Thông tin khoa học công nghệ

Baby boys may show spatial supremacy

Male superiority on mental rotation tasks may develop within a few months after birth

How long babies spent time looking at rotated blocks and the mirror images of blocks was a measure of the ability to mentally rotate an object.

The gender gap in spatial abilities — charted for more than 30 years — emerges within the first few months of life, years earlier than previously thought, psychologists report.

Males typically outperform females on spatial-ability tests by age 4, especially on tasks that require mental rotation of objects perceived as three-dimensional. Yet, two studies of 3- to 5-month-olds, both published in the November Psychological Science, conclude that a substantially greater proportion of boys than girls distinguish a block arrangement from its mirror image, after having first seen the block arrangement rotated. Babies who prefer looking at the mirror image are presumed to have mentally rotated the block arrangement, recognized it and chosen to gaze at the novel mirror image.

One investigation was conducted by David Moore of Pitzer College in Claremont, Calif., and Scott Johnson of the University of California, Los Angeles. The other was directed by Paul Quinn of the University of Delaware in Newark and Lynn Liben of Pennsylvania State University in University Park.

Both sets of researchers suspect that sex differences in mental rotation develop shortly after birth due to an unknown mix of genetic, biological and environmental influences.

“The result we found was really somewhat of a shocker,” Moore says. He had expected to demonstrate no sex difference in infants’ mental rotation skills, laying the groundwork for pinpointing the age at which this spatial gap first appears.

“Simultaneous reports by two different labs using two different techniques are difficult to dismiss,” remarks psychologist Nora Newcombe of Temple University in Philadelphia.

Still, the new reports don’t confirm that baby boys perform mental rotation tasks better than baby girls do, comments psychologist Susan Levine of the University of Chicago. That’s because both studies first familiarized babies with a block arrangement oriented at specific angles but then presented it from a new angle for comparison with its mirror image, a process that may mask baby girls’ spatial insights.

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By 3 months of age, girls — but not boys — may notice changes in a block arrangement's angle, Levine proposes. If so, girls would regard both a newly oriented block arrangement and its mirror image as novel, spending roughly equal amounts of time looking at both. Scientists have yet to address this possibility, she says.

If infant boys don't notice angle shifts, they would spend most of the time looking at novel mirror images, Levine suggests. Baby boys would thus falsely appear to be better than baby girls at mental rotation.

"Even if there is an early advantage in favor of males, there is ample research showing that mental rotation skill is malleable," Levine says. Preschool activities such as block building, assembling jigsaw puzzles and playing certain video games have been linked to stronger mental rotation skill. In 2005, Levine reported that second- and third-graders from poor families, who receive little or no exposure to such activities, show no sex difference in the ability to mentally rotate an object.

Some parents play with their children and babies in ways that promote spatial thinking, such as naming the shapes of toys and guiding a child's hand to rotate a toy, notes Penn State's Liben. It's not known whether parents target such behavior at boys, she says.

Researchers have yet to show that early proficiency on mental rotation tasks translates into an aptitude for spatially challenging subjects such as geometry, geography and science, Levine cautions.

Moore and Johnson showed 20 boys and 20 girls, all 5 months old, videos of a block arrangement rotating back and forth through a 240° angle. Each child sat in his or her mother's lap as the mother kept her eyes closed. After tiring of looking at this image, infants saw alternating videos of the original block arrangement or its mirror image rotating through a 120° angle.

Video records of infants' gaze and head movements revealed that 14 boys, or 70 percent of them, preferred looking at mirror images, compared with 9 girls, or 45 percent of them.

Quinn and Liben showed 12 boys and 12 girls, all 3 to 4 months old, a series of images of either a black number 1 or its mirror image, each drawn to appear three-dimensional and situated at a different degree of rotation. Each baby then saw presentations of both the number 1 and its mirror image in a new degree of rotation.

In the latter trials, 11 boys preferred looking at the image that they hadn't seen before, compared with 5 girls.

It may be possible to study mental rotation in babies within the first few days after birth, Quinn says.

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