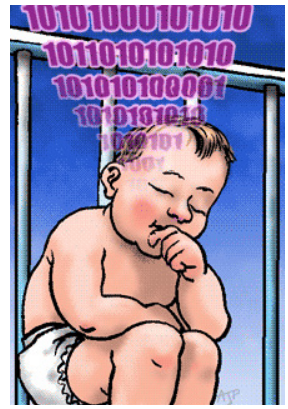
The Economist

Who wants to be a genius?

Psychologists are divided over whether genius is innate or acquired. Nobody has yet been smart enough to figure it out

Jan 11th 2001



THOMAS EDISON gave his famous formula for genius as 1% inspiration and 99% perspiration. Modern-day students of geniuses and prodigies, though, argue over the relative contributions of more tangible factors—of genetics, of physiology, of hours spent in training. Most believe that geniuses have special genes. Almost nobody takes the opposite stance: that prodigy performance, in any field, lies within the grasp of anyone who cares to try hard enough.

Anders Ericsson, a psychologist at Florida State University, falls into the minority camp. Given ten years of deliberate practice, Dr Ericsson says, anyone should be able to attain prodigy-level performance in his discipline of choice. The intuitive objection to this idea is the "Mozart argument", as it is called by Brian Butterworth, a neuroscientist at University College London who has studied the psychological aspects of arithmetic for many years. This argument is that not everyone can become a Mozart merely by dint of hard work. Dr Ericsson wonders why not. After all, he argues, did not Mozart become Mozart by dint of hard work?

This may seem to be easily refuted by popular legends about geniuses such as Mozart, Paganini and Gauss, which report that they all showed exceptional skills in early childhood before receiving a shred of formal instruction. But Dr Ericsson points out that most of these stories are, indeed, legends. Rather than rely on such myths, he insists on studying those experts and prodigies who are living today.

Practice makes perfect

Dr Ericsson does not believe that the exceptional abilities of such people are due to their innate talent. Rather, he explains their performance by pointing out that they have developed powerful memories for storing information about particular topics. Psychologists recognise (and brain-science confirms) a distinction between short-term "working" memory and long-term memory. Dr Ericsson believes that prodigies get such impressive mileage out of their working memories by placing important pieces of information into their long-term memories in a way that makes them accessible to working-memory processes. According to Dr Ericsson, this "long-term working memory" is the essential ingredient for expert performance in any field, from chess to typing to golf, and can be developed at will.

Recently, some neuroscientists tried to observe long-term working memory in action. Nathalie Tzourio-Mazoyer at the University of Caen, in France, and her colleagues, measured the brain activity of a maths prodigy as he performed some feats of arithmetical acrobatics. Their subject, Rüdiger Gamm, can calculate the fifth root of a ten-digit numeral within seconds, and as quickly raise a two-digit number to its ninth power. When asked to divide one integer by another, he unhesitatingly recites the answer to 60 decimal places. Dr Tzourio-Mazoyer's research, published in this month's *Nature Neuroscience*, represents one of the first efforts to watch such a performance as it unfolds in the brain.

Through the use of positron-emission tomography (PET), an imaging technique, Dr Tzourio-Mazoyer's team found that Mr Gamm was using more of his brain than normal controls, with whom they compared him, as he performed his mathematical tricks. Both Mr Gamm and the controls showed activity in 12 parts of the brain, but in five additional areas, Mr Gamm alone showed any activity. Three of these areas have previously been linked with the formation of episodic memories, which are a kind of long-term memory.

Mr Gamm appeared to be using his long-term memory to store the working results that he needed to complete his calculations—for example, all the dividends and remainders of a division sum. His use of this extra memory space meant that he could circumvent that perennial pitfall of mental arithmetic, losing one's place. In other respects, Mr Gamm's brain does not appear notably unusual. Nor does he perform with exceptional aptitude on tests of skills that lie outside his area of expertise, such as verbal recall. Moreover, Mr Gamm, who is now 26, was not born with this computing ability. He developed his skills, through four hours of practising memorisation daily, only after he had passed the ripe old age of 20.

As both the PET scan and his past experience bear out, enhanced memory appears to be the key to Mr Gamm's ability. So this study seems to provide some neurological evidence for Dr Ericsson's idea that long-term working-memory function underpins prodigy-level performance. So far, so plausible. But Dr Ericsson also maintains that such memory function, and the superlative performance that goes with it, can be attained by anyone—biology no bar—given enough practice and perseverance.

This is a much more contentious point. Twenty years ago, Dr Ericsson tried to prove it by training some ordinary laboratory volunteers up to prodigy-level performance in a number-memory task. Average people tend to have a "digit-span" of seven—in other words they can recall a string of seven random digits after hearing it read out once. But after a year's practice, two of his particularly dedicated subjects were able to increase their digit-spans to lengths of 80 and 100.

Just as Dr Ericsson took people with no discernible talent and turned them into champions, so, in a fashion, did a Hungarian, Laszlo Polgar. When he began training his daughters, it was widely believed that women could not play serious tournament chess. But through a deliberate (and still continuing) psychological experiment, Dr Polgar and his wife created a trio of world-class chess champions out of their own daughters, overturning this prejudice.

By 1992, all three had reached the women's top ten worldwide. The third, who presumably received the most refined training regimen, became the youngest grandmaster in the history of the game and is reckoned by her peers to have a good chance of becoming world champion one day. With remarkable, if not hubristic, prescience, Dr Polgar had written a detailed book on the subject of child rearing, entitled "Bring Up Genius!" before beginning the coaching of his children. But would any child reared by such a parent have become a chess prodigy?

Ellen Winner, a psychologist at Boston College who has been studying the relationship between exposure to the arts and subsequent academic achievement, believes not. She argues that only children with the "rage to master" a skill could make it through the gruelling years of training needed to achieve expert ability. The rage to master may be the point at which nature unequivocally makes its constraints felt. Even Dr Ericsson concedes that there might be a genetic component separating the child willing to persevere with a rigorous schedule from the child who would rather play videogames.

Put it another way: even if there are no born mathematicians or musicians, there may be "born achievers". The particular area in which such people make their mark might be determined purely by the kind of environment or skill to which they were exposed and how hard they then applied themselves. But among many psychologists this all-purpose view of genius is not a popular one. Dean Simonton of the University of California, San Diego, dubbed it the "drudge theory" of genius in a recent book review.

Dr Simonton considers genius to have more of a genetic component. Yet this conviction has not stopped him from writing a book of profiles of psychologists who were reckoned to be geniuses. The American Psychological Association will publish this book later this year, so that its members may learn from Dr Simonton's observations on the great prodigies of psychology. And though Dr Ericsson is not on his list this year, in ten years from now he doubtless will be—if he wants it badly enough.

The Economist Newspaper | Science and Technology