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perceive accurately and to recreate or transform aspects of the world.

## April 12, 2007 How do humans process information?

Human beings have developed specialized abilities to process information about the world around them in a number of ways. One of our most important mental abilities is spatial intelligence — the ability to

The Spatial Intelligence and Learning Center (SILC), Northwestern's new interdisciplinary center, brings together researchers from four leading universities in a collaborative effort to understand and solve scientific puzzles of spatial learning and to enhance the mental skills people need to compete in today's technological workforce.

Northwestern scholars have joined with colleagues from Temple University, the University of Chicago and the University of Pennsylvania to form SILC. The center draws together researchers who focus on spatial intelligence — a central arena of human mental processing. The goal is to gain a deeper understanding of human cognition and how it develops and to use this understanding to increase spatial ability in individuals and enhance the country's competitive edge.

Dedre Gentner, professor of psychology and education, and director of the Cognitive Science Program at Northwestern, directs the new Spatial Intelligence and Learning Center. "Our research comprises three strands: foundational research on the mental processes that underlie spatial intelligence and how they develop; research on the effects of spatial symbols such as maps, graphs, and spatial language on spatial cognition; and research on how best to foster spatial learning from preschool through college and beyond," she says. An understanding of spatial relationships provides the foundation for a wide range of reasoning and communication skills as varied as designing buildings, solving mathematical problems, and forming mental abstractions.

Gentner's own research focuses on analogical processes in learning: e.g., how children learn to understand spatial models. She also studies language learning, including effects of spatial language on spatial cognition.

Researcher David Uttal, psychology and education, studies the role of map learning in fostering children's spatial understanding. For example, Uttal conducts studies both in the laboratory and in children's neighborhoods that assess how children come to think about the world beyond their immediate experience and how doing so influences their spatial thinking.

Ken Forbus, computer science and education, studies spatial processes by building intelligent artificial intelligence (AI) systems that can represent and reason about spatial relations. Forbus and his team are developing a unique research platform called CogSketch — a program that will be able to interpret sketches in a humanlike way. CogSketch will allow students to sketch on a screen and receive feedback on their work. Once installed on hand-held computers, CogSketch could be used in classrooms to promote spatial learning or by engineers working out conceptual design issues.

SILC researchers are collaborating to study how students' spatial reasoning skills influence their ability to learn from maps and other spatial representations and to see how their use of these representations

contributes to their spatial analysis skills. Louis Gomez, education and computer science, studies how to improve students' use of charts, graphs, and other spatial media in science and math texts. Daniel Edelson, education and computer science, conducts research on Earth and environmental science education. He designs and studies curricula that engage students in investigations of real-world data using interactive mapping tools.

Other Northwestern faculty members who are central to SILC include Larry Hedges, statistics, education and social policy, a fellow of the Institute for Policy Research.

Spatial insight extends beyond domains that directly involve spatial relations. Spatial analogies are used to portray abstract relationships across a range of disciplines, from economics (e.g., we speak of economic indices rising or falling) to ethology (e.g., we speak of a species whose evolutionary niche is shrinking or expanding); these analogies often form the basis for graphs and predictions. Being able to interpret and use these spatial tools is becoming increasingly important in our highly technological society. People must be able to work with data and manipulate images mentally in reasoning about complex phenomena and systems.

SILC members are always seeking families to participate in studies on the development of spatial learning and thinking. "The studies are fun for children, and parents can sign up for one visit or more, as they prefer," Uttal said.

For more information about SILC, go to <a href="http://spatiallearning.org/">http://spatiallearning.org/</a>.



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