of religion, an assemblage of new approaches to the academic study of religion spearheaded by scholars such as Pascal Boyer and Thomas Lawson. Evidence of this interest appeared in the June 2008 issue of the *Journal of the American Academy of Religion*, which featured an article by Edward Slingerland on the significance of cognitive science to the study of religion. Within the cognitive science of religion, however, there have been few attempts to theorize and apply cognitive semantics to an analysis of religion and religious texts (Slingerland's own research is a prominent exception). My attraction to cognitive semantics derives from my work on issues of interpretation, rhetoric, and ideology in the study of Japanese Buddhist texts. My work to date has primarily applied postmodern methodologies to these Buddhist texts, with little attention given to the cognitive constructs that are in operation in this literature. For reasons I will make clear in my presentation, I no longer find postmodern

approaches sufficient. Within cognitive semantics I find the possibility of concepts and theories that can provide a far richer and more robust account of what is occurring in these Japanese Buddhist texts. In short, I seek a way to reconcile issues of embodied cognition with the cultural contexts in which religious discourse is produced, and to do so in a way that takes into consideration the cognitive limitations on what counts as a plausible interpretation. In this colloquium, I apply frame semantics and mental space theory to the Hokke genki ("Miraculous Tales of the Lotus Sutra"), an eleventh century Japanese collection of brief stories extolling the spiritual benefits of the Lotus Sutra, historically one of the most influential Buddhist scriptures in East Asia. I explore how the interpretation of these stories is both cognitively and contextually constrained, and consider how cognitive activity negotiates language and context to produce the Buddhist meanings found in these narratives.

Tarcisio de Arantes Leite and Leland McCleary. Wednesday, 5 November 2008, 4pm. 618 Crawford Hall. Title: Prosody, attentional gesture and segmentation in Brazilian sign language conversation. Tarcisio de Arantes Leite has been admitted as professor of Libras at the Federal University of Santa Catarina and Leland McCleary is professor of modern languages at the University of São Paulo, Brazil. Website (http://mccleary.futuro.usp.br/).

Abstract: An enduring issue in sign language linguistics based on naturalistic discourse is knowing how to segment the stream of speech without imposing grammatical categories and relations which may be more appropriate to the oral-language gloss than to the language on its own terms (Baker & Padden 1978). One way to< investigate how the language is segmented "on its own terms" is to tap into the intuitions of native speakers as they project possible turn-completion points in the course of a conversation. Having established that Brazilian sign language (Libras) speakers follow the one-speaker-at-a-time heuristic common for oral languages (Sacks, Schegloff & Jefferson 1978), this presentation will focus on the analysis of how sign language prosody and orientational and indexical gestures (especially eye gaze, body and head orientation, pointing and sign spatialization) contribute to the production of attentional framings (Langacker 2001) toward which conversationalists orient in performing complex turns such as lists and contrasts.

Dimitria Gatzia. Wednesday, 15 October 2008, 4-5pm. 618 Crawford Hall. Title: Color Subjectivity: The Individual Variability problem. Dimitria Gatzia is Assistant Professor in theDepartment of Philosophy (http://www3.uakron.edu/philosophy/Site/Welcome.html) at the University of Akron. Individual website. (http://degatzia.googlepages.com/)

Abstract: Studies show that there are widespread intrasubjective and intersubjective color variations among subjects who do not suffer from color deficiencies, i.e., normal subjects. I argue that these variations present difficulties, albeit not the same kind, for both realists and subjectivists about color. This suggests that we ought to rethink the debate about the nature of color. I offer some alternative ways of thinking about the problem of color.

Ana Eliza Barbosa de Oliveira and Bento Carlos Dias da Silva. Wednesday, 15 October 2008, 3-3:30pm. 618 Crawford Hall. Title: "Metaphors and WordNets." Ana Eliza Barbosa de Oliveira is Ph.D Student and Bento Carlos Dias da Silva is Associate Professor in the Department of Modern Languages at Sao Paulo State University (UNESP), Araraquara, Sao Paulo, Brazil.

Antônio S. Abreu and Sarah Barbieri Vieira. Wednesday, 15 October 2008, 3:30-4pm. 618 Crawford Hall. Title: "Projections, culture, and image schemas as metacognitive resources for learning English as a second language."

Abstract 1: "Metaphors and Wordnets."Research in Human Language Technology has proven the need for extensive and complete machine tractable lexical resources for natural language processing (Saint-Dizier & Viegas, 1995; Dale et al., 2000). While the lexical-bottleneck problem seems to be softened to English, Brazilian Portuguese wide range lexicons are not available. To bridge such a gap, our research group in Brazil has been working on the development of a particular sort of lexicon (Dias-da-Silva et al., 2002, 2003, 2006): the Brazilian Portuguese WordNet, based on both Princeton WordNet (Fellbaum, 1998) and EuroWordNet (Vossen, 1998). These lexicon-building projects have consolidated as methodological standards for encoding both (i) robust conceptual atoms and domains that are lexicalized by natural language words and phrases (Levin & Pinker, 1991) and (ii) cross-linguistic lexical and conceptual relations (Miller&Fellbaum, 1991; Vossen, 1998). These two features motivated the study we present at this colloquium: metaphors in wordnets. Metaphor is defined as a cognitive process that co-relates and transposes cognitive structures between Cognitive Domains (Lakoff & Johnson, 1980). By examining conceptual metaphors that guide production and understanding of metaphorical sentences, words, and phrases, the task has been to identify distinct kinds of metaphor (KÃ¶vecses, 2002; Croft & Cruse, 2004) and the grammatical types of metaphor instantiation (Sullivan, 2007; Stefanowitsch & Gries, 2006). The mining, analysis, and encoding of conceptual metaphors and their linguistic instantiations are supported by the following cognitive-linguistic and computational-linguistic constructs: Image Schemas (Johnson, 1987), Cognitive Domains (Lakoff & Johnson, 1980; Lakoff, 1987, 1993), Semantic Fields (Leher, 1974; Kittay, 1987), and Frames (Minsky, 1972; Fillmore, 1981). In a nutshell, we follow Alonge&LÃ¶nneker (2004), and

claim that metaphorical meaning can be represented into wordnets by means of pairs of hierarchically-structured Inter-Lingual-Indexes (CILI) that encode conceptual metaphors. Each CILI in turn clusters pairs of individual language synsets (i.e. individual language synonym sets that represent lexicalized concepts) that manifest the appropriate conceptual metaphors linguistically.

Vito Evola. Wednesday, 30 April 2008, 4-5pm. 618 Crawford Hall. Title: Multimodal Semiotics of Spiritual Experiences: Representing Beliefs, Metaphors, and Actions. Vito Evola is a doctoral student at the University of Palermo, Italy.

Abstract: Traditionally, spiritual experiences have been considered "ineffable," but metaphors pervade the representations of certain concepts of the transcendental in an attempt to talk about such abstract ideas. Whether it be during the description of a vision or simply talking about morality, people use conceptual metaphors to reason and talk about these concepts. Many representations of God, spirits, or the afterlife are culturally based, but whereas some may differ based on individual experiences, others seem to have a more universal character. From a phenomenological point of view, it seems that the descriptions are contingent and not necessary, that is, the language a believer is exposed to may influence, but not condition a priori, his or her own spiritual experience as Constructivists have thought. People's views about themselves and the world around them are deeply rooted in their conceptual systems, which are created by their experiences and their bodily interactions with the world, whether it's having to do with gravity in the case of UP and DOWN, or what our individual and social concepts are. When people talk about religious and spiritual concepts, they are revealing a great deal about their world and themselves and the way they interact with it. Concepts dealing with people's system of beliefs are very "meaningful" for the individual, and the more entrenched a frame of mind is, the less plastic it is, a fact confirmed by the neurosciences, which claim that it is difficult to break down and reconstruct certain synaptic structures of the brain. How do today's common "faithful" relate to certain metaphors about spiritual concepts transmitted by their faiths? What do these metaphors say about the individuals' concepts of themselves and their world? I will explore some of my own conclusions concerning conceptual metaphors and figurative language collected in various sacred texts and during a series of interviews of religious people with different backgrounds of religious systems. The data include linguistic expressions as well as gesture. Moreover, the interviewees were asked to draw on paper certain experiences of religious nature and then to describe their pictures. My investigation will try to shed new light on the phenomenology of religious experiences and personhood, using cognitive linguistics as a prime tool of analysis.

Savin SAGES Lecture. (http://case.edu/artsci/news/Savin08.html) Michael Schoop. Monday, 7 April 2008, 4pm. Amasa Stone Chapel. Title: Teaching Imagination in the Age of Digital Experience.

Eve Sweetser. Case TV Recording. (http://tv.case.edu/actions/tv2/tv?play=true&id=9101&filter=talking) Wednesday, 26 March 2008. 4-5pm. 9 Crawford Hall (Inamori Center). ACES Distinguished Lecturer. Reception to follow at 5:15pm in 111 Crawford, the SAGES Seminar Room. Title: Viewpoint and perspective in language and gesture. Website. (http://linguistics.berkeley.edu/people/fac/sweetser.html) Eve Sweetser is Professor of Linguistics and former director of the Cognitive Science program at UC Berkeley.

Abstract: Viewpoint permeates human cognition and communication â€"predictably, since we never have experience of the world except as a viewpoint-equipped embodied self among other viewpointed embodied selves. Examination of some of the areas where perspective is known to be centralâ€"such as linguistic deixis (Hanks 1990), or gestural pointing (Kita 2003)â€"has helped motivate researchers to examine the much broader presence of perspectival phenomena in language and bimodal communication. Signed language dataâ€"necessarily embodying portrayed viewpoints in ways which spoken language does not (Dudis 2003, 2008)â€"has also helped spoken language researchers to notice parallel phenomena in their data. In this presentation, I will examine multimodal viewpoint in linguistic and gestural data, and will go on to suggest that we should in general be thinking of viewpoint as an intersubjective phenomenon rather than a unitary first-person phenomenon. Data from all the relevant sources come together to push us towards a theory which includes mutual awareness of viewpoints between participantsâ€"and incorporation of addressees' and spectators' (and readers' [see Verhagen 2005, Tobin 2008]) perceived viewpoints into the cognitive perspectives of speakers, narrators and writers. Intersubjective viewpoint contruction is important at every level, from construal of local physical spatial affordances to literary narrative.

Mark Johnson. Tuesday, 18 March 2008. 4-5pm. 9 Crawford Hall (Inamori Center). Title: Natural Sources of Morality. Website. (http://www.uoregon.edu/~uophil/faculty/mjohnson/mjohnson.html) Mark L. Johnson is Knight Professor of Liberal Arts and Sciences at the University of Oregon.

Abstract: Our moral values are shaped by the nature of our interactions with our physical, social, and cultural environments. They are born in our flesh, not handed down from some transcendent source. Moral reasoning is a form of ongoing problem solving that is tied to the bodily origins of our values.

Our reason is both emotional and imaginative. Consequently, moral deliberation is akin to the creation of art. To appreciate this analogy, we have to understand the bodily and neural bases of aesthetics. The result is a moral pluralism, not a relativism or subjectivism.

Symposium on Morality and Mind: Ethics at the Crossroads of Culture and Science. Friday, 29 February 2008. 8:30am-6pm. George S. Dively Building, Room 214 (http://www.case.edu/cgi-bin/campusmap?b=Dively+Executive+Education+Center). See the Case News Center Story (http://blog.case.edu/case-news/2008/02/14/ethicssymposium). Speakers: Pascal Boyer (Department of Anthropology, Washington University in St. Louis), John Doris (Department of Philosophy, Washington University in St. Louis), Jesse Prinz (Department of Philosophy, University of North Carolina at Chapel Hill), Stephen Stich (Department of Philosophy, Rutgers University), Chris Meyers (Department of Philosophy and Religion, University of Southern Mississippi). Abstract: Recent research in cognitive science challenges ethical perspectives founded on the assumption that rationality is key to moral knowledge or that morality is the product of divine revelation. Bedrock moral concepts like free will, rights, and moral agency also have been questioned. In light of such critiques, is the study of ethics best understood as a humanities discipline or as the science of morality? Is ethics an issues of moral philosophy and religious reflection or is it an issue in cognitive science and evolutionary biology? Is ethics primarily informed by nature or by culture? Or is ethics informed by both?

The Project on Ethics and Cognitive Science at Case Western Reserve University, in conjunction with the Departments of Cognitive Science, Philosophy, and Religious Studies, will explore junctions and disjunctions between ethics, culture, and cognitive science in a daylong symposium titled "Morality and Mind: Ethics ad the Crossroads of Culture and Science."

Organizers: William Deal (Religious Studies), Anthony Jack (Cognitive Science), and Sara Waller (Philosophy). The symposium is free and open to all faculty, staff, and students, but reservations are required. Reservations can be made athttp://morality-and-mind.eventbrite.com (http://morality-and-mind.eventbrite.com/). Friday, February 29, 2008
8:30-9:00. Continental Breakfast provided in the Dively Building
9:00-10:15. Dr. Jesse Prinz (introduced by William Deal)
"How Do Emotions Relate to Morality? A Review of Competing Models." There is a growing body of evidence that emotions occur when people make moral judgments. This fact alone, however, is consistent with a variety of processing models. Emotions might be the effects of moral judgment, or the causes of moral judgments, or components. Emotions might be involved in all moral judgments, or just some (a dual process theory). I argue that emotions are components of moral judgments and against dual processing theory. I also consider competing "philosophical models", i.e., metaethcial theories of the role that emotions play in morality. I present empirical evidence of a "response-

dependent" view as opposed to an "error theory" or "emotivism."

10:30-11:45. Dr. John Doris (introduced by Anthony Jack).

"On Reflection (. . . more or less)." In philosophy, persons are often distinguished by a propensity for reflection — a conscious and concerted mentation effecting control of behavior. In psychology, research on unconscious processing suggests that this philosophical conception of persons is unrealistic; ethically significant human behavior is very often beyond reflective control. A psychologically lifelike conception of persons will therefore de-emphasize reflective control; instead, the human ethical distinctiveness marked with such philosophical honorifics as "person," "agency," "practical rationality," and "the self" is found in the collaboratively developed rationalizing explanations of behavior by which humans living in groups regulate their lives.

12:00-1:00. Lunch provided in the Dively Building.

1:00-2:15. Dr. Pascal Boyer (introduced by Anthony Jack)

"Imagination as constraint: Mental Time-Travel & Moral Psychology." What is the function of our capacity for episodic memory, or 'mental time-travel'? Evolutionary considerations suggest that vivid memory but also imaginative foresight may be crucial cognitive devices for human agents, otherwise drawn towards impulsive, myopic opportunism. This model of evolved self-restraint casts doubt on the psychological reality and unity of a moral psychology.

2:30-3:45. Dr. Stephen Stich (introduced by Sara Waller).

"The Definition of Morality." Debates about the definition of 'moral judgment' and 'moral rule' have a venerable history in philosophy. In addition to debating the merits of various proposed definitions, philosophers have also disagreed about what the definition is supposed to do: What counts as getting the definition right? One proposal is that moral rules or moral judgments are a psychological natural kind, and that the correct definition should specify the essential features of this kind. Recently, a number of philosophers and psychologists have suggested that research using the moral / conventional task, first introduced by Elliot Turiel, has uncovered some of the essential properties of this natural kind. If the empirical generalizations drawn from this work were correct, it would be reasonable to conclude that we have indeed discovered the essence of morality. However, a growing body of evidence indicates that those generalizations are not correct, and thus that the moral / conventional task tells us nothing of interest about the definition of morality. So, I will argue, we still do not have good answer to the question "How should 'morality' be defined?" But with the explosion of interest in empirically informed moral psychology in recent years, the issue has taken on added importance. Indeed, some of the most heated debates in empirical moral psychology are actually debates over the definition of morality.

4:00-5:00. Discussion: Dr. Chris Meyers (introduced by Sara Waller).

5:00-6:00. Symposium Reception in the Dively Building.

David Quinto-Pozos. Friday, 8 February 2008. 4-5pm. 618 Crawford Hall. Title: Depicting animacy in American Sign Language: Examining gestural and linguistic strategies. University of Illinois at Urbana-Champaign

Abstract: Perhaps one of the most obvious facets of signed languages to the non-signer is the manner in which signers use their bodies in mimetic ways to depict the actions of characters while also producing signs and other linguistic structures that are not understandable to a naïve language user. So, a signer of American Sign Language (ASL) may commonly utilize her head and face, upper torso, and hands/arms to depict corresponding parts of animate objects and certain actions of those animate beings. I refer to this method for communicating the actions of an animate referent as constructed action (following Metzger 1995), although it has also been labeled—throughout various literatures—using other terms such as character-viewpoint, demonstrations, and reported action. Some authors (e.g., Liddell & Metzger, 1998) claim that constructed action is gestural in nature, whereas other writers have described such meaningful articulations within ASL as linguistic devices at the lexical and the sentential levels of structure (e.g., Supalla 1982, 1990, 2003; Lillo-Martin, 1995; Kegl, 1985, Padden 1990). In this presentation, I will discuss data from several studies of constructed action in signed language. In particular, I will use examples of constructed action production, judgments of such productions, and investigations of constructed action across different ASL registers and different sign languages to provide a picture of how and why signers depict animacy by using this strategy. In the presentation I will also present data that speak to the following points: 1) constructed action does not seem to pattern in some traditional linguistic ways, 2) for many signers, constructed action can be considered to be an obligatory mechanism for the description of animate objects, and 3) constructed action can alternate and co-occur with linguistic strategies for depicting or describing animate objects. The points discussed in this presentation raise various questions about this communicative device. For instance, why might this strategy for meaning communication be a necessary part of a signed utterance even though it lacks some traditional linguistic properties? Are there other ways that signers can communicate similar information about animate objects without utilizing constructed action? Might there be constraints that govern the production of constructed action? Finally, how can work on co-speech gesture inform studies of constructed action within the signed modality (and vice-versa)?

Peter Whitehouse. Monday, 4 February 2008. 4-5pm. 618 Crawford Hall. Title: The Myth of Alzheimer's: lessons in applied cognitive science. Website.
(http://www.case.edu/artsci/cogs/whitehouse.html) Peter J. Whitehouse, MD, PhD is Professor of

Neurology and founding member of the Department of Cognitive Science at Case Western Reserve University, staff at University Hospitals Case Medical Center, and Director of Adult Learning at The Intergenerational School Professor of Cognitive Science.

Abstract: "Discovering a disease, taking a history, and making a diagnosis" are all cognitive processes undertaken by physicians. Put differently these process become "inventing a disease, sharing an illness experience, and applying a social label." In this talk I will relate the story of an idea which became a book, *The Myth of Alzheimer's: What You Aren't Being Told About Today's Most Dreaded Diagnosis* (http://www.themythofalzheimers.com/), coauthored with Danny George. Alzheimer's is a label constructed 100 years ago which provokes fear and dread in individuals and health policy makers alike. Whereas the phenomenology of age associated cognitive decline is real, of course, and does potentially create suffering, Alzheimer's is not one single condition but rather a variety of biological processes that start early in life. Alzheimerization of the brain is probably another name for aging processes. Hence the dominant story that Alzheimer's is one disease, different from aging, which can ultimately fixed with sufficient investment in reductionistic scientific approaches is wrong. Exploring the myth should lead to different and more hopeful ways of conceptionalizing cognitive aging and of meeting its challenges. For example, a sense of purpose, community engagement and legacy is critical to cognitive well-being as we age. The Intergenerational School (http://www.tisonline.org/), founded with my wife, Catherine, another cognitive scientist, will be used to illustrate these ideas. In the broad sense of cognitive science developed here at Case, we will explore the historical, cultural and ethical, as well as scientific and clinical, aspects of the myth of Alzheimer's.

Gaurav Patel. Wednesday, 23 January 2008. 4-5pm. 618 Crawford Hall. Title: Attention networks in the macaque monkey. Gaurav Patel has just defended his Neuroscience PhD as part of the MD/PhD program at Washington University in St Louis. His research, conducted in collaboration with the laboratories of Maurizio Corbetta and Larry Snyder, uses fMRI of awake behaving monkeys to look at the relationships between human and monkey functional brain anatomy.

Abstract: We have performed a series of experiments using fMRI in awake behaving macaques to characterize the cortical networks underlying visual processing and attention. These experiments have revealed several previously unknown topographic and functional properties of the visual attention system in macaques, and also indicate that there may be substantial differences with humans.

Daniel Casasanto. Thursday, 17 January 2008. 4-5pm. 618 Crawford Hall. Title: Meaning & Motor Action: The role of motor experience in concept formation. Website. (http://www.stanford.edu/~casasan/) Daniel Casasanto is an NRSA postdoctoral fellow in the department of psychology at Stanford University and Ph.D. in Brain & Cognitive Sciences, MIT, 2005.

Abstract: How do people transform experience into knowledge? This talk reviews a series of studies testing the hypothesis that our physical experiences in perception and motor action contribute to the construction of even our most abstract thoughts (e.g., thoughts about value, time, happiness, etc.) These studies begin to distinguish the contributions of linguistic experience, cultural experience, and perceptuo-motor experience to the formation of concepts and word meanings. Some experiments show that people who talk differently think differently; others show influences of non-linguistic cultural practices on conceptual structure; others show that people with different bodies, who interact with their environments in systematically different ways, form dramatically different abstract concepts. These demonstrations of linguistic relativity, cultural relativity, and what I will call 'bodily relativity' highlight the diversity of the human conceptual repertoire, but also point to universals in the processes of concept formation.

Suzy Scherf. Monday, 14 January 2008. 4-5pm. 618 Crawford Hall. Title: Faces on the Brain: Developing the Neural Basis of Category-Specific Representations. Website. (http://www.pitt.edu/~scherf/) Suzy Scherf is Post-Doctoral Fellow in the Cognitive Neuroscience Laboratory at Carnegie Mellon University and Ph.D., Developmental Psychology, University of Pittsburgh, 2003.

Abstract: In adults, the ventral visual cortex is organized in a category-selective map with particular stimulus categories (e.g., faces, places, objects) eliciting distinct patterns of cortical activation. This functional organization supports fast and efficient recognition of visual objects, and particularly faces, and represents an ideal system in which to study developmental changes in brain-behavior correspondences. I will describe several behavioral, functional and structural neuroimaging studies that demonstrate how the location and selectivity of face-related cortex is uniquely developmentally delayed into adolescence, while place- and object-related cortex matures in childhood. Furthermore, the nature of the computations performed within face-related cortex do not mature until early adulthood. This delay in the functional specialization of face-related regions co-occurs with the maturation of face and emotion recognition skills and late developing structural changes in white matter tracts that connect regions in the broader face-processing network. I have used this same approach to understand atypical brain development in developmental disorders in which visuoperceptual processes appear to be disrupted. For example, face-processing deficits are some of the most widely cited symptoms in autism. I will also describe a series of parallel studies in children with autism, which demonstrate that there is a selective abnormality in the development of face-

related cortex. This abnormal pattern of brain development may reflect atypical development of very basic visuoperceptual processing skills in autism that are especially disruptive for face processing. This research reveals important mechanisms by which brain-behavior correspondences change developmentally and may identify vulnerable developmental periods in which targeted intervention programs could have more success for individuals with developmental disorders.

Rick Grush. Thursday, 10 January 2008. 4-5pm. 618 Crawford Hall. Title: Is it now? Some explorations of the metaphysics of the mind and the semantics of indexicals. Website. (http://mind.ucsd.edu/) Rick Grush is Professor of Philosophy and of the Interdisciplinary Ph.D. program in Cognitive Science at UC San Diego. He specializes in theoretical cognitive neuroscience, philosophy of mind, and philosophy of language.

Abstract: Cognitive semanticists seek to explain linguistic meaning in terms of relations between linguistic items and cognitive representations, as opposed to relations between linguistic items and states and objects in the world. On this approach, indexicals such as 'I', 'here', and 'now' can seem to be straight forward, but in fact the opposite is the case. Exactly what a language user is representing, and how she is representing it, when using or interpreting such expressions is subtle and surprising. I will approach this issue from an oblique angle, by exploring the nature of the subjective agent (the putative referent of 'I'), and its relation to time and space, the 'here' and 'now'. In particular, I will ask the simple question: Where (and when) is the speaker?

Edward Hubbard. Friday, 4 January 2008. 4-5pm. 618 Crawford Hall. Title: Neural Mechanisms Underlying Mappings between Number and Space. Website. (http://psy.ucsd.edu/~edhubbard/) Edward Hubbard is NUMBRA Post-Doctoral Fellow at the INSERM-CEA Cognitive Neuroimaging unit (http://www.unicog.org%20%20/) and Ph.D. Psychology and Cognitive Science, UC San Diego.

Abstract: Various studies have suggested that spatial metaphors are often used to structure cognitive representations. One such metaphor is the "mental number line," in which small numbers are mapped to the left side of space, and large to the right. We have previously suggested that this mapping arises through a process of "neuronal recycling" of pre-existing mechanisms involved in numerical and spatial abilities (Hubbard et al., 2005; in press). In our first test of this hypothesis, we used fMRI to measure BOLD signal change while subjects judged the parity status of a number. We found that parietal regions involved in shifts of attention and eye movements were differentially activated depending on the magnitude of the number; the left hemisphere region was more active for large numbers compared to small numbers, while the corresponding right hemisphere region was more

active for small numbers compared to large numbers (Hubbard et al., submitted). In a second set of fMRI studies, we used three tasks—mental arithmetic, a multisensory localizer, and saccades—to further explore homologies between human and macaque parietal regions, and test their roles in mental arithmetic. Our results demonstrate a partial overlap between calculation and multisensory regions bilaterally, with overlap between calculation and saccade related regions in parietal cortex and frontal eye fields. Correlation analyses within these regions demonstrate that this overlap extends to the pattern of activations across voxels (Hubbard et al., in prep). In a third experiment, we used event-related potentials to demonstrate that processing of non-informative numerical cues lead to attention-related ERP components similar to those elicited by arrow cues (Ranzini et al., in prep). Taken together, these results support the hypothesis that similar brain circuits are involved in processing of numerical and spatial processing in numerate adult human subjects. Building on these results, I will discuss future studies exploring the role of space in the acquisition of basic mathematics, the role of these same neural circuits in number-space synesthesia, and in structuring higher-order mathematical representations, such as in algebra or calculus. Finally, I will discuss how these methods can be applied to elucidate the role of space in structuring other, non-numerical, cognitive representations.

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