

Susan Levine

Members of the CCSN conduct research related to cognitive and social neuroscience in their field of expertise and with unique scholarly perspectives. Susan Levine, Ph.D., Chairman of the Department of Psychology and the co-director of the Center for Early Childhood Research at the University of Chicago, was interviewed about her work in early childhood cognitive development and the Spatial Intelligence and Learning Center.

What is the focus of your work?

With Professors Susan Goldin-Meadow and Janellen Huttenlocher, as part of the National Institute of Child Health and Human Development Program Project *Environmental & Biological Variation and Language Growth*, I conduct language development research. Our overarching research goal is to understand how language interactions between children and parents impact the child's language, literacy, and conceptual development over time. For this research, we visit participating family's homes every four months, beginning when children are fourteen months old. During these visits, we ask the primary caregiver to simply do what they normally do – we do not give them any special toys to play with or explicit tasks to perform. We videotape the parent-child interactions for ninety minutes, focusing on the child if the parent happens to leave the room. When we return to the lab, we

transcribe all the language and co-speech gesture that was produced by the child and the parent. We code the utterances in various ways, depending on our particular research questions.

For example, one such question concerns parents' use of number words, and the particular ways in which they talk about number. Elizabeth Gunderson, a graduate student at the University of Chicago, and I found that parents varied widely in their frequency of use of number words. Children who heard more "number talk" during the five visits between fourteen- and thirty- months of age had a more developed understanding of cardinal number, a central mathematical concept. We also found that certain kinds of number talk were most predictive of children's cardinal number knowledge – in particular, parent number talk referring to object sets rather than just rote counting or labeling numerals, and parent number talk extending beyond set sizes of three. Such parent-child interactions are dynamic, as the child's actions and interests may influence parent behavior, and vice versa.

Many researchers want to determine the activities in which children engage (i.e., reading, counting, puzzle-solving), and at what age those behaviors emerge, and then see how those activities predict academic achievement or development. However, this is a complicated story to tell. For example, parents and children often read books together, but the individual who initiates the practice changes over time — when a child is fourteen months old, a parent might always initiate the activity, but when she is four years old, a child is likely to ask to her parent to read to her. We are striving to answer the questions, "What is the parent saying? How is it influenced by the child's behavior? And do these patterns change when parents initiate certain kinds of interactions?"

Through this work, we hope to identify the kinds of interactions associated with strong

language and conceptual development. Then, to follow up on these findings from our naturalistic study, we hope to test whether this is the case in experimental studies.

What is the Spatial Intelligence and Learning Center (SILC)?

The Spatial Intelligence and Learning Center (SILC) is a National Science Foundation Science of Learning Center. The Center involves faculty and graduate students from Temple University, Northwestern University, the University of Chicago, the University of Pennsylvania, and the Chicago Public Schools. We have several related initiatives: to understand more about spatial cognition through basic research, to study the tools that we think could improve spatial learning, to use these tools in training studies to see whether we can improve spatial learning, and to translate these findings into real world learning environments, such as schools and museums. This work includes studies of the early development of spatial thinking (the core of my research) as well as studies examining spatial learning in older students, particularly those studying science and math (e.g., physics, organic chemistry).

The basic premise of the Center is that spatial learning is important, but underemphasized in educational settings. There is not a subject in school called 'Spatial Learning'. As a society, we tend to believe that some people are spatial thinkers, and others are not. However, research supports the fact that spatial ability is malleable, and can improve through instruction, particularly instruction that makes use of strong learning tools such as analogy, spatial language, embodiment and gesture. Spatial ability is predictive of entry into the STEM disciplines (science, technology, engineering, and math), even when you control for other abilities, like math and verbal skills. People who have better spatial visualization skills are more likely to take STEM courses and work in STEM-related fields. Research has also found

sex differences in spatial skills, particularly in mental rotation and navigation tasks, and we would like to determine the basis of those sex differences. Because spatial thinking is malleable, and an important predictor of achievement in the STEM disciplines at school and in the workplace, this research has the potential to increase the representation of females in these disciplines.

What processes contribute to spatial thinking?

While my research focuses on the cognitive processes that underlie mathematical and spatial thinking, social and emotional factors also contribute. My research with Sian Beilock, an associate professor at the University of Chicago, as well as Gerardo Ramirez and Elizabeth Gunderson, graduate students at the University of Chicago, has shown that an individual can have perfectly good spatial thinking skills, but do poorly on spatial tasks because of anxiety stemming from societal stereotypes passed from teacher to student or parent to child, not unlike math anxiety.

Understanding spatial skill development requires both naturalistic (e.g., home observation) and controlled experiments (in the laboratory). For example, during home visits, we observe which children engage in puzzle play and for how long. In one phase of study, we found that approximately half of our sample played with a puzzle in our presence. Later, we found that the children who played with puzzles at home were better at mental rotation tasks in the laboratory at four and a half years of age. However, this data is correlational. We are now carrying out an experiment to determine if there is a causal relationship between this kind of play and spatial ability. Ultimately, our goal is to translate our findings into curricula and teacher practice. •

WE STRIVE TO ANSWER THE QUESTIONS, "WHAT IS THE PARENT SAYING? HOW IS IT INFLUENCED BY THE CHILD'S BEHAVIOR? DO THESE PATTERNS CHANGE WHEN PARENTS INITIATE CERTAIN KINDS OF INTERACTIONS?"

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UPCOMING EVENTS AND RESOURCES

The Center faculty participate in workshops, brown bags, and research seminars. To be added to the email list for announcements of talks and events, email Anna Gomberg at agomberg@uchicago.edu

Support the CCSN

To make a donation to the Center for Cognitive and Social Neuroscience, please contact ccsn@uchicago.edu.

CCSN Events

Fall 2011 Job Talks

17 November 2011, Harper Memorial Library, Room 140

Adrianna Jenkins

Harvard University

Reading the Minds of Others: Dissociable Processes and their Social Consequences

22 November 2011, Rosenwald, Room 011

Sara Verosky

Princeton University

More Than a Face: Interactions Between Visual and Non-Visual Social Knowledge

29 November 2011, Stuart Hall, Room 101

Greg J. Norman

University of Chicago

The Social Brain, Oxytocin and Health

Publication

Empathy: From Bench to Bedside, edited by Jean Decety, Ph.D., is now available from MIT press.

