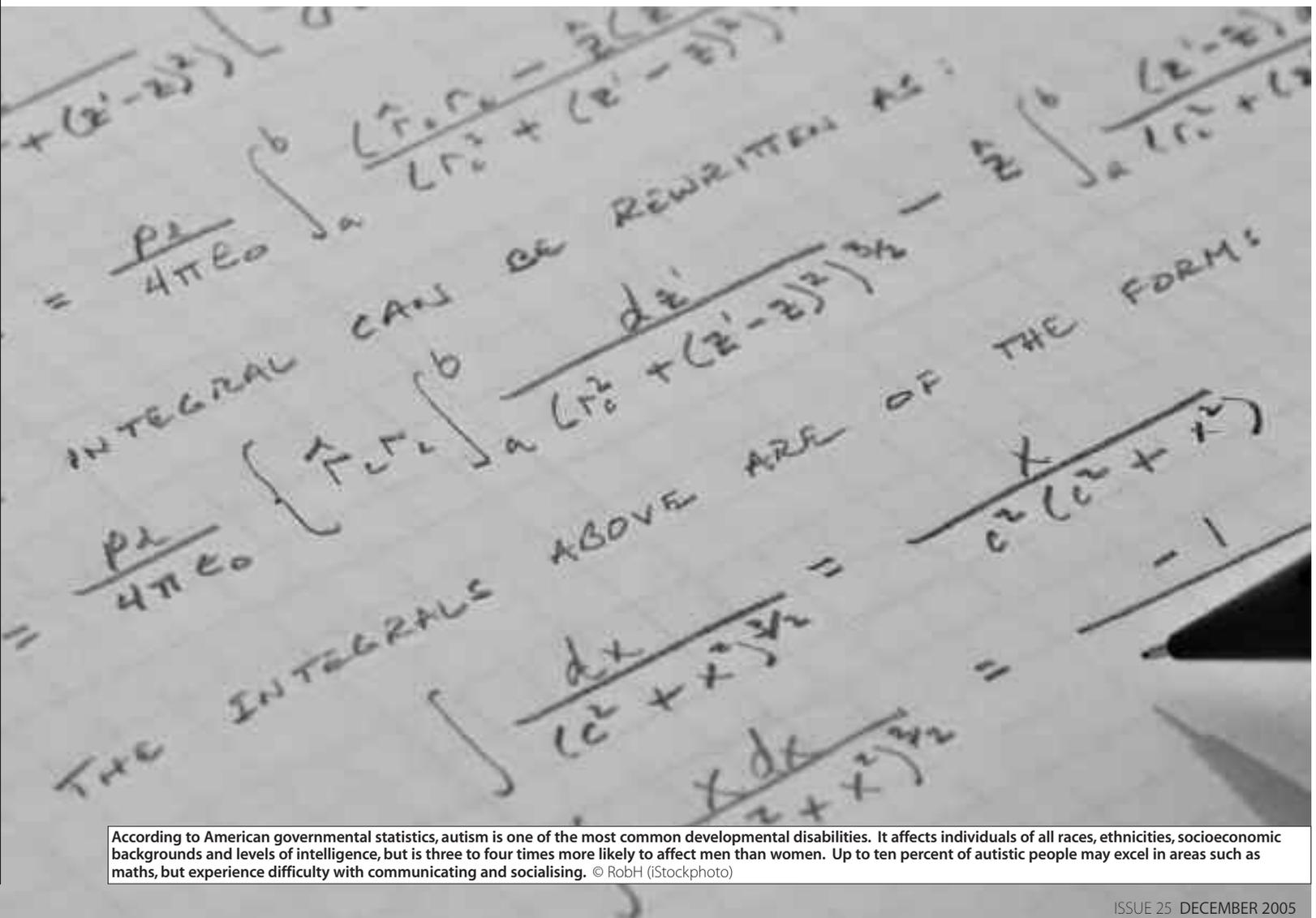


AUTISM AND ENGINEERS: IS THERE A CONNECTION?

Some characteristics of autism, such as highly developed skills in mathematics or engineering may have been inherited from parents or grandparents who were or are engineers. After these comments were aired in the media during Autism Week this year, *Ingenia* asked Fabian Acker to talk to Temple Grandin and Simon Baron-Cohen, two leading experts in the field.



According to American governmental statistics, autism is one of the most common developmental disabilities. It affects individuals of all races, ethnicities, socioeconomic backgrounds and levels of intelligence, but is three to four times more likely to affect men than women. Up to ten percent of autistic people may excel in areas such as maths, but experience difficulty with communicating and socialising. © RobH (iStockphoto)



Research shows that accelerated brain development processes occur in autistic children. "We found that autistic children had significantly increased cerebral volumes compared to typically developing children," said study author Stephen R. Dager, MD, with the University of Washington School of Medicine in Seattle, WA © Luis Carlos Torres (iStockphoto)

"We found that autistic children had significantly increased cerebral volumes compared to typically developing children."

The main symptoms of autism, generally known as autism spectrum condition or ASC, are a poor (or late) development of language skills, and difficulty in communication or social relationships. This is often accompanied by highly developed visual or mathematical aptitudes, some to the point of genius. Fathers and grandfathers of children with ASC are twice as likely to be engineers compared with the general population.

It is generally recognised that autism has a strong genetic component and is probably caused by a neurological disorder. Studies show that if one twin of an identical pair is autistic, there is a 90 per cent chance that the other twin will also have the condition. If parents have one autistic child, the chance of their second child being autistic increases from 1 in 500 to 1 in 20.

People with ASC have a wide range of characteristics and IQs. One of the sub-groups within the condition, those with Asperger's Syndrome, is distinguished by a higher than average IQ and fewer difficulties with language compared with others. A

second sub-group (classic autism) has characteristics similar to those with Asperger's Syndrome, but more problems with language.

THE ODDS AGAINST

The average number in the general population who have ASC is approximately one in 200, but fathers and grandfathers of children with ASC are twice as likely to be engineers, compared with the general population. An early study found that of almost 1,000 families who were members of the National Autistic Society in the UK, 21.2 per cent of the grandfathers of children with ASC worked in the field of engineering, compared with only 10 per cent of grandfathers of children with different neurological conditions.

"The link between engineering and autism is absolutely obvious," according to Assistant Professor Temple Grandin at Colorado State University, USA, who herself has Asperger's Syndrome. Her grandfather was an engineer, the co-inventor of the

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automatic pilot for aircraft. She also has second and third cousins who are engineers and mathematicians. Dr Grandin is recognised as an expert in animal husbandry.

She says that if the poor social skills exhibited by autistic children are not modified at an early stage, it makes it difficult for them to follow conventional career paths. "It's more difficult for them now than it was in my time, because children used to be taught social accomplishments at school. Therefore many autistic children had a chance to move up the system until they reached a stage when they could develop their special abilities in maths or engineering or whatever."

IN THE GENES?

The apparent link between engineering and autism, and more specifically Asperger's Syndrome, is being studied by Professor Baron-Cohen, Director of the Autism Research Centre at Cambridge University, UK. He says the ability to understand the laws of physics, maths, or engineering could be inherited. Where there are two generations of engineers in a family, the third generation may have this ability to a high degree, but sometimes at the expense of social or communication skills.

In a new study of autism, he has developed an analysis in which events of the outside world are categorised according to their degree of 'lawfulness'. In this context, lawful means obeying a set of laws such as

the relationship between volume and pressure in a gas, or speed and fuel consumption. Such relationships are considered to be highly lawful. However, social transactions are highly 'unlawful' in that the rules governing them tend to be imprecise or non-existent. For instance, a conversation could be considered 'unlawful' since there are many visual and social clues that will push it along various routes, but very few specific rules or 'laws' that govern the interchange.

Autistic people, Baron-Cohen says, are better at dealing with lawful situations than unlawful ones. They can deal more easily with a clearly understood set of laws, such as those of maths, physics or engineering, but cannot easily manage social situations where there are few laws. He defines the skill needed to deal with the outside world and its laws as 'systemising mechanism' (SM).

DEGREES OF AUTISM

He categorises SM into seven levels. At level one, there is very little understanding of the outside world, and a general difficulty in acquiring languages. At level seven, the SM capability borders on genius, but communication and social skills may be very poor.

The general population exhibits SM at levels two and three; these are considered average and mean that most people have adequate social skills and adequate understanding of physical laws. Clearly there

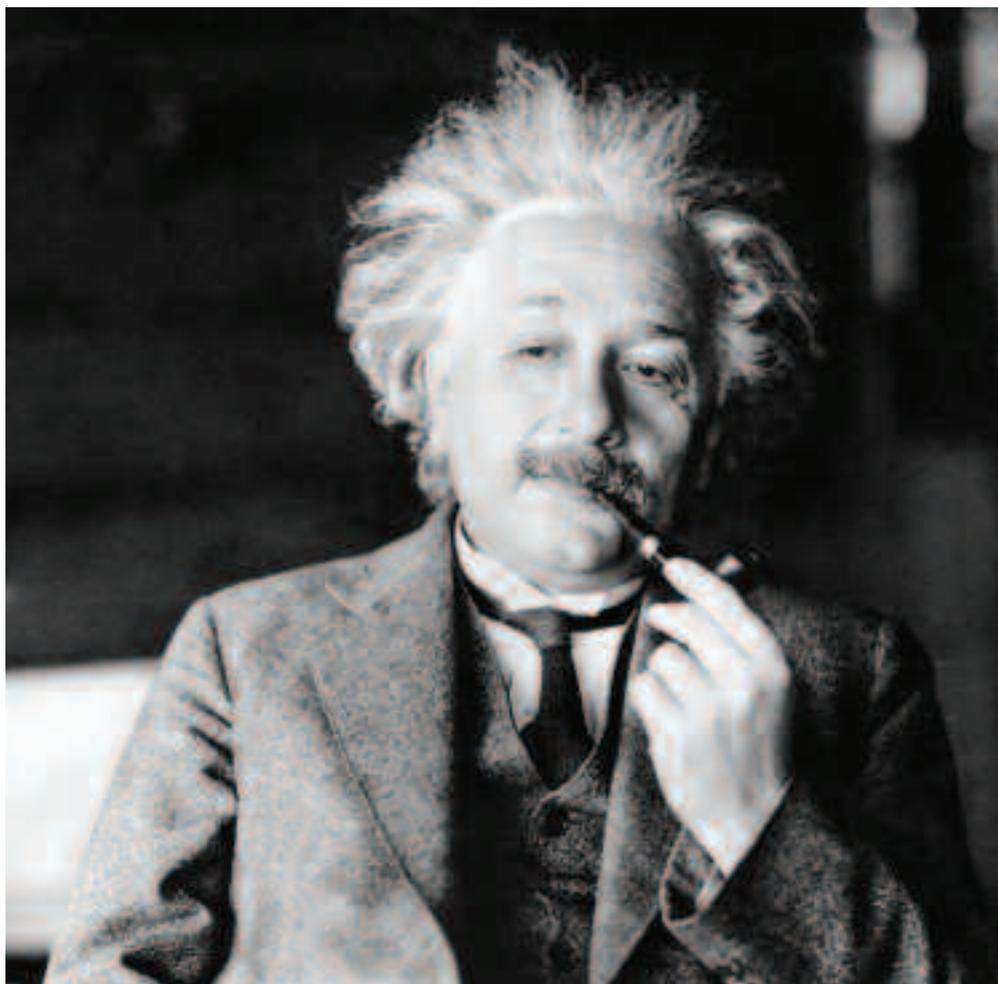
is a wide spectrum; some people understand mechanical or abstract processes better than others; some are better at 'people' skills; some are good all-rounders.

Many engineers and mathematicians have an SM level of four and this can be passed on to their children and grandchildren through a process of what Baron-Cohen calls 'assortative mating' ('assortative mating of strong systemisers', in the jargon). People with similar interests or traits, such as engineers or mathematicians tend to marry each other. In addition, they tend to belong to similar interest groups, concentrating the gene pool from which they draw their partners. The children and grandchildren from these liaisons may inherit similar genes from both sides of the family, and when these genes have a marked SM component, the children may display ASC. It is not axiomatic, and many other factors may be involved. But it is higher than the average of the general population. In fact, anecdotal evidence suggests that the incidence of ASC in children in Silicon Valley is increasing at a rate well above the national average.

NEED FOR UNDERSTANDING

When these children have an SM level of five, they display marked autistic characteristics. They find socialising difficult even though they can easily systemise calendars or timetables. This imbalance becomes more pronounced as the SM level moves towards

“Many job advertisements are unnecessarily exclusive; they include phrases such as ‘good communication skills’ or ‘good team worker’. These requirements may not be essential for the work.”



According to Temple Grandin, who visited relatives of Dr Albert Einstein at an autism meeting, “Einstein’s family history includes a high incidence of autism, dyslexia, food allergies, high intellectual aptitude, and musical talent, and he himself had many autistic traits.” ©AP/EMPICS

level seven. And it is the deficiencies at the lower end of this scale that cause people to overlook the aptitudes at the higher end. Dr Grandin says that it was the understanding of a particularly sympathetic professor who recognised her potential and enabled her to read for her doctorate.

But not every college or university may have such understanding staff, and the challenge is to change attitudes so that educational institutions or potential employers can recognise that poor communication or social skills do not necessarily indicate a lack of intellect.

There is clearly a lot of work to be done to realise the full potential of the many autistic children or youths who are overlooked by the educational system or

employment market. Their unusual abilities may never be realised. Dr Grandin gives Einstein, whom she is convinced had mild Asperger’s Syndrome, as an example. “Had he been born today, he would probably have ended up just driving a truck in twenty years time!” she says.

REALISING POTENTIAL

The National Autistic Society claims that there are many kinds of work for which those with ASC are highly successful and suitable. These include: research, data input or word processing, where attention to detail and accuracy are important; tasks involving numbers, statistics and facts such as in finance and accounting; computer

programming or systems testing. Yet many job advertisements are unnecessarily exclusive; they include phrases such as ‘good communication skills’, or ‘good team worker’.

These requirements may be ‘defaults’, and may not be essential for the work. It is important therefore that these types of vacancies do not deter the very people that would be best able to do them, and that those with ASC are not deterred from applying for jobs that will enable them to earn, gain recognition and socialise with a variety of like-minded, and unlike-minded individuals.

Further reference

Professor Baron-Cohen hopes that readers of *Ingenia* who are parents may be willing to help further autism research by filling in some online questionnaires at the following website www.cambridgepsychology.com/parents.

For general enquiries, the website of the National Autistic Society is www.autism.org.uk.

BIOGRAPHY – Fabian Acker

Fabian Acker is a science writer. He is a Chartered Engineer, a member of the IEE and ImarestE and Consultant Editor for Hydropower & Dams