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Mind » Mind Matters

What Makes a Prodigy?

Insights from psychology into the origins of extreme ability

By David Z. Hambrick | September 22, 2015 | 0

This January, Wolfgang Amadeus Mozart, classical music's original *wunderkind*, turns 260. Before his untimely death, at age 35, Mozart composed 61 symphonies, 49 concertos, 23 operas, 17 masses, and scores of other works. He was said to be composing on his deathbed. But through a dozen or so major biographies and the 1984 movie *Amadeus,* what has most captivated the popular imagination are Mozart's childhood accomplishments. As the historian Paul Johnson recounts in *Mozart: A Life,* Mozart began playing the clavier at age 4 and was composing at 5. The following year, he played for the Holy Roman Empress of the Habsburg Dynasty and her musically inclined daughter, Marie Antoinette. At age 7, he toured Germany and played for Louis XV at a dinner party in Paris, and by age 14, he had composed an opera. Thus did Mozart accomplish more by the age that someone today would enter high school than one of his contemporaries would hope to accomplish in a long composing career.

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What explains prodigies? How can a person accomplish so much so fast? Psychologists have long debated this question. According to one account, it is possible that most anyone could be a prodigy, with the right environment. As the late psychologist Michael Howe argued, "With sufficient energy and dedication on the parents' part, it is possible that it may not be all that difficult to produce a child prodigy." Extraordinary opportunity is indeed a theme that runs through the biographies of many prodigies. Mozart's father, Leopold, was a highly sought after music teacher, and gave up his own promising career as a musician to mange his son's career. More recently, Tiger Woods' father introduced him to golf at age 2. When Venus and Serena Williams were children, they moved with their family from California to Florida so they could train at an elite tennis academy.

However, recent research indicates that basic cognitive abilities known to be influenced by genetic fact achievement. In the most extensive study of prodigies to date, the psychologist Joanne Ruthsatz and h standardized test of intelligence to 18 prodigies—five in art, eight in music, and five in math. There wa sample, from 100—the average for the general population—to 147—well above the usual cutoff for "int an average score of 140 (above the 99th percentile), nearly all of the prodigies did extraordinarily well Analogous to the central processing unit of a computer, working memory is a cognitive system respons operations involved in complex tasks such as problem solving and language comprehension. It is what for a dinner check in your head, or when you hold in mind the steps of a complex skill you are trying to

Working memory is measured with tests that involve both remembering information for a short perio information in some way. For example, in backward digit span, the test-taker is read a sequence of ran 5 0. The goal is then to recall the digits back in the reverse order—0 5 7 3 1 5 9 2 3 8 for the preceding s like these, people differ substantially in the capacity of their working memory system—some people ha than other people. Moreover, this variation is substantially influenced by genetic factors, with estimate 50%.

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With an average score of 148, the music prodigies in the Ruthsatz study were especially high in workin math prodigies was 135 and for art prodigies was 132). In fact, all eight of the music prodigies were at four were at or above the *99.9th* percentile. The odds of eight randomly selected people scoring this hi Ruthsatz and colleagues concluded that a superior working memory is one characteristic that prodigie common.

Prodigies also exhibit an unusual commitment to their domain, which the developmental psychologist master". Winner describes children who possess this quality in the following terms: "Often one cannot activities in their area of giftedness, whether they involve an instrument, a computer, a sketch pad, or a a powerful interest in the domain in which they have high ability, and they can focus so intently on wo sense of the outside world." Winner argues that this single-mindedness is a *part* of innate talent rathe of genetically-influenced aptitude, interest, and drive that predisposes a person to obsessively engage i master" is a good description of Mozart's personality. In her landmark biographical study of 301 geniu from "before his 6th year, Mozart's sole absorbing interest was in music, and even the games he played

Consistent with Winner's thesis, results of a recent study of more than 10,000 twins by Miriam Mosing colleagues at Sweden's Karolinska Institute revealed that a common set of genes influence both music practice—an example of a phenomenon known as genetic pleiotropy, which occurs when one gene (or traits.

Taken together, these findings add to a growing body of evidence indicating that exceptional performa science, and other complex domains is, at its core, determined multiply—the product of both environm influenced traits. More generally, psychologists who study expertise are moving beyond the question o "made." As the psychologist Jonathan Wai put it, it is increasingly clear that "Experts are born, then m

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