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NEWS OF THE WEEK

EDUCATION:

Science Needs Kids With Vision

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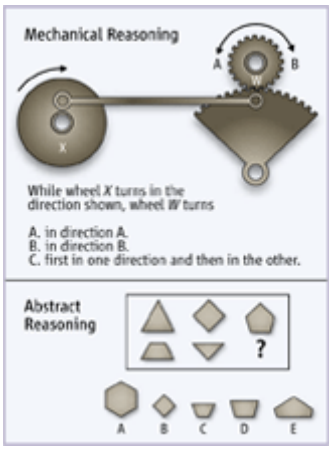
Albert Einstein, who was famously able to conduct physics experiments in his head, once said his "elements of thought are not words but certain signs and more or less clear images." Einstein would probably make the cut in most modern-day science talent searches. But many of those with exceptional spatial abilities are being missed, claims psychologist David Lubinski of Vanderbilt University in Nashville.

Lubinski, who put his case last week to the National Science Foundation's National Science Board at a workshop on innovation, says that despite their importance in science, particularly in fields such as engineering, robotics, or astronomy, spatial abilities are getting short shrift both in school curricula and in programs trying to spot precocious youths. He estimates that such programs overlook more than half of those with exceptional spatial abilities. "How many Edisons and Fords are we missing?" he asks.

According to educational psychologist David Lohman of the University of Iowa in Iowa City, spatial ability is "the ability to generate, retain, retrieve, and transform well-structured visual images." Tests cover areas such as visualization (figuring out what happens when a piece of paper is folded, for example), mentally rotating an object, and mechanical reasoning (see illustration). Many talent hunts for gifted elementary and high school students rely on the results of the SAT, which assess verbal and math—but not spatial—skills.

Lubinski and Camilla Benbow of Vanderbilt have found from their analyses of data from the Study of Mathematically Precocious Youth, begun in 1971 at Johns Hopkins University in Baltimore, Maryland, that there is wide variability in spatial abilities even among the one in 1000 children who score over 700 on the math SAT before age 13. Their latest paper, scheduled for publication in the November issue of the *Journal of Educational Psychology*, shows that spatial abilities "behave in the same way in an average sample" as they do in the hyper-precocious, says Lubinski. Spatial ability roughly correlates with math and verbal ability, but many spatially gifted people are not in the top tier of math or verbal ability. Using data from Project TALENT, a 1960 survey of 400,000 U.S. high school students, they found that among those who scored in the top 1% of spatial ability, 70% did not make it into the top 1% of math or verbal ability. That means they would have been overlooked by most talent searches. But an 11-year Project TALENT follow-up showed that spatial abilities tend to correlate with scientific achievement. For example, 45% of those with science and engineering Ph.D.s were in the top 4% of the spatial ability range,



compared with 25% of the bachelor of science degree holders. Fewer than 10% of the Ph.D.s were below the top quartile in spatial ability.

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[Larger version of this image]

Such data are news even to people in the field. "I was really amazed at the numbers," says psychologist Nora Newcombe of Temple University in Philadelphia, Pennsylvania, principal investigator for the Spatial Intelligence and Learning Center, a consortium that does research on spatial skills and how to improve them. Newcombe agrees that people with such skills are not getting the attention they deserve in school. As Lubinski says, the typical "highly verbal" high school curriculum "turns them off; they love classes with a big lab component."

The Belin-Blank International Center for Gifted Education and Talent Development at the University of Iowa, where Lohman is the research director, is interested in developing and validating a new spatial test to add to those it uses for its talent search and has applied for a foundation grant. A nationally normed test in which results can be reliably compared with math and verbal test scores will offer "a new dimension to help us understand why some are more [scientifically] creative than others," says center director Nicholas Colangelo.

Everyone agrees that spatial tests will disproportionately select boys. Larry Hedges, a statistician at Northwestern University in Evanston, Illinois, has estimated that the ratio of boys to girls in the top 5% of spatial ability is more than 2.3 to 1. For mechanical reasoning, it's about 11 to 1. But Hedges also points out that spatial ability is highly malleable: "You can change it much more than IQ or verbal or math abilities."

"It's of concern that you would over-identify males if you just make a decision on the basis of this," notes Newcombe. But, she says, more focus on spatial ability is long overdue: "It's an orphan skill."

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