Medical Xpress

Neuroimaging study: Building blocks activate spatial ability in children better than board games

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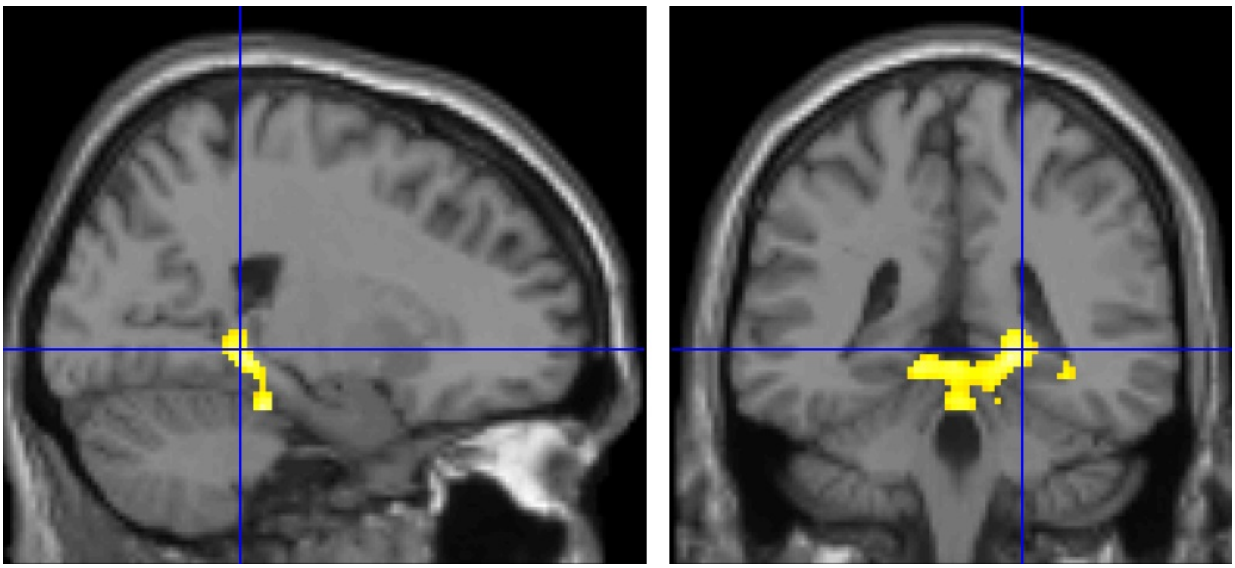

Scans of the children's brains show increased activation in the anterior lobe of the cerebellum and the parahippocampus during the second mental rotation test, which was administered after they played with blocks. Credit: Indiana University

Research from Indiana University has found that structured block-building games improve spatial abilities in children to a greater degree than board games.

The study, which appears in the journal *Frontiers in Psychology*,

measured the relative impact of two games—a structured block-building game and a word-spelling board game—on children's spatial processing, including mental rotation, which involves visualizing what an object will look like after it is rotated.

The research lends new support to the idea that such block games might help children develop spatial skills needed in science- and math-oriented disciplines.

It is also the first study to use neuroimaging to explore the effects of block building on brain activity, said Sharlene Newman, a professor in the IU Bloomington College of Arts and Sciences' Department of Psychological and Brain Sciences, who led the research.

"Block play changed brain activation patterns," Newman said. "It changed the way the children were solving the mental rotation problems; we saw increased activation in regions that have been linked to spatial processing only in the building blocks group."

The structured block-building game used for the study was called "Blocks Rock"; the board game was Scrabble.

The research builds upon previous studies that have shown that children who frequently participate in activities such as block play, puzzles and board games have higher spatial ability than those who participate more in activities such as drawing, riding bikes, or playing with trucks and sound-producing toys.

It is also demonstrates that training on one visuo-spatial task can transfer to other tasks. In this instance, training on the structured block-building game resulted in transfer to mental rotation performance.

"Others studies look solely at behavioral changes, such as the improved

performance on measures of spatial ability," Newman said. "We're actually scanning the brain."

Children underwent brain scans before and after playing with either a block-building game or a word-spelling board game. Credit: Indiana University

To conduct the study, IU researchers placed 28 8-year-olds in a magnetic resonance imaging scanner before and after playing one of the two games. Play sessions were conducted for 30 minutes over the course of five days.

To create an equal distribution of spatial ability between the two groups from the start, the children were divided evenly according to several categories that have been linked to differences in spatial ability: gender, age, musical training, mathematical skill and socio-economic status.

The two groups of 14 children also took a mental rotation test while inside the scanner, both before and after playing the games. The test—a longstanding measure of spatial visualization and analysis—presents two versions of the same letter, and the children had to decide whether the second letter was simply a rotated version of the same letter or a rotated mirror image of that letter.

There were no differences in mental rotation performance between the two groups in either the brain activation or performance during the first rotation test and scan. But the block play group showed a change in activation in regions linked to both motor and spatial processing during the second scan.

The group who played board games failed to show any significant change in brain activation between the pre- and post-game scans, or any significant improvement on the mental rotation test results.

Insofar as the spatial abilities of 8-year-olds are still developing, Newman said the change from the first scan to the second scan might reflect a shift in the strategy used to solve the mental rotation problems.

In other words, as children develop their spatial abilities, they may move from a piecemeal strategy in which they analyze the internal relations or parts of an image to a holistic strategy in which the image as a whole is mentally rotated.

"The block play group showed a change in activation in regions linked to both motor and spatial processing," Newman added. "This raises the possibility that the block play group changed how they were performing the mental rotation task after training."

Ultimately, Newman, who in other work has explored the relationship between math and spatial reasoning, hopes that such findings will help

students struggling with math and other disciplines.

"Any way you can improve a child's mathematical competence, whether through block-building or any other method, that's where my interest lies," she said.

More information: Sharlene D. Newman et al, An fMRI Study of the Impact of Block Building and Board Games on Spatial Ability, *Frontiers in Psychology* (2016). DOI: 10.3389/fpsyg.2016.01278

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