Paradox of the savant mind

The provocative exceptions to our understanding of intellectual ability.

Bright Splinters of the Mind: A Personal Story of Research with Autistic Savants
by Beate Hermelin
Jessica Kingsley: 2001. 160 pp. £29.95, $49.95 (hbk); £13.95, $19.95 (pbk)

Allan Snyder

Art, music and mathematics are often presumed to be the supreme expressions of the creative mind. They supposedly require superior intelligence along with years of disciplined training. But do they? By the age of three, Nadia could draw horses with astonishingly lifelike perspective. She did so spontaneously, without any training, and from memory. Yet Nadia could not even distinguish her mother from the nurse and was unable to communicate.

Tom, from the age of four, could play Mozart piano sonatas flawlessly after a single hearing. He could also repeat, word for word, extended conversations in any language. Yet he, too, was mentally retarded and lacked the ability to communicate. The same was true of Joseph, the inspiration for the Hollywood film *Rain Man*, who could mentally calculate which two numbers, when multiplied, give the product 1,234,567,890.

These provocative exceptions to our understanding of intellectual abilities are known as savants. Savants are extremely rare individuals who, although severely brain damaged, display islands of astonishing excellence. And they have no idea how they do it.

How do they do it? One view argues that savants acquire their skills like any normal person, through repetitive practice. The idea is that brain damage fuels obsessional interest and the capacity for pathological concentration. But this explanation does not fit well with the fact that savant skills often emerge 'spontaneously' and do not improve qualitatively with time, even though the skill might become better articulated.

At the other extreme, my colleagues and I have argued that savant skills are a form of mimicry, requiring little or no practice. Savants simply tap into information and mental machinery that resides equally in us all but cannot normally be accessed. For example, our brains possess algorithms for calculating the shape of an object from subtle shading across its surface. We are not conscious of this shading, for otherwise we would all be able to draw without training. But brain damage enables savants to have privileged access to such information.

To formulate explanations such as these, we need to have quantitative studies of savant performance. Most accounts of savants are purely descriptive. But in the 1960s, two trail-blazing psychologists, Beate Hermelin and Neil O'Connor, brought autistic savants into the laboratory and began to devise methodologies and conduct carefully controlled experiments to unravel this phenomenon.

Bright Splinters of the Mind is Beate Hermelin's personal account of her research with autistic savants, in particular their abilities in poetry, foreign languages, lightning-fast arithmetic, drawing and calendar calculating. Discussing artistic savants, Hermelin concludes that they have a "specific ability to draw", and that they use the same pictorial rules of linear perspective as do trained normal artists to portray a three-dimensional world on a flat surface.

Take mathematical savants who can rapidly identify whether or not a large number is a prime (divisible only by one or by itself). Hermelin concludes that these savants use the same "strategies as mathematically trained individuals", specifically the Eratosthenes algorithm — derived from the 'sieve' of the Alexandrian philosopher Eratosthenes for identifying prime numbers. A similar conclusion is reached for calendar-calculating savants who can instantly answer

Nadia's horses, drawn when she was aged three (inset) and five. But Nadia couldn't tell her mother from her nurse and was unable to communicate.

FROM NADIA: A CASE OF EXTRAORDINARY DRAWING ABILITY IN AN AUTISTIC CHILD BY L. SELFE (ACADEMIC, 1977)

questions such as "what day of the week was 18 April 1720?". Hermelin says that they use the rules and regularities of the calendar, and that musical savants extract the "grammar" of music.

So Hermelin believes that savants apply the same rule-based strategies as do trained people of normal intelligence. How do they learn these strategies? She believes that the rules of linear perspective used in drawing are extracted from posters and illustrations. As for the other skills, she believes savants advance from a focus on specific details (say, numbers) to the whole picture (say, the Eratosthenes algorithm).

But savant skills can emerge suddenly after a person is hit on the head, so it seems possible that these skills are in us all without training, but cannot normally be accessed. Recent evidence suggests that they might even be switched on by using magnetic pulses to switch off part of the brain, as our work had indicated.

Hermelin's is a highly readable book. She goes well beyond merely presenting a scientific account. Rather, she conveys something about who these people really are. She weaves a tapestry of their personal lives, especially their difficulties in confronting life as we normally know it. The book works well at all levels.

Anyone who has interacted with autistic individuals will appreciate the magnitude of Hermelin's contribution. Her findings are a giant step forward in unravelling the treasures of our minds. To extract the core explanation for savant skills, it might be necessary to test savant prodigies when their skill first emerges because, with maturity, autistic savants often acquire concepts and knowledge which inevitably become incorporated into their skill base. Such research remains a herculean task for future investigators. ■

Allan Snyder is at the Centre for the Mind, Australian National University, Canberra, ACT 0200, and University of Sydney, Main Quadrangle, Sydney, New South Wales 2006, Australia.

Spandrels or selection?

The Evolutionists: The Struggle for Darwin's Soul
by Richard Morris
W. H. Freeman: 2001. 272 pp. $22.95, £18.99

Dawkins vs. Gould: Survival of the Fittest
by Kim Sterelny
Icon: 2001. 160 pp. £5.99, $9.95 (pbk)

Michael A. Goldman

Nature or nurture? Chance or necessity? These dichotomies embody a controversy that has raged among the top thinkers in evolutionary biology. The question is: does adaptation by natural selection explain everything in nature, including human behaviour, or is the situation more complicated? The problem is that no one really believes the first proposition, but the second does not constitute a useful scientific hypothesis. And except as the impetus for a spate of books and articles, and lots of acrimonious debate, it may not matter much.

The contemporary debate started in 1979, when Stephen Jay Gould and Richard C. Lewontin published an article entitled "The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme". This became the focus for the conflict between two lines of evolutionary thought. On one side are Richard Dawkins and like-minded evolutionary biologists, who believe that natural selection is adequate to explain virtually every observation in evolutionary biology. On the other are Gould and his followers, who believe that natural selection is a very important force in evolution, but not the only one. The most heated controversy arises when we attempt to apply our knowledge of evolutionary biology to the origin of human behaviour.

In *The Evolutionists* and *Dawkins vs. Gould*, Richard Morris and Kim Sterelny, respectively, recount this controversy in excruciating detail. Sterelny gets almost to the heart of the matter, and Morris's engaging style makes the history, politics and political motivations fun to read. Unfortunately, neither author really brings us any closer to a resolution, and neither really explains why the controversy may never be resolved.

Both try to dissect the argument into its component parts. They agree that Gould departs from "Darwinian fundamentalists" in his belief that evolution occurs by periods of stasis followed by periods of rapid evolution ("punctuated equilibria" or, as his detractors quip, a theory of "evolution by jerks"). Palaeontologist Gould sees evidence for rapid transitions, catastrophic extinctions and spectacular radiations in the fossil record, and thinks that a model of slow, steady change by natural selection acting on genetic variation is not adequate to explain history. In particular, Gould's notion of contingency in evolution may be important in understanding the origin of new species and higher taxa, and aspects of the broad pattern of evolutionary history that have never been fully explained by the neodarwinian synthesis.

Another area of disagreement concerns Gould and Lewontin's concept of 'spandrels' in evolution. Named after an architectural feature that is a by-product of the construction, evolutionary spandrels are biological structures or traits that are accidental by-products of history, not the results of natural selection. However, natural selection can clearly mould a spandrel into a useful structure. Spandrels, Morris and Sterelny agree, don't much change our understand-

PAUL ALMASY/CORBIS

The spandrels of San Marco's basilica, symbols of a long-running debate on evolution.