

Learning spatial terms improves children's spatial skills

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One- to four-year-olds, who heard and then spoke 45 additional spatial words that described sizes and shapes saw, on average, a 23 percent increase in their scores on a non-verbal assessment of spatial thinking Credit: © 2011 Jupiter Images Corporation

Preschool children who hear their parents describe the size and shape of objects and then use those words themselves perform better on tests of their spatial skills, researchers at the University of Chicago have found.

The study is the first to show that learning to use a wide range of spatial [words](#) predicts children's later spatial thinking, which in turn is important in mathematics, science and technology. [Children](#) who heard and then

produced 45 additional spatial terms saw, on average, a 23 percent increase in their scores on a non-verbal assessment of spatial thinking.

"Our results suggest that children's talk about space early in development is a significant predictor of their later spatial thinking," said Susan Levine, a psychologist at UChicago, who co-authored the paper in the current issue of [Developmental Science](#).

The finding provides further evidence for the importance of exposing children to words related to mathematical concepts. In earlier work, Levine, the Stella M. Rowley Professor in Psychology, and colleagues showed that talking about mathematics with children at an early age greatly improved their performance in math.

"In view of findings that show spatial thinking is an important predictor of STEM (Science, Technology, Engineering and Mathematics) achievement and careers, it is important to explore the kinds of early inputs that are related to spatial thinking," Levine and colleagues write in the article, "Children's Spatial Thinking: Does Talk About the Spatial World Matter?" Spatial language may encourage children to adopt a habit of mind when looking at the world that increases their attention to spatial relations.

Joining Levine in writing the article were lead author Shannon Pruden, assistant professor of psychology at Florida International University and former postdoctoral fellow at UChicago, and Janellen Huttenlocher, the William S. Gray Professor Emeritus in Psychology at UChicago.

Observing how parents and children interact

For the study, the research team videotaped children between ages 14 and 46 months who were accompanied by their primary caregivers. They videotaped the caregivers, primarily the children's mothers, as they

interacted with their children during their normal, everyday activities. The 90-minute sessions were conducted at four-month intervals.

The study group included 52 children and 52 caregivers from an economically and ethnically diverse set of homes in the Chicago area.

The researchers recorded words that were related to spatial concepts used by both children and caregivers. They noted the use of names for two- and three-dimensional objects, such as "circle" or "triangle"; words that described size, such as "tall" and "wide"; and words that described the features of shapes such as "bent," "edge" and "corner."

As was the case in their research on the use of mathematical words, the researchers found a wide variation in the number of spatial words parents and children used. On average, parents used 167 words related to spatial concepts during the 13.5 hours of recorded time during the period of 14 to 46 months, but the range was very wide -- from 5 to 525 spatial words.

Among children, there was a similar variability, with children producing an average of 74 spatial related words and using a range of 4 to 191 spatial words during the study period. The children who used more spatial terms were more likely to have caregivers who used those terms.

Moreover, when the children were four-and-a-half years old, the team assessed them for their spatial skills, to see how well they could mentally rotate objects, copy block designs and do spatial analogies, which involved picking out the same spatial relations when different objects were involved.

The researchers found that the children who were exposed to more spatial terms during their everyday activities and produced these words themselves performed much better on spatial tests at four-and-a-half

years of age than children who did not hear and produce as many of these spatial terms. Importantly, this was true, even controlling for children's overall productive vocabulary.

The impact was greatest for children's performance on the spatial analogies and mental rotation tasks. For every 45 additional spatial words children produced during spontaneous talk with their parents, they saw, on average, a 23 percent increase in their scores on the spatial analogies task and a 15 percent increase in their performance on the mental rotation task.

The increased use of spatial language may have prompted the children's attention to spatial information and improved their ability to solve spatial problems, the researchers said. Spatial language also may reduce the mental load involved in transforming shapes and help children represent the spatial relations used on the spatial analogies task, they added.

Provided by University of Chicago

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