

The Imprinted Brain

HOW GENES SET
THE BALANCE
BETWEEN AUTISM
AND PSYCHOSIS

Christopher Badcock



Jessica Kingsley Publishers
London and Philadelphia

Contents

PREFACE	7
Introduction	9
1 • Autism and Its Compensations	15
Autism, schizophrenia, and Asperger's syndrome.....	16
Savants and savantism	25
People people and things people	34
Mechanistic or systemizing?.....	38
2 • Deficits in Mind	45
Not seeing the wood for the trees	45
Mind-blindness	50
Mentalism	57
From attention to intention.....	63
3 • From Gaze to Grandeur	73
Delusions of gaze	73
The why and how of passion and persecution	79
Conspiracies and magic	86
The sense of self in ASD and psychosis.....	91

4 • Cancers of the Mind	99
Memory, self-deception, and candour	99
Hyper-mentalism	107
Magic and religion	119
Mental metastasis	130
5 • The Battle of the Sexes in the Brain	133
Strange inheritance	133
The extreme male brain	138
Genomic imprinting	143
Imprinting and the brain	148
Mother's baby—father's? Maybe!	157
6 • Sex and Psychosis	161
The X in psychosis	161
Psychosis, poverty, and pathogens	168
Handedness, belief, and the brain	172
Paranoia and homosexuality	177
ASD, PSD, and normality	183
7 • Beyond the Balanced Brain	189
The cognitive configuration of genius	190
The genius of detective fiction	196
Psychotic savants	199
The case of Freud	204
Therapeutic implications of the imprinted brain theory	212
NOTES	223
REFERENCES	231
INDEX	251

Autism and Its Compensations

Once, autism was thought to be a condition with few if any positive aspects, but today a more balanced view has emerged. In this chapter I aim to show that autism is not simply a combination of deficits as was once supposed, but is associated with some remarkable sensory and cognitive compensations. As we shall see, research into autism suggests that human beings have evolved two parallel ways of thinking. One, which you might call *people-thinking*, *mentalistic cognition*—or more simply *mentalism*—is wholly concerned with understanding human beings, their minds, motives, and emotions; the other, which by contrast you could call *things-thinking* or *mechanistic cognition* is concerned with understanding and interacting with the physical, non-human universe of inert objects. It is to the latter that we owe our technological, scientific, and material mastery of the world, and we shall see that although autistics symptomatically have deficits in mentalistic people-thinking, they are often superior where basic sensory sensitivity is concerned, and can sometimes show extraordinary abilities in mechanistic things-thinking. Furthermore, this way of looking at autism suggests that the exact opposite cognitive configuration—superior mentalistic skills with deficits in basic senses and in mechanistic cognition—could also exist. Later I shall argue that it indeed does in psychotic disorders such as schizophrenia and that what passes for normality is nothing but a more or less stable balance of both tendencies. The fundamental insight is that autism is part of a much bigger picture which includes

both psychosis and sanity, and lies at the heart of human genius, as I shall argue in my conclusion.

But this is to anticipate. First, let me set the scene with a brief historical summary of what we have come to know about autism.

Autism, schizophrenia, and Asperger's syndrome

The word *autism* was originally coined by one of the founding fathers of modern psychiatry, Eugen Bleuler (1857–1939), to describe a style of thinking found in schizophrenia (itself another Bleuler coinage).¹ He derived it from the Greek *αυτοσ* (*autos*) meaning “self,” and defined it as “detachment from reality, together with the relative and absolute predominance of the inner life.”² In 1936 the paediatrician, Hans Asperger (1906–1980), gave a lecture at the Vienna University Hospital in which he described the characteristics of “autistic psychopaths,” and in 1938 and 1944 published details of more such cases.^{3,4} Meanwhile, in 1943 the psychiatrist, Leo Kanner (1896–1981), also published an account of 11 children at Johns Hopkins University Hospital in Baltimore who were suffering from what he called “early infantile autism.” He concluded that “Profound aloneness dominates all behaviour” in the autistic child, adding that “We must, then, assume that these children have come into the world with innate inability to form the usual, biologically provided affective contact with people, just as other children come into the world with innate physical or intellectual handicaps.”^{5a}

It is not known whether Asperger's discovery influenced Kanner or even if he knew of its existence. In any event, Asperger remained largely unknown to the English-speaking world until the 1980s⁶ and his name was not so much as mentioned in one of the most well-informed and wide-ranging reviews of the autism literature published in the 1960s.⁷ Recently an account of six cases diagnosed in 1926 as various types of “schizoid personality disorder” has been translated from the original German. Some of these subjects were also described as “autistic” by its author and bear striking similarities to the type of high-functioning

autism now associated with Asperger.^{8,9} However, even earlier accounts certainly exist.^{7a,10} Indeed, there is evidence of a five-year-old autistic boy having been admitted to Bedlam in 1799. The case was described in a textbook of 1809 by John Haslam, the Apothecary of Bethlehem Hospital, and this may well be the earliest description of autism in the psychiatric literature.¹¹ Nevertheless, authors such as Jane Austen (1775–1817) and Sir Arthur Conan Doyle (1859–1930) appear to have had an implicit awareness of features of autism and to have been able to portray autistic characters in their fictional works quite independently of science and psychiatry¹² (for more on Conan Doyle, see pp. 196–198).

Today autism and schizophrenia are thought to be separate disorders, and Bleuler himself later substituted *dereistic* for *autistic* as a description of schizophrenic thought that was less likely to be misunderstood.¹³ However, a major theme of this book will be to argue that there is indeed an important link between them. Later I shall suggest that autism and psychoses such as schizophrenia could be seen as extremes on a single line of development—with normality balanced precariously in between. Just as both over-sensitivity and under-sensitivity to light or sound will cause visual or hearing short-comings, so we shall see that both over- and under-sensitivity to your own and other people's minds can cause the contrasting mental deficits seen in autism and psychosis. If this is so, you might wonder to what extent the early association of the two disorders in psychiatry was an anticipation of what is now beginning to look like a profound connection ultimately explicable in terms of genetic findings that are only now coming to light.

Autism is a disorder that usually first becomes apparent in childhood, mainly as a result of failure to develop normally. A consensus panel of the American Academy of Neurology recommends that a child with any of the following symptoms should be evaluated for possible autism: no babbling, gesturing, pointing, or waving good-bye by 12 months; no single words by 16 months; no two words spoken together spontaneously by 24 months; and any loss of language or social skills at any time.¹⁴ As the last item suggests, children can develop normally

Typical symptoms and signs of autism

- deficits in non-verbal communication such as eye-contact, facial expression, and body language
- self-absorption, egocentricity, and lack of awareness of and insensitivity to others, with difficulty in establishing relationships, friendships, or peer-relations
- delay, or total lack of language competence, with communication deficits or peculiarities in speech, gesture, and conversation
- repetitive and/or stereotyped movements (such as hand-flapping), with distress over change and insistence on routine, or a compulsion to carry out rituals
- fragmented sensory perception with inability to generalize, and pre-occupation with parts rather than wholes
- abnormal pre-occupation with or intensity of interest in one subject or activity, perhaps with isolated areas of expertise and/or exceptional rote memory alongside more general cognitive impairment

Additional features often found associated with autism

- mental retardation (found in about 75% of cases)
- unusual beauty, often looking younger than they are, with a characteristic “autistic look” described by Kanner as “beatific serenity”
- odd or unusual gait
- difficulties with hand-writing
- insensitivity to pain, often combined with indifference to cold (and sometimes lack of fear of heights and an amazing ability to survive falls)

- synaesthesia (mixing of perceptual categories) with confusion between different senses
- problems with depth-perception, “white-out” effects and other visual deficits, particularly in relation to moving objects, strange places, or novel situations
- unusual sensitivity to smell, sound, or other sensory perceptions, sometimes with sensations of “sensory overload”
- allergic or phobic reactions to specific foods, smells, or sensory perceptions, with resulting fastidious food preferences and avoidances
- bowel disorders
- sleep disorders
- epilepsy (25–35% of cases)
- intolerance of itchy and/or tight clothing
- chronic anxiety, often with excessive startle and fear reactions
- fear of crowds and strangers, and dislike of socializing
- panic reactions at being touched or hugged by people
- a liking for being wedged in small, enclosing spaces, or tightly squeezed into corners
- a fascination for spinning objects
- enthrallment with machines, mechanisms, and gadgets of all kinds

up to a certain point, and then regress; while others can appear to have early delays in these respects that are later fully compensated and leave no lasting deficits.¹⁵ Typical symptoms and signs of autism are set out in the box above along with a number of other features often mentioned in connection with autism although not found in all cases (for a more exhaustive discussion see ¹⁶.)

An important aspect of diagnosis in autism is the extreme variability of the symptoms. Autistic children within the same family can have strikingly different autistic traits,¹⁷ and authorities point out that “None of the criteria exactly describes every individual with autism. Autism presents in a myriad of ways; every individual with autism is different and unique, and has features that would lead a person superficially examining them to say that this person can’t have autism.”^{18a}

Another factor that has bedevilled diagnosis is confusion of autism with schizophrenia and other mental disorders, despite the fact that almost from the beginning some writers could see that they were anti-thetically different in many respects.⁷ What we would now call autism was often given labels such as “schizoid personality disorder” or even “childhood schizophrenia” in the past, and more recently there was also a tendency to diagnose children as autistic but to substitute “schizophrenic,” “psychotic,” “borderline,” or some similar diagnosis for the same symptoms when they grew up. Indeed, I shall argue in a later chapter that even today it is easy to confuse autism with psychotic disorders, and that although the symptoms might seem very similar, closer examination shows them to have completely different causes. Nevertheless, mis-diagnosis—principally of autistics as suffering from various forms of psychotic illness but also psychotics mis-diagnosed as autistics—has been a major factor in confusing autism with psychosis. This has certainly been true in forensic psychiatry where, despite the high numbers of autistics in secure prison hospitals,^{18b} autism has tended to be regarded as a much less convincing plea of mitigation in the courts than has schizophrenia. A case in point is that of Theodore J. Kaczynski, otherwise known as the Unabomber, who has recently been diagnosed as a high-functioning autistic, but who was prevailed upon to plead insane on account of schizophrenia at his trial by his lawyers. Kaczynski’s autism and associated social isolation resulted in a highly atypical career of lone terrorism which occasioned the longest and most expensive manhunt in the twentieth century, and was only brought to an end when he attempted to communicate his ideas by publishing *The Unabomber Manifesto*.¹⁹ The result is that a classic case of autism has gone down in legal history as one of

schizophrenia, and there is no way of telling how many other similar cases there may be.

Despite the fact that Kanner specifically remarked in his original report that “Even though most of these children were at one time or another looked upon as feeble-minded, they are all unquestionably endowed with good *cognitive potentialities*,”^{5b} Kanner’s name has become associated with a more severe degree of disability. One reason may be that 8 out of 23 cases of autism reported by him in 1946 featured *mutism*: in other words, serious language deficits amounting to an inability to speak.²⁰ By way of contrast, Asperger’s original cases were described as having well-developed speech and even “talking like grown-ups” in early childhood. What is now known as *Asperger’s syndrome* shares many of the same central deficits and the restricted, repetitive patterns of behaviour, interest, and activity seen in classical autism, but is distinguished by the absence of delays or deficits in language and of obvious signs of cognitive impairment in childhood. Today about half of all children diagnosed with Asperger’s syndrome have relatively advanced verbal skills and are sometimes described as *verbalizers*.^{21a} Indeed, a leading clinician comments that from his experience he considers that children and adults with Asperger’s syndrome just have a different, and not necessarily defective, way of thinking.²² Alternatively, Asperger’s syndrome is sometimes described as *high-functioning autism*²³—and this was the actual autistic diagnosis of the Unabomber, mentioned just now.

Estimates of the relative proportion of high- to low-functioning autism vary, but a recent study in the UK concluded that 55 per cent of people with an autistic disorder are low-functioning, and 45 per cent are high-functioning.²⁴ However, in early childhood the distinction is not always clear-cut. According to the same clinician I have just cited:

At one point in a child’s early development, autism is the correct diagnosis, but a distinct subgroup of children with autism can show a remarkable improvement in language, play and motivation to socialize with their peers between the ages of four and six years. The developmental trajectory of such children

has changed and their profile of abilities in the primary or elementary school years is consistent with the characteristics of Asperger's syndrome.^{21b}

For reasons such as this, there is now a tendency to think of classical, Kanner autism and Asperger's syndrome as the principal examples of *autism spectrum disorder*, or ASD for short (others include Rett syndrome, disintegrative disorder, and pervasive developmental disorder not otherwise specified).*

In the very first case of autism he described, Kanner recounts how the child in question was asked to subtract 4 from 10, and replied: "I'll draw a hexagon!"^{5c} Of course, this is the wrong answer, but a hexagon is a six-sided figure, and even being able to make this connection so quickly and spontaneously hints at an unconventional geometric rather than arithmetic way of thinking that might be seen in some ways as more intelligent—and certainly more creative in certain respects—than the "correct" answer. Nor was this an isolated or untypical finding. As early as 1960, American writers on autism were pointing out that the autistic child is "not mentally retarded in the ordinary sense of the word, but rather is a child with an inadequate form of mentation which manifests itself in the inability to handle symbolic forms and assume an abstract attitude."²⁵ Today some leading authorities are arguing that the perceived association between autism and mental retardation is not based on the fact that they usually have common causes but is more likely to be because the presence of both greatly increases the probability of a clinical diagnosis.²⁶ Indeed, according to the latest research, intelligence in autistics has generally been under-estimated, and they are not as impaired in fluid intelligence as many theories predict. On the contrary, autistic intelligence is revealed by the most complex single test of general intelligence in the literature: Raven's

* For a fictitious, but remarkable insight into the world of a child with Asperger's syndrome see Mark Haddon's novel, *The Curious Incident of the Dog in the Night-time*. However, perhaps the most striking of all depictions of high-functioning autism in literature is found in Albert Camus' classic novel, *L'Étranger*, published in 1942.

Progressive Matrices.²⁷ Such findings have been interpreted to suggest that Asperger's syndrome in fact involves superior abstract reasoning ability or higher general fluid intelligence.²⁸

For reasons which will be discussed in the next chapter, autistic people tend to perform poorly on subtests of intelligence that demand a high degree of communicative competence and/or social intelligence. An example would be comprehension tests, which require an ability to interpret the often implicit meanings, intentions, and understandings conveyed in a passage of writing. However, even where comprehension is concerned, there is a notable exception. A recent study compared autistics with normal subjects on tests of comprehension that involved sentences which demanded both verbal and visualization skills such as *The number eight when rotated 90 degrees looks like a pair of eye-glasses*. As the researchers point out, in sentences such as this the linguistic content must be processed to determine what is to be imagined, and then the mental image must be evaluated and related to the verbal meaning. Normal subjects only used mental visualization when necessary, but autistics were found to use it even when it was not, and the researchers comment that they were probably "thinking in pictures" much of the time. Indeed, the study suggested that as a result autistics might be better at visualizing linguistic information than normal people are.²⁹

Autistics are also superior to normal when it comes to copying impossible figures,³⁰ and the same is true of more straightforward visualizing ability. High-functioning autistics often have a remarkable eye for detail, and notice things that might escape the attention of others. That such impressions are not without an objective basis was recently demonstrated when the vision of a group of people with ASD was compared with that of non-autistic controls. Astonishingly, all 15 of the ASD subjects tested had superior eyesight, which was 2.79 times better than average (giving a score of 20:7, meaning that they could see details from 20 feet that an average person could only see at 7 feet). As the researchers remark, this approximately two-to-three-fold superiority in vision is comparable to that of birds of prey, and their results suggest that increased visual acuity applies to individuals across

the autistic spectrum, making this yet another respect in which autistics outperform the normal population.³¹

Indeed, there is now evidence that autistics may have heightened sensitivities in most senses. For example, despite sometimes giving the impression of being deaf, people with ASD often have superior hearing, as a number of studies have confirmed where discrimination of pitch is concerned.^{32,33} A study which explored sensitivity to touch found that people with ASD had a lower threshold for tactile stimulations than normal controls.³⁴ Another which investigated both touch and hearing in 20 adults with and 20 without ASD matched for sex, age and IQ found that the autistic subjects were hyper-sensitive in both hearing and touch. The two sensitivities appeared to be correlated, suggesting a shared underlying factor (and perhaps explaining autistic symptoms such as intolerance for loud noises and itchy clothing, dislike of being touched, or difficulties with distinguishing individual voices in noisy environments).³⁵ Another experiment compared 17 ASD subjects with 17 normal controls in a standard test of sensitivity to smell. The autistic group proved able to detect the test odour at a mean distance of 24.1 cm compared to 14.4 cm in the case of the controls. The study also found a quantitative relationship between level of enhanced sensory processing and the number of autistic traits, with greater severity of autistic behaviour related to higher sensory perception. However, there was no correlation between sensory thresholds and age or level of cognitive functioning, suggesting that hyper-sensitivity to smell might be a core feature in ASD.³⁶ Some parents of autistic children credit them with extra-sensory perception, and these findings suggest that there may indeed be a major core of truth in the claim—at least in so far as those children’s sensory sensitivities do in fact go beyond the normal range.³⁷

As long ago as the mid-1960s, Rimland remarked that “Judging from his excellent ability to reproduce nursery rhymes and melodies, his memory for spatial relations and his motor performance and finger dexterity, the child with infantile autism has a clear and precise focus on the physical, if not the psychological, aspects of reality.”^{7b} Summarizing a wide range of studies, a recent review concludes that “The level of

performance of persons with autism on tasks of spatial orientation, phonological discrimination, word perception, and simple geometrical patterns, is typically higher than their general level of development.”³⁸ Indeed, if extraordinary facility with doing things such as jigsaw puzzles is included, the majority of people with autism would be classed as showing some specific talent.³⁹

Again, the compulsive concentration on a single subject so typical of ASD need not always be counter-productive, as an autistic writer observes:

While most clinicians with expertise in Asperger’s syndrome would likely say that dwelling on certain subjects counts as negative, I must disagree. I have the trait of sticking to a project long enough to see it through to completion... Since I can think about subjects repeatedly for long periods of time without getting bored, my mind has greater access to deeper thinking about those subjects. I find that with repeated tenacious thoughts, things that were initially difficult to figure out do eventually get figured out.⁴⁰

Savants and savantism

In his original paper on autism, Hans Asperger remarked that:

To our own amazement, we have seen that autistic individuals, as long as they are intellectually intact, can almost always achieve professional success, usually in highly specialized academic professions, with a preference for abstract content. We found a large number of people whose mathematical ability determines their professions: mathematicians, technologists, industrial chemists, and high ranking civil servants... A good professional attitude involves single-mindedness as well as a decision to give up a large number of other interests... It seems that for success in science or art, a dash of autism is essential.

... Indeed we find numerous autistic individuals among distinguished scientists.⁴¹

Perhaps appropriately, Asperger himself has recently been put forward as an example of his own syndrome,⁴² and autistic tendencies allied with outstanding skills and even genius have been detected in other famous scientists and mathematicians. Examples are Sir Isaac Newton (1643–1727); Albert Einstein (1879–1955); Paul Dirac (1902–84),⁴³ Alan Turing (1912–54),⁴⁴ and Charles Richter (1900–85), the seismologist who gave his name to the Richter Scale of earthquake intensity.⁴⁵ Another is Michael Ventris (1922–56), the cryptographer who deciphered the ancient Mycenaean script known as *Linear B*.⁴⁶ Others who have been retrospectively diagnosed as somewhere on the autistic spectrum include the poet, artist, sculptor, and architect Michelangelo Buonarroti (1475–1564); the philosopher Ludwig Wittgenstein (1889–1951); and the Indian mathematician, Srinivasa Ramanujan (1887–1920).^{47,48} Writers and poets include Hans Christian Andersen (1805–75); Herman Melville (1819–91); Jonathan Swift (1667–1745); William Butler Yeats (1865–1939); and Lewis Carroll (Charles Dodgson, 1832–98), the author of *Alice in Wonderland*.¹⁸ Politicians and statesmen too have been added to the list of those suspected of having been Asperger's cases: specifically Thomas Jefferson (1743–1826),⁴⁹ Eamon de Valera (1882–1975); and perhaps most interestingly of all, Adolf Hitler (1889–1945).⁴⁸

Recently Michael Fitzgerald published a book about what he terms *Asperger's savants*: that is, “persons with high functioning autism or Asperger's syndrome who produce works of genius.”^{18c} Despite the fact that, as Fitzgerald himself notes, persons with Asperger's syndrome are often “anti-theory” and have problems with abstraction, he includes the philosophers Spinoza (1632–77), Immanuel Kant (1724–1804), and A. J. Ayer (1910–89). Less surprising perhaps is his inclusion of several famous musicians, such as Wolfgang Amadeus Mozart (1756–91); Ludwig van Beethoven (1770–1827); Eric Satie (1866–1925); and Béla Bartók (1881–1945); and along with Van Gogh, the painters L. S. Lowry (1887–1976) and Andy Warhol (1928–87).¹⁸

Understandably perhaps in the light of the on-going debate about the exact diagnosis of autism and Asperger's syndrome, not all of these suggestions have been accepted by everyone. In particular, Oliver Sacks has questioned whether Wittgenstein, Einstein, and Newton were "significantly autistic," contrasting their cases with that of the chemist, Henry Cavendish (1731–1810), who he believes certainly was. Sacks thinks that, unlike most other "supposed autistic geniuses," he showed "near-total incomprehension of common human behaviours, social relationships, states of mind, and money, as well as an almost obsessed attention to detail—which led him to the great generalizations he was later to erect."⁵⁰

But however that may be, the combination of outstanding skill or talent and autistic tendencies is not confined to a few, famous cases. According to some authorities, up to 10 per cent of autistics, but only 1 per cent with other developmental deficits, show some kind of so-called *savant skills*: in other words, remarkable cognitive and/or memory ability found among more prevalent disability.⁵¹ Such talents are usually limited to music, art, maths and calendar calculation, mechanical and spatial skills, often featuring astonishing memorization feats; while the combination of blindness, autism, and musical genius is unusually frequent.⁵² For example, a pair of identical twin savants described by Sacks possessed calendar-calculating skills over an 80,000 year range; could not do simple arithmetic, but would calculate lengthy prime numbers for fun; could instantly count and factorize the number of matches that fell out of a box; and could remember the weather and the important political events on every day of their adult lives while having little or no memory of more personal events.⁵³ Kim Peek, the inspiration for the film *Rain Man*, walks with a sideways gait, needs help buttoning his clothes and managing many of the practical chores of daily life, has great difficulty understanding abstraction, and has an overall IQ of 87. Yet he has an encyclopaedic knowledge of history, political leaders, roads and highways in the USA and Canada, professional sports, the space program, movies, actors and actresses, Shakespeare, the Bible, Mormon doctrine and history, calendar calculations, literature, telephone area codes, major Zip codes, television stations, classical music,

along with the detailed content of 9000 individual books at the time of writing.^{54,55} (For further examples of savantism, see the box on p. 29: Musical savants.)

So-called *acquired savant syndrome* can occasionally emerge after brain injury or disease in a previously normal person. For example, a nine-year-old, who was deaf-mute and paralysed by a gun-shot wound to the left hemisphere, developed outstanding mechanical skills after the injury.⁵¹ Another remarkable case is that of Daniel Tammet. Diagnosed with Asperger's syndrome, Daniel developed an unusual combination of synaesthesia and savantism following a series of childhood epileptic seizures. *Synaesthesia* describes the mixing of senses so that in Daniel's case, for example, every number up to about 10,000 is seen as a uniquely coloured and textured shape, occasionally also associated with a specific emotional feeling. By means of manipulating numbers visualized in this way, Daniel can perform calculations with the speed and accuracy of a computer, and currently holds the British and European record for the rote recitation of the places of π from memory to 22,514 places—a feat achieved in just over five hours. His synaesthesia also extends to words, and following a challenge from a TV producer, Daniel learnt one of the world's most difficult and distinct languages, Icelandic, in one week sufficiently well to be successfully interviewed live in the language on Icelandic television—so much so that one of the Icelanders described Daniel's linguistic skill as “not human”!⁵⁶

But acquired savant syndrome need not only be acquired in childhood. Dementia in older people can sometimes release remarkable artistic skills while devastating normal functions.⁵⁷ Experimental evidence pointing to the same conclusion comes from a remarkable study in which 11 right-handed male volunteers underwent magnetic stimulation of part of their brains before being asked to reproduce images of animals and faces by drawing. The magnetism had the effect of temporarily inhibiting the left frontal temporal lobe, which is the same part of the brain where damage or degeneration is known to be associated with the spontaneous appearance of savant skills in previously normal people. Although some autistic savants excel in pictorial art, the output, be it drawing, painting, sculpture, or modelling, is usually realistic,

Musical savants

Tom Wiggins (1849–1908), known as “Blind Tom,” was purchased as a child at a slave auction in Georgia in 1850 along with his mother. A contemporary described him as “idiotic for any other purpose,” and capable of nothing but “gyrations and melodies.” He did not speak and could barely walk by the age of five and “gave no other sign of intelligence” apart from an “everlasting thirst for music.” But despite having been blind from birth, he taught himself to play the piano by the time he was four, and by the age of 11 he was performing before the president at the White House, and later went on a successful concert tour to Europe. His vocabulary ultimately amounted to less than 100 words, but although incapable of learning anything else, his musical repertoire eventually included over 5000 pieces, and he was said to be able to reproduce perfectly passages of unfamiliar music up to 15 minutes long. Indeed, a panel of 16 outstanding musicians of the day concluded that “in . . . every form of musical examination” Blind Tom “showed a capacity ranking him among the most wonderful phenomena in musical history.”^{1a}

In a controlled experiment, Hermelin and O’Connor compared the performance of a 19-year-old musical autistic savant who had an IQ of 61 and almost total absence of spontaneous speech with that of an accomplished musician. Both listened to two pieces of recorded music that they had not heard before (Grieg’s “Melody,” opus 47 no. 3, and part of Bartók’s “Mikrokosmos”). The autistic savant gave an almost note-perfect rendering of all 64 bars of “Melody,” playing 798 notes of which only 8 per cent were wrong. By contrast, the professional pianist attempted to play only 354 notes, but in this much abbreviated version there were a total of 80 per cent wrong notes. Hermelin adds that after 24 hours during which he had not heard the piece again, the savant gave a second near-perfect performance. However, in the case of the less conventional piece by Bartók, the savant again played more notes (277 against the control’s 153), but got 63 per cent of them wrong as compared to only 14 per cent in the case of the professional musician.

Leslie Lemke is a modern equivalent of Blind Tom who was born blind and with cerebral palsy, and who taught himself to play the piano in much the same way as his famous predecessor. He gives regular concerts and reproduces music from memory with such machine-like precision that members of the audience are asked to write down their requests rather than shout them out (because otherwise Lemke will insist on playing each and every one in the order in which he heard them, no matter how long it takes!).^{1b}

In another experiment, Lemke was asked to reproduce and improvise on the same two pieces and was compared with another professional musician. Having first played a few bars of Grieg's "Melody" note-perfectly, Lemke produced 215 bars of improvisation, which the researchers described as played with enormous enthusiasm and verve. The professional pianist played only 95 bars. Then, in a manner reminiscent of Beethoven's famous improvisations (and who, as we have already seen, has also been diagnosed an Asperger's savant), the savant replaced Grieg's rather thin musical texture with something much more dense, extravagant and flamboyant. In contrast to Lemke's embellishments of Grieg's sparse texture, the professional musician tended to retain it, and his improvisations were simple, reflective, and restrained. Where the Bartók was concerned, Hermelin recounts that "the two participants resembled each other much more closely than they had done in their improvisations on the piece by Grieg, although for the Bartók, too, Leslie also gave a much richer interpretation, mostly by putting in more chords." However, like the other savant mentioned above, Lemke reproduced the piece by Bartók much less impressively than he had the one by Grieg, which he got almost note-perfect by comparison with the Bartók, which he got 80 per cent wrong—and much worse than the professional musician, who got the Bartók 76 per cent correct.² Although Bartók has been posthumously diagnosed as an Asperger's savant,³ his music nevertheless seems more difficult for autistic performers to reproduce, perhaps because of its more modern, informal style.

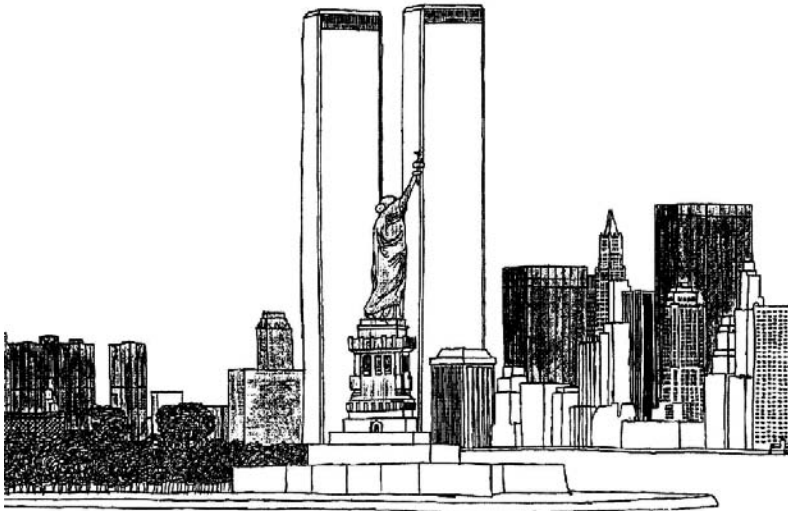
rather than abstract or conceptual.^{58a} Indeed, this is often how savants' artistic skills are first recognized: even as children they show technical competence in representing things which goes far beyond that normal for their age. The frontal-lobe magnetic-inhibition study found that some subjects showed a dramatic change of style towards a more life-like way of drawing, with more attention to realistic details and less of a tendency to caricature—but only after genuine stimulation, not after control sessions when no magnetism was applied. Indeed, one subject said that after the stimulation he was more “alert” and “conscious of detail,” and that the experimenters had “taught him how to draw dogs!”^{59a} (See the box on p. 32: Savant artists.)

Another study of five patients all diagnosed with fronto-temporal dementia noted that the creativity of these subjects was visual but never verbal. Similarly, the paintings, photographs, and sculptures were realistic copies lacking an abstract or symbolic content. The painters remembered realistic landscapes, animals, or people, and seemed to recall images that were then mentally reconstructed as pictures without the mediation of language. Also, despite progressive cognitive and social impairment, they showed increasing interest in the fine detail of faces, objects, shapes, and sounds. The authors of this study also cite the case of a Polish painter who suffered a left-hemisphere stroke associated with aphasia (loss of speech) but lost only the ability to create the highly symbolic pictures that he had previously painted, while retaining an ability to paint realistically without a flaw.⁵⁷

Brain-imaging shows left-brain abnormalities in savants along with changes to the *corpus callosum*, the thick bundle of nerve fibres that connects the two hemispheres—indeed, Kim Peek lacks this structure altogether. Language is localized more on the left half of the brain than the right in most people. It is in the left hemisphere that the main speech centres are found, but in children with autism language develops much more on the right side of the brain than it does in normal children.⁶⁰ Exactly the same is found in the pattern of activity involving the prefrontal and parietal regions of the brain, which are normally correlated on the left in normal subjects, but on the right in high-functioning autistics.⁶¹ Typical savant skills such as artistic, musical, and mechanical

Savant artists

Temple Grandin remarks that autistic savants can make perspective drawings without being taught how: "They're drawing what they see, which is all the little changes in size and texture that tell you one object is closer up and another object is further away. Normal people can't see all those little changes without a lot of training and effort, because their brains process them unconsciously. So normal people are drawing what *they* 'see,' which is the finished object, after their brains have put it together. Normal people don't draw a dog, they draw a *concept* of a dog. Autistic people draw the dog."¹ An outstanding example of what Grandin has in mind is the so-called "Living Camera," Stephen Wiltshire, an autistic savant who drew a remarkably accurate aerial view of London at the age of 11 after a helicopter ride over the city. Another is Gilles Tréhin, who made the drawing of New York illustrated here at the age of 14 and has gone on to create an entire imaginary city, drawn in astonishing detail and with stunning realism.²



Like the artwork of autistics, cave paintings are amazingly life-like and show great attention to detail and a natural sense of perspective, sometimes along with an equally striking neglect of the context in which the image is drawn. (Autistics, like the cave artists, will on occasions draw or paint over existing images—and in the latter case, often did so in astonishingly inaccessible places within the caves.) Nick Humphrey remarks in comparing the drawings of Nadia, an autistic child, with those found in the caves at Chauvet that animals almost seem to have been “snapped” in active motion.³ Indeed, in a further comment, Humphrey notes that certain drugs can induce comparable “autistic” visual perception and that Aldous Huxley reported that in his experience of taking mescaline the artist whose work came closest to the resulting visual experience was Vermeer⁴—a painter who is strongly suspected of having used mirrors or lenses to create his images.⁵

Lascaux is the best known example of Palaeolithic cave art, but Chauvet dates from at least ten thousand years earlier. The fact that such stunningly realistic works of art can suddenly appear without any precursors, re-appear ten thousand years later, then finally vanish and be replaced by more rudimentary and more caricatured “stick-man” representations is difficult to explain if cultural tradition is believed to be the operative factor. Furthermore, there is no way that such realism could have been drawn directly from life nor aided by any means of imaging when you recall that these works are found deep inside caves and were made by stone-age hunters. However, if autistic savants existed among Palaeolithic peoples, they certainly might have been able to produce such images directly from memory just as savant artists such as Gilles Tréhin or Stephen Wiltshire do today, explaining the striking similarity in style and execution to autistic art.⁶

abilities are also found more on the right side of the brain. Taken together, these observations suggest that savant syndrome may result from compensation in the right hemisphere of the brain for damage in the left. The five- to six-fold predominance of savant syndrome in males may be explained by the left hemisphere completing its development later than the right. This might make it more vulnerable to prenatal influence from the male sex hormone, testosterone, which slows and impairs neuronal function. The result would be enlargement of the right hemisphere, perhaps with a shift towards the right hemisphere skills typical of savants.⁵² Musical savantism often features perfect pitch (as it did in the case of Mozart, for example), and according to some estimates up to a third of autistics have this gift.⁶² A particular region of the auditory cortex in the right hemisphere is much more specialized for representing detailed pitch information than its counterpart on the left side of the brain, and tones that are close together in pitch seem to be better resolved by neurons on the right.⁶³

People people and things people

Another name you might add to the catalogue of Asperger's savants is that of the person many would regard as the Darwin of the twentieth century, William D. Hamilton (1936–2000), the originator of the so-called “selfish gene” view of evolution popularized in the famous book of that title by Richard Dawkins. Hamilton described himself as “almost idiot savant” and rated himself “fairly good at woodwork as at other handicrafts” to the extent of having carpentry as a “reserve life plan” in case his theory proved un-publishable.^{64,65a} Like the Unabomber—who was also a skilled woodworker and whose bombs were astonishingly made in large part of wood—Hamilton experimented with explosives as a child, in his case losing parts of three fingers and gaining some pieces of shrapnel permanently lodged in his lungs. Also as a child, Hamilton recalled typical autistic behaviour such as “pointless routine actions,” making “odd clicking sounds,” and hours spent “bouncing a ball into a corner to watch it spin.”^{65b} In games with other children he

“was usually the one out of step and the slowest to pick up the rules.”^{66a} As an adult, he described himself as possessing “notably a trait approaching to autism about what most regard as the higher attributes of our species,” and went on to portray himself as “a person who... believes he understands the human species in many ways better than anyone and yet who manifestly doesn’t understand in any practical way how the human world works—neither how he himself fits in and nor, it seems, the conventions.”^{65c}

Hamilton made a telling discrimination between what he called “people people” as opposed to “things people.” He observed that “people people just need people to interact with, not necessarily the understanding of them: They tend to be conformist and are seldom more than superficially critical of any ethos of their time.”^{66b} But Hamilton himself was obviously one of the things people: “in us things people...there occurs some aberration of a natural sequence that has been evolved for the purpose of bonding person to person. In us this sequence has grown awry somehow and gained untypical intensity directed towards inhuman objects.” Nevertheless, he could also see that there were compensations when he added, “Yet the same misdirection, which is so often disastrous socially...can be very helpful in the making of [a] scientist, an engineer, or the like. Thus it is probably not wholly maladaptive. I believe it is in essence an aberration of this kind that makes me a successful scientist.”^{66c}

Hamilton’s family background also seems to have featured a number of things people: his father was a well-known engineer (co-designer of the Callender-Hamilton bridge) and was followed into engineering by one of Hamilton’s brothers, while a geriatrician sister had things skills to the extent that she developed an improved pressure-mattress for the treatment of bed sores.⁶⁷ The relevance of this to Asperger’s syndrome is that it is sometimes called “the engineer’s disorder,” and children with autism are described as relating to others “as though they were machines rather than people.”⁶⁸

Folk physics is an intuitive ability to grasp physical principles involved in mechanical systems and machines. Reverting to Hamilton’s distinction, you might call it *things-thinking* as opposed to *people-thinking*,

understood as a corresponding intuitive ability to understand other people's behaviour and mentality. When tests of such things-thinking were administered to them, Asperger's cases functioned significantly above their mental age by comparison with normal children despite the fact that on comparable tests of folk psychology or people-thinking the autistic children performed predictably worse. Although the experiment could not determine whether such so-called folk physics and folk psychology are independent of one another or just inversely related, it did demonstrate a significant superiority in the Asperger's children where such things-thinking was concerned. Indeed, the fascination with machines of all kinds that is so frequently found in autistics is almost certainly another manifestation of the same bias towards inanimate objects, as the researchers themselves point out.⁶⁹

According to a survey of 919 families of children with autism or Asperger's syndrome which listed occupations of parents, fathers of children with ASD were twice as often employed in engineering as were fathers in any of four control groups of children with Tourette's or Down syndrome. The *Autism-Spectrum Quotient* or AQ Test consists of 50 questions covering social skill, attention switching, attention to detail, communication, and imagination. Fifty-eight adults with Asperger's syndrome, 174 randomly selected controls, 840 students at Cambridge University, and the 16 winners of the UK Mathematics Olympiad were each sent a questionnaire by post. Results showed that the majority of people with Asperger's syndrome scored above 32 (out of a maximum of 50). But interestingly, among the students at Cambridge University, those in the sciences and technology had a higher AQ score compared to those in the arts and humanities. Mathematicians scored the highest of all—around 20 out of 50—and were closely followed by engineers, computer scientists, and physicists. Among the scientists, biologists and medics scored the lowest, around 14 out of 50.⁷⁰

These results strongly suggest that people-thinking is independent of IQ, executive function (planning, prioritizing, and postponing), and reasoning about the physical world. The researchers conclude that there seems to be a small but statistically significant link between autism and engineering.⁷¹ Indeed, it is one that can be seen in a sample of

Asperger's original cases. A recent study of these found that in 37 instances where the father's profession was mentioned, the most common form of employment was a technical one and that the most frequently seen profession was "engineer" or "electrical engineer."⁷²

Temple Grandin, one of the world's most distinguished and famous autistics, confesses that as a child she "was completely turned on by machines instead of people" and that even as an adult who regards herself as partly recovered from autism, she is still "turned on by machines, especially control mechanisms designed to interact with people."^{73a} Grandin had a maternal grandfather who she describes as "a brilliant, shy engineer who invented the automatic pilot for airplanes," and is herself a noted and very successful engineer to the extent that she has designed a third of all cattle- and pig-handling equipment in the USA. She relates "better to scientists and engineers, who are less motivated by emotion" than other people,^{73b} and explicitly attributes her engineering success to her predominantly visual mode of thinking: "Every design problem I've solved started with my ability to visualize and see the world in pictures... I visualize my designs being used in every possible situation, with different sizes and breeds of cattle and weather situations. Doing this enables me to correct mistakes prior to construction."⁷⁴ Drawing on her extensive knowledge of autism and autistics, Temple Grandin speculates that:

There may be two kinds of thinking—visual and sequential. Society needs to recognize the value of people who think visually... Misinterpretation of psychological test results could label a brilliant visual thinker as below average intelligence. Einstein was a visual thinker who failed his high school language requirement and relied on visual methods of study.^{73c}

She adds that "People with autism can develop skills in fields that they can really excel in... I've known people who are engaged in satisfying jobs as varied as elevator repair, bike repair, computer programming, graphic arts, architectural drafting, and laboratory pathology. Most of

these jobs use the visualization talents that many people with autism have.”^{73d}

Mechanistic or systemizing?

Nevertheless, according to another view, the autistic brain is predominantly hard-wired for understanding and predicting the behaviour of events and objects by building *systems*. *Systemizing* is defined as the drive to analyse and explore a system, to extract underlying rules that govern the behaviour of a system; and to construct systems. The systemizer intuitively figures out how things work, or what the underlying rules controlling a system are. Systems can be as varied as a pond, a vehicle, a plant, a library catalogue, a musical composition, a cricket ball, or even an army unit. They all operate on inputs and deliver outputs, using “if-then” correlation rules.^{46a}

As we have already seen, there is a clear link between ASD and engineering, and to my way of thinking *mechanistic* describes most of the examples produced to justify it much more aptly than does *systemizing*.⁴⁶ As such, *mechanistic cognition* would be another term for folk physics or things-thinking: in other words, a system of cognition specific to the physical world in the same way in which folk psychology or people-thinking is specific to the human world. Indeed, where making this distinction is concerned, no less an authority than Kanner himself used the words “mechanized” and “mechanization” to try to capture the impersonal, cold relationship between autistic children and their parents.^{75,76}

Another virtue of *mechanistic* as a term for autistic thinking is that it is already current. People with rich experience of autistics comment that “Individuals with autism assign not an everyday but a more mechanistic significance to things.”^{77a} Certainly, the notorious insistence on punctilious repetition and regular routine by autistics of all kinds might be called “systematic,” but *mechanistic* catches its mechanical, mindless character better in my view. The same is true of the rigidly repetitive way that autistics often carry out instructions without any apparent

thought about their meaning. Of course this is systematic, but *mechanistic* is a much more apt term, and certainly captures the mechanical, robotic quality that is often attributed to such behaviour by others.

The virtue of *mechanistic* rather than *systematic* is even found in art—at least if the comments of artists with autistic proclivities are considered. The essentially mechanistic inspiration of Warhol's work comes out in Michael Fitzgerald's observation that "One reason for Warhol's success may have been that he represented the machine age. Romanticism was meaningless to him; the machine age was everything." He goes on to quote Warhol remarking, "The things I want to show you are mechanical," adding, "I would like to be a machine, wouldn't you?" Fitzgerald concludes that Warhol "had the autistic mechanical mind."^{18d} He also quotes other authorities who point out that Warhol "loved all sorts of machines and gadgets, embracing new techniques and technologies, working with tape recorders, cassettes, Polaroid, Thermofax, but the heart of all this experimentation had at its central focus photography and silkscreen for making a painting." They add that "This was by extension his love for the machine because the screen process was very machinelike."^{18e} Describing Lowry, Fitzgerald comments that this "chronicler of industrial reality," who looked on other humans as comical automatons, "habitually avoided any conversation that hinted at inner meaning in art, or one that looked as if it might lead to such conclusions." Indeed, "the Lowry automaton" as he was sometimes called was not above teasing his own friends in this respect, "in order to deflate pomposity or pretension."^{18f}

Where autistic savants are concerned, abilities like calendar-calculation (one of the most common of all) certainly seem to involve a system. But authorities on savants point out that, although able to perform such calculations, savants typically cannot account for how they do it, or explain the system to anyone else. Indeed, authorities on savants conclude that "The savant is a concrete calculator, not an abstract mathematician," and call such concrete thinking "an almost universal symptom or trait" of the condition.^{54a} Nor is it limited to savants: although some Asperger's cases are gifted mathematicians, a common problem for them at school is that, although they are good

at getting the right answers to maths problems, they are often unable to explain how they arrived at them.^{21c} But systemizing something implies both that you can apply it yourself *and* could explain the system to someone else. *Systemizing*, in other words, suggests insight in a way that *mechanizing* does not. You would not necessarily expect a mechanism that could work out the date of Easter to enable you to know how it did it, but you would expect a *system* to work out the date of Easter to be comprehensible to you. An Easter-predicting mechanism would be a kind of calendrical clock, and it is worth pointing out that, although a rare savant skill, stop-watch-like accuracy in estimating the passing of time is occasionally found: a skill which might be described as *systematic*, but which literally works like clock-work and is *mechanistic* to that extent.^{51a}

Again, if you describe something as “systematic” you imply that it is coherently consistent and does not have parts that are discrepant with or independent of the whole—that would obviously be *unsystematic*. In other words, *systemizing* implies a top-down or *holistic* approach, which focuses on an integrated whole. In his book on autistic thinking, Peter Vermeulen points out that “the first axiom in systems theory” is “that the whole is more than the sum of its parts... Systems theory regards the world in terms of the mutual relatedness and dependency of phenomena. The characteristics of a system, an integrated whole, cannot be reduced to its constituent parts.” By contrast, he adds that “individuals with autism live in a multi-universe: a world of unaccountable, incoherent details that are experienced as having only one meaning: the literal meaning. The world of people with autism is more like a world of different bits and pieces.”^{77b} At its worst, this leads to a highly disintegrated and chaotic view of life that is anything but systematic in its cognitive quality. Speaking of one particular autistic young woman, someone who knew her well described her as follows:

Kate knows and understands a great deal but seems to have very limited ability to structure. To use her way of putting things, her life is a heap of odd-shaped stones. Anything she tries to construct soon falls down, whereas other people build

amazing structures, which often seem impenetrable and meaningless walls to her, hemming her in on every side. The more structured a subject, the less it means to her...^{58b}

Temple Grandin characterizes autistic cognition as *hyper-specific* and claims that “autistic people don’t see their ideas of things, they see the actual things themselves. We see the details that make up the world, while normal people blur all those details together into their general concept of the world.” According to Temple Grandin, “The problem with normal people is they’re too cerebral,” or what she calls “*abstractified*.”⁷⁸ *Mechanistic* avoids the abstraction implied by *systemizing* because it suggests that the thing it describes is working on concrete, mechanical, cause-and-effect principles. As such, I shall use the term from now on in preference to *systemizing* to epitomize the bottom-up, visual-rather-than-verbal, concrete thinking style of autism.

Controlled scientific studies of autistic savants certainly suggest that their cognitive style is mechanistic, rather than systematic. Consider the autistic savant with a measured verbal IQ of only 89 but a vocabulary score equivalent to an IQ of 121 who can understand, talk, read, write, and translate from Danish, Dutch, Finnish, French, German, Greek, Hindi, Italian, Norwegian, Polish, Portuguese, Russian, Spanish, Swedish, Turkish, and Welsh. However, he translates word-by-word like “an automaton,” with no concern for the meaning of whole sentences. When asked to take his time and look at the whole sentence first, he became distressed and said that he could not do it.^{58c} You could call this “systematic,” but *mechanistic* seems a much better description. Indeed, this is precisely the way in which computer translation tends to turn out: fine for translating individual words, but weak on rendering the sense of the whole. Contrast this with the method used by Sigmund Freud (1856–1939) when translating: “Instead of laboriously transcribing from the foreign language, idioms and all, he would read a passage, close the book, and consider how a German writer would have clothed the same thoughts—a method not very common among translators.”⁷⁹ Perhaps not, but as a method of translation it was just

as systematic as the one above in its own way, but was distinctly less mechanistic in its top-down, empathic, and holistic approach.

In the experiment described earlier in which normal volunteers' frontal lobes were inhibited by magnetic means, the same subjects who had shown the most notable change in their drawing style also showed the greatest improvement in a proof-reading test. But here again the improvement in proof-reading skill was only found after actual stimulation of the subjects' frontal lobes, not after the placebo. As the experimenters comment, "These proof-reading results provide non-subjective evidence of the ability to switch on savant-like skill by turning off part of the brain in healthy individuals."⁵⁹ Proof-reading requires close attention to detail—the kind of bottom-up, word-by-word approach seen in the linguistic savant described just now. You could also call proof-reading "systematic," but *mechanistic* seems a much more apt term for something that nowadays computers can do for you while you type.

In the box on musical savants (pp. 29–30) I pointed out in passing that both Leslie Lemke and another musical savant reproduced a piece by Bartók much less impressively than they had one by Grieg. As I suggested there, an explanation may lie in the relatively looser structure and greater informality of modern music. Another autistic with a musical talent complained that even though some of his favourite music was from the Romantic era, he felt lost in a sea of non-harmonic tones and was unable to impose an analytic structure upon the music. He added that "The resultant muddiness in the demarcation of the structural borders along with the increased use of tones that are not part of a given chord make it more difficult for me to separate the foreground from the background in order to determine the harmony."⁸⁰ At the very least, this suggests that, not only in memory and language skills, but in music also, autistic savants may be relying on a machine-like, things-thinking ability to achieve their distinctive results that might be best described as *mechanistic*.

Finally, *mechanistic* has the virtue of being a term that covers the purely manual, technical, and practical abilities that are also sometimes found associated with ASD in a way that *systemizing* does not. An example would be the carpentry skills possessed by both Hamilton and

the Unabomber—and even by Temple Grandin, who was one of the first girls in her school “to be allowed to take wood-shop,” at least until she was forced “to return to the traditional cooking class” and become “a failure once again!”^{73c} Furthermore, there are cases of true savantism where such skills are concerned. The “Genius of Earlswood Asylum,” James Henry Pullen (1835–1916), was perhaps the most notable and bears comparison with the musical and artistic savants discussed in the boxes. Although described as “deaf and dumb,” diagnosed as congenitally mentally retarded, and institutionalized in an asylum from the age of 15, his exquisite carving, carpentry, and model-making skills made him a national celebrity. His masterpiece was a model of the steamship, *The Great Eastern*: a ten-foot long replica held together by over a million wooden pins and containing 5585 rivets which reproduced the original in stunning detail. At a time when people such as Pullen were diagnosed as *idiot savants*, the Prince Consort understandably “expressed the greatest surprise that one so gifted was still to be kept in the category of idiots, or ever had been one.”^{54b} Such manual skills are not always accorded the same respect as more abstract, intellectual ones, but at the very least Pullen proves that they can feature in a form of genuine savantism, and would certainly be part and parcel of what I would call *mechanistic cognition*.