By William Harms

Photo by Jason Smith

A six-year-old girl pauses for a moment at a small table in the spatial skills lab in Beecher Hall before confidently telling her father: "I have a little secret in putting puzzles together. The buddy pieces for the corner pieces have straight lines."

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—Barbara Tversky
Professor Emerita in Psychology at Stanford University

With a snap, she links two pieces together that are part of a purple orchid in a 48-piece puzzle of a jungle scene. With her father looking on from her side, she sorts through the pieces, finding a frog and a snake as she puts together the faces of the jungle animals. She turns the pieces to test her prediction that they will fit together and uses words like "top" and "bottom" to describe how she assembles the puzzle.

This demonstration illustrates a study of children and parents by UChicago early childhood researchers, who are examining how children of various ages use spatial words. The puzzles offer a window into children's developing minds, revealing how they understand shapes and build knowledge related to spatially demanding tasks they will encounter in mathematics, science, and related fields.

The study gets at subtle issues as well, such as how stereotyping might
influence the way adults interact with their children. By studying parents and children together, scholars hope to gain insights into why boys, on average, seem to progress more quickly in spatial learning.

“We want to see whether parents provide the same input to boys and girls when the puzzles are of the same difficulty,” says Susan Levine (http://news.uchicago.edu/profile/susan-levine), the Stella M. Rowley Professor in Psychology. “When we recorded interactions in people’s homes, parents of boys may have used more spatial language in order to scaffold their performance because boys typically worked on more difficult puzzles than girls.”

Levine and gesture expert Susan Goldin-Meadow (http://news.uchicago.edu/profile/susan-goldin-meadow), the Beardsley Ruml Distinguished Service Professor in Psychology, are part of a cadre of researchers at UChicago who are changing current ideas about how exposure to various tasks and language cues shape learning in the earliest years. The early childhood team (http://babylab.uchicago.edu/welcome.html) has been publishing a series of papers that show specific ways in which children get a boost from early exposure to conversations about numbers, as well as play with puzzles and blocks and talk about shapes and spatial relations. Moreover, the group is disseminating that knowledge to educate parents, improve preschool curricula, and advance research in the field generally.

“The research group on early childhood at the University of Chicago has made fundamental contributions to our understanding of cognitive development and to applications of principles of cognition to learning, teaching, and cognitive deficits,” says Barbara Tversky, Professor Emerita in Psychology at Stanford University. “The results have been surprising and illuminating, as well as practical and useful.”

The lasting value of early learning

As part of their innovative research agenda, Levine and Goldin-Meadow have videotaped a diverse set of parents and preschool children as they do everyday activities in the home, which, at times, involve mathematics.

What they found was startling: Parents varied drastically in their talk about mathematics, both “number talk” and talk about spatial concepts. The children who heard the most number talk, for example, had a better understanding of the connection between the count list and the meanings of the number words (that “three” refers to sets of three).

Levine and Goldin-Meadow are working with the Everyday Mathematics
program, created at the University of Chicago, to enhance the curriculum in pre-kindergarten and the early elementary school grades, based on research showing that young children are capable of more sophisticated spatial thinking than previously thought. Such early childhood research at UChicago also has inspired Dana Suskind, an associate professor at the University of Chicago Medicine, to start a program on word learning with disadvantaged families.

Understanding how to harness the impact that parents and teachers can make on young children's development is the focus of many scholars at UChicago.

“This is critical, as these are skills people need for careers that our nation needs in science and mathematics,” Levine says. “We want to learn more about how we can help children learn and improve opportunities for all children. Children from lower socioeconomic backgrounds typically are not as prepared for academic work when they arrive at kindergarten, and we find that differences in their learning opportunities are a significant predictor of these knowledge gaps.”

A team of researchers devoted to early childhood

Levine did seminal work with Janellen Huttenlocher, the William S. Gray Professor Emeritus in Psychology, a pioneer in the field. The two showed in research published in 2002 that children's exposure to complex syntactic constructions from teachers and parents during the preschool years play an important part in their language comprehension skills, which in turn, relates to their later reading comprehension.

Goldin-Meadow is studying the connection between gesture and early learning. She has found that the large differences in vocabulary that children from different socio-economic classes bring with them to school can be traced, in part, to the gestures that the children produced early in development. Those gestures can, in turn, be traced to the gestures their parents produced during the early years.

Gesturing also plays an important role in math learning. In another study Goldin-Meadow showed that encouraging children to gesture improved their ability to learn from a math lesson. “The study highlighted the

This laboratory study builds on naturalistic observations that suggested that parents use more spatial language while engaging in puzzle play with boys than they do girls — although boys tended to play with more difficult puzzles.

UChicago doctor examines language across socioeconomic levels

As a surgeon specializing in cochlear implantation, Dana Suskind helps deaf children hear. Yet she began to notice a profound disparity in learning achievement between newly hearing children from higher socioeconomic backgrounds and those from other households.

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importance of motor learning even in non-motor tasks, and suggests that we may be able to lay the foundation for new knowledge just by telling learners to move their hands,” she says.

One of the nation’s leading scholars on infant learning is Amanda Woodward, the William S. Gray Professor in Psychology, who did important work on infants while a faculty member at UChicago from 1993 to 2005. She returned in 2010 after serving on the faculty of the University of Maryland.

“The strong focus that many of my colleagues have on the roles of embodied experience, and the social context in development, dovetails with my own interests in the early development of social cognition and social learning,” Woodward says. “I was thrilled to be able to return to the University of Chicago because of the outstanding community of developmental scientists here.”

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