

Brains, geeks, computers, and HCI.

Joseph Leech

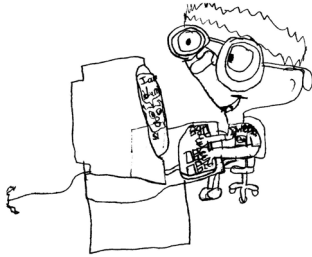
MSc Human Communication and Computing

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Popular images of computer users/programmers



A computer 'dweeb'
From Brosnan (1999)³⁵

The picture opposite shows when people consider to be a typical computer user. The popular stereotypes³⁷ are that users tend to be socially unskilled male teenagers who have little or no social life and or self confidence, and are described as 'geeks', 'nerds' or 'dweebs'.² Stereotypes that are highlighted in the media.⁴²

The fact that women receive less than 28 percent of the computer science bachelor's degrees, down from a high of 37 percent in 1984.³ shows that the IT profession is male dominated and has been since the start. "Computers are mysterious devices meant to be used for mathematical calculations."⁴¹ was the view of computers in the 1960s. Those that operated the first computers were generally academics specialising in engineering, physics or mathematics.

Where did this stereotype come from and why does it persist?

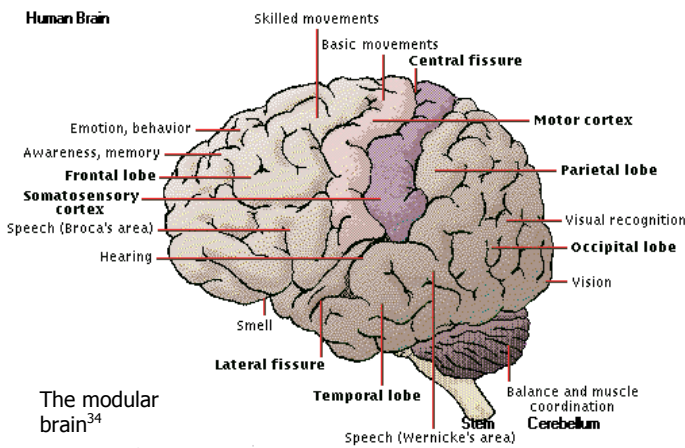
The personality traits associated with the computer 'geek' are reminiscent of the developmental disorder autism.⁴ Autism is characterised by impaired social and communicative development and restricted interests and activities. Many people with autism also have learning difficulties and a low IQ. 20% of people with autism have are considered high functioning (HFA), that is they have average or above average IQ and a high rate of unusual obsessions, but still have social and communicative impairments.⁵ Asperger's syndrome (AS) was first identified in 1944 by Hans Asperger. It is very similar to high level autism but without difficulties with verbal communication, AS find non-verbal communication difficult as well as detecting any subtleties in language that a speaker may use. A famous high level autistic, Temple Grandin describes how she and others with autism regard language: "Thinking in language and words is alien to me. I think totally in pictures. It is like playing different tapes in a video cassette recorder in my imagination. I used to think that everybody thought in pictures until I questioned many different people about their thinking processes." With both autism and Asperger's syndrome a stereotyped preoccupation with particular interest are a part of the diagnostic criteria.⁶

"...it's a geek fantasy that the perfect woman is just a programmer with breasts."

Douglas Coupland⁷

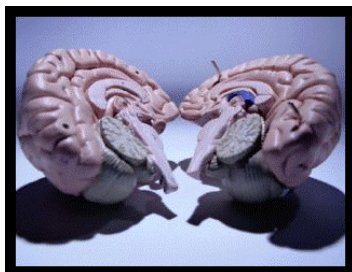
In Silicon Valley, the heart of the world's IT industry, the levels of Autism and AS diagnosis have increased dramatically. Figures from Santa Clara County show a dramatic 31% increase in one year of diagnosis of Autism in children.⁸ Wired magazine⁴ ran an article speculating on the reasons behind this; the number of computer and scientist is extremely high in the area suggesting a genetic link with the disorder. It is well known that with relationships people are attracted to other that share similar personality traits to themselves.⁹ The above quote shows that programmers are no different. Simon Baron Cohen has also found similar increased rates in AS and autism among the children of Silicon Fen¹⁰, Britain's Silicon Valley, just outside of Cambridge. The dramatic increase in diagnosis may be in some way be due to improvements in the diagnostic criteria but do point to the fact that among scientific and technologically skilled people the levels of HFA and AS are high. In a recent BBC article¹¹ Dr Robin Hansen said the following: "If your father has four genes and is a computer whiz, and your mother has three genes, you might well get all seven and get full-blown autism." The link has been substantiated further by Baron Cohen³¹. They found that families of Engineers and Mathematicians often have higher numbers of AS and autistics members. Jarrold *et al*¹² of Bristol University have added to the debate with a study that claims equal evidence of these traits in father's who are accountants and scientists. The gene for the conditions has yet to be identified but many scientists believe that within the next few years using data from the Human Genome Project, a genetic link will be discovered.

The neo-cortex of the human brain is split into two distinct physiological parts; the left and the right cerebral cortices. (see the diagram below) The brain being modular means that each area of the brain has a different function¹³ associated with a different skill or ability. Studies on split brain patients, those who have had the area between their two cortices cut so they can no longer communicate, as well as studies on patients who have lost certain areas of their brains in accidents or through surgery, have shown that each cortices is



associated with certain behaviours and skills. (see the split brain diagram) In his 1983 book Jerry Fodor¹³ discusses the implications of a modular model of the brain. He suggested that prenatal testosterone effects modularity and could play a part in the why certain people are better at certain task. Testosterone is responsible for the development of many male sexual characteristics, both in the body and the brain. Even small differences in brain structure can

lead to psychological differences. For example generally men are better at visio-spatial tasks whereas women are more proficient with verbal tasks. It has even been postulated that the right-hand side of the brain is more 'male' and the left more 'female'. The 'non-verbal' right brain plays a crucial role in understanding the overall context of a situation and the state of mind of another person in order to judge if someone is telling a joke, a lie, the truth or using a metaphor.



Left Hemisphere Right Hemisphere

Verbal Competence	Visuo-Spatial
Sequential	Parallel
Logical	Gestalt
Analytical	Emotional

"There are 10 types of people in the world: those who understand binary, and those who don't."

-Unknown

Baron-Cohen¹⁴ in his recent book has identified two distinct cognitive styles; systemising and empathising. Systemising individuals think of the world as being as a series of interrelating systems. Everything is defined as being part of system. Systemising individual also show a strong drive to investigate how something functions, to get to the root of the system, a fascination with the law-governed physical universe. Empathising on the other hand is more concerned with the social

world around us. Analysing relationships between oneself and others. The focus is much more on people and their interactions. Baron-Cohen suggests systemising is more of a male trait and empathising more female. Giving further reasoning for why IT is seen as a male dominated world.

"Being a social outcast helps you stay concentrated on the really important things, like thinking and hacking." **Eric Raymond**

Further work by Baron-Cohen *et al* has suggested that scientists may show some of the traits associated with AS^{15, 32}. They conducted a series of 'folk' psychology and 'folk' physics tests on a mathematician, a computer scientist and a physicist. The 'folk' tests, having no

scientific base, showed that compared to controls, the three individuals scored much higher on the physics section but scored much lower on the psychological section. (See the notes sections 40 and 41 for examples of the tests)

Baron-Cohen used findings such as these along with the fact that only one in four autistics and one in ten AS are female to put forward the theory that autism is in fact no more than an extreme example of the male brain. The male brain theory suggests that systemising being a very male trait when taken to extreme can explain AS and high-level autistics abilities with computers, physics and mathematics.²⁹ The same evidence also lead Oliver Sacks to comment that: *"NASA is the largest sheltered workplace in the World."*¹⁶

In 1994 Petre and Blackwell¹⁷ looked at the mental imagery employed by high-level computer programmers to produce computer programmes. Each of the participants had a strong visual style. That is they formed visual models of the programmes they built before coding them. The imagery each of the programmers in the study describe is very similar to that used by AS when attempting to model certain real-life social situations.

Computer Programmer	Asperger Syndrome
"great bristling multi-coloured scaffolding of pipework and gadgets floating in space"	"In my mind are colours and shapes and images, all distorting and merging... I concentrate on focusing on this world"
"... it moves in my head... like dancing symbols.... I can see the strings [of symbols] assemble and transform like luminous characters suspended behind my eyelids"	"The process is like trying to figure out what the picture on a jig saw puzzle is, when only some of the pieces are put together. A piece is put on one corner and then another corner and after about one fourth of the pieces are in place, a person can tell that the puzzle has a picture of a house on it."
<p>"One of the earliest things is to visualize this structure in my head, a dynamic structure, so I can think about how things fit together and how they work . . . and once I have the structure fairly strong and clear in my mind, move it around and move around inside it, examining it and tweaking it . . ."</p> <p>"I think of these systems of relationships as alive, interacting beings . . . I make this dirty dynamic mental representation, a sort of organic thing . . ."</p>	"I see regular patterns and structures everywhere and in everything. It gets quite frustrating at times, because the world being the sort of place it is these patterns are frequently disrupted or have bits missing."

The skills that expert computer programmers need along with strong systemising abilities make computer science an attractive career for AS. Being able to systemise, that is, analyse the variables in a system and derive the underlying rules that govern that system, is known to be strong in Asperger's syndrome adults again an extremely important skill for any computer scientist. Asperger's Syndrome and HLA individuals often have higher than average IQ's and are logical and serial in their abilities¹⁸, two important attributes needed to be a successful computer programmer.

The social organisation of many IT companies, the flat management structures and the fact that when working with computers means that social engagement is minimal could explain the higher rates of AS and autism in Silicon Valley. The eminent psychologist, Tony Attwood, puts it well: "Computers are an ideal interest for a person with Asperger's Syndrome ... they are logical, consistent and not prone to moods".⁵

"In a very real sense we have two minds, one that thinks and one that feels."

Daniel Goleman²⁰

Daniel Goleman in his 1995 book, *Emotional Intelligence*²⁰ argues that IQ does not make one intelligent in way that is going to succeed. Emotional Intelligence, defined by Goleman as 'self awareness, self-discipline and empathy' seems to run in parallel (although first proposed 5 years beforehand) to Baron-Cohen's systemising/empathising quotient. As mentioned earlier Asperger's individuals often perform very well with maths and physics problems – questions similar to those used in standard IQ tests, and indeed are noted as having often very high IQs.

Creativity and imagination in autism and Asperger syndrome

An impairment in creativity is often seen with Asperger and high level autism.²¹ The drawings of Asperger and autistic children are often less varied which leads the authors to believe that they are less creative. In the same study AS and autistics were asked to imagine what various abstract foam shapes could be. Compared to a control group they were unable to imagine as many possibilities of what the object could be. A lack of imagination could be seen as a disadvantage when it comes to designing for others.

How does this explain software design, or more importantly bad software design.

"Design is really an act of communication, which means having a deep understanding of the person with who the design is communicating."

Donald A. Norman²²

The skills that make a good programmer are not the same skills that make a good software designer. The computer programmer is held with high esteem among in many software companies In his book *the Inmates are Running the Asylum*²³ Alan Cooper discusses the software development environment at Microsoft during the 1990s. Microsoft holds computer programmers in the highest esteem, believing them to be their most important asset – often at the expense of others involved in the software design process. Software developers, those who design the look and fell of the product produce a specification that is handed to the programmers to implement. If the programmer cannot see why it should be implemented or believes something should be implemented in a different way then often this is how it is done – this is something that is noted in the diagnostic criteria for AS.

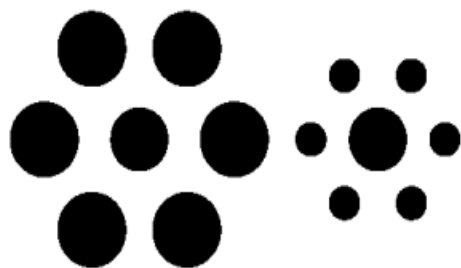
The downside of AS individuals designing and producing software is that AS individuals often have poor social understanding and an inability to empathise - they lack a theory of mind. The very nature of a theory of mind means that one is essential when it comes to designing for others. Not being able to understand the differences between oneself and any potential user of the system would mean that the software would be perfectly usable for anyone that shares the logical serial view of the world, but not for those who do not possess a strong systemising mind. Donald Norman gives an excellent example in his book *The Design of Everyday Things*,²² of Steve Jobs of Apple Computers, who had many electrical items in his living room that were operated by remote control. In 1986 he decided to produce a one-for-all remote control to eliminate the need for all the multiple remotes cluttering up his coffee table. The final product was extremely difficult to use, requiring a complex series of commands to be remembered and executed in strict order to function correctly. When questioned about the difficult to use design by Norman, Jobs replied, "Well, it'll probably be only techies that use it." The inability to imagine what it would be like for those with different skills to yours is a key feature of AS and HLA.

As Simon Baron-Cohen puts it: "Being more object focused is clearly only a disability in an environment that expects everyone to be social."²¹

"Let's face the obvious: yesterday we were nerds, today we're the cognitive elite. Let's conquer!"

Chester G Edwards

Francesca Happé²⁴ argues that far from being a cognitive deficit may in fact just be a different cognitive style. Happé quotes a theory first put forward by Frith in 1989. AS and autistic show detailed level processing at the expense of a 'gestalt' view of the whole. That is context is not readily processed, whereas the details are. Frith uses the following sentence to demonstrate "The sea is full of salt and..." AS and autistics answer "pepper" as opposed to water. Unable to see the full context of the statement they only see a detail, salt matches with pepper. Frith believes that AS and autistics do not possess central coherence (CC), to process information in context, for gist. AS and autistics do not perceive perceptual illusions in the same way those with AS or HLA do. The figure on the right shows two sets of circles. The central circle in each pattern is the same size but appears to be different. Far from being a disadvantage Happé argues that it may just be a different cognitive style suiting the individual to technically and scientifically demanding tasks – such as computer programming. Simon Baron-Cohen goes further: "...such cases illustrate that in the right environment the condition of AS need not be a disability or interfere with remarkable levels of achievement."¹⁹



A visual illusion, the circle on the right appears to be larger than that on the left. More examples are in the notes section (no. 39)

But this is all well and good but what are the consequences of labelling computer programmers as Asperger's

Temple Grandin²⁵, a well known writer on the subject of Autism related conditions, remarks on the increase in rates of diagnosis of Asperger's Syndrome in the USA and the negative effects this label may convey; "One mother called me and was very upset that her six-year-old son had Asperger's. She then went on to tell me that his IQ was 150. I replied that before people knew about Asperger's Syndrome, their child would have received a very positive label of intellectually gifted."

Many AS and HLA object to the label that has been given them. In previous times they may have been labelled as being *eccentric* or just a bit *different*. Once diagnosed with the 'disorder' they feel stigmatised and in some ways patronised by the scientific community. For example: "*But a lot of what I've found out there, mostly written by 'experts' and 'professionals', has been arrogant, insulting, and just plain wrong. My bête noire of the moment is finding my emotions described as 'flat'... ... I can state unequivocally that my emotions are not 'flat'. They are different, yes, but they are most certainly not 'flat.'*"²⁶ The term neurotypical has been coined by many aggrieved AS and HLA individuals for those who do not share the same cognitive style as themselves, see 26 for more information.

Famous thought-to-be aspergers

The internet being rife with speculations on many issues has been publishing the suggestions that many famous physicists, mathematicians and computer scientists both alive and dead may show traits of AS.²⁷ This speculation has also been mentioned in the press.³⁰ AS traits are not necessarily a disadvantage. A strong analytical, or systemising minds have been responsible for some of the greatest discoveries that mankind has made. Without these discoveries humanity may not be as successful as we are. As Temple Grandin puts it: "What would happen if you eliminated the autism genes from the gene pool? You would have a bunch of people standing around in a cave chatting and socialising and not getting anything done!"¹⁹

Conclusion

In 1990 Barba²⁸ showed that: "Computer users according to the children in this study, are middle aged adults, not the white-haired, bespectacled, absent minded professors envisioned by most adults in our society." The prevalence of AS and HLA among computer scientist remains to be quantified, but it's clear that many traits of the 'disorders' certainly convey an

advantage in the field. A diagnosis of either AS or HLA may not be a positive thing stigmatising the individual and making a normal life difficult. Computer geeks, far from being marginalised really came into their own in the 1990s during the dot com boom where they were commanding huge salaries and large stock options, starting their own multi-million dollar companies and becoming 'cool' again. The cartoonist Scott Adams (the man behind *Dilbert*) says of geeks: "*Men Who Use Computers Are The New Sex Symbols Of The '90s*" The final word however should go to a thought-to-be AS; Bill Gates: "*Be nice to nerds. Chances are you'll end up working for one.*"⁴³

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Backlash against labelling of AS and HLA
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 A very angry spoof website: **Centre for the study of Neurotypical disorder**
<http://isnt.autistics.org/> Are you neurotypical?
<http://isnt.autistics.org/ntscreening.html>
27. Are Albert Einstein and Bill Gates Autistic? <http://omicron.8m.com/autism/eingate.htm>
 Famous People with Autistic Traits
<http://www.geocities.com/WestHollywood/Stonewall/4502/famousac.html>
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37. – Anecdotal evidence that computer programmers are geeks

"Sometimes the best engineers come in bodies that can't talk."

Nolan Bushnell

"The world is a tragedy to those who feel, but a comedy to those who think."

Horace Walpole

"People that think logically are a nice contrast to the real world."

Matt Biershbach

"Computer geek: an asocial, malodorous, pasty-faced monomaniac with all the personality of a cheese-grater." **Jargon Files**

"Lovers of problem solving, they are apt to play chess at lunch or doodle in algebra over cocktails, speak an esoteric language that some suspect is just their way of mystifying outsiders. Deeply concerned about logic and sensitive to its breakdown in everyday life, they often annoy friends by asking them to rephrase their questions more logically."

Time Magazine in 1965

"Being a social outcast helps you stay concentrated on the really important things, like thinking and hacking."

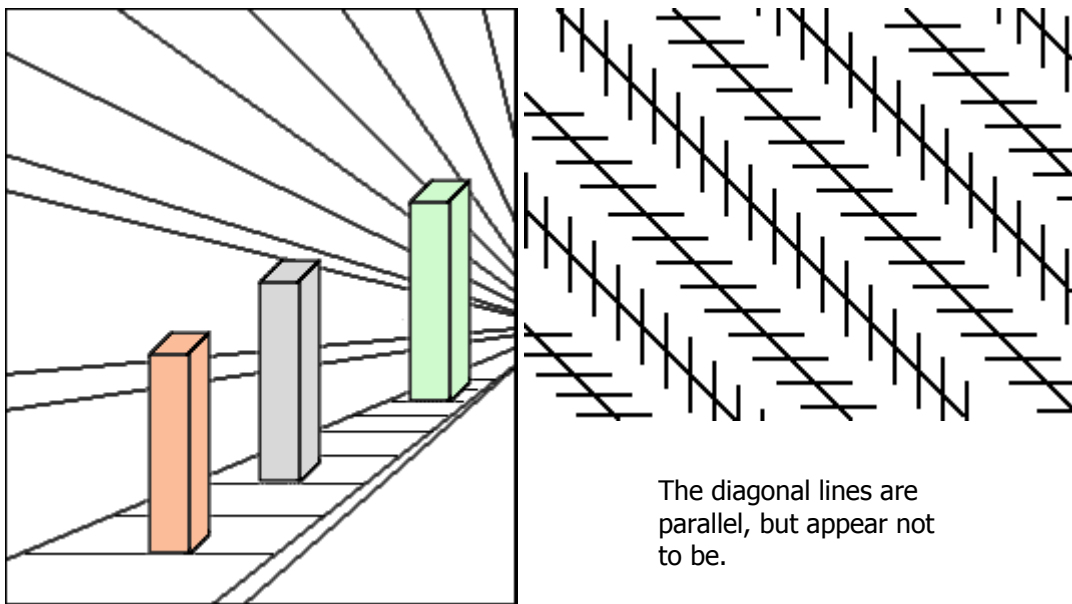
Eric Raymond

38. **BBC Radio report August 2002**

http://news.bbc.co.uk/media/audio/38195000/rm/38195592_autism07_feilden.ram

Plays through RealPlayer (www.realplayer.com)

39. Perceptual Illusions

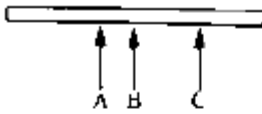


All three shapes are the same size, but the green one appears to be larger.

The diagonal lines are parallel, but appear not to be.

40. An example of a 'folk' physics test

Example



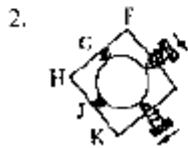
Which arrow will balance the beam?
 (a) A (b) B (c) C (d) all equal

NOTE THE TIME BEFORE YOU START!

Questions



If the wheel rotates as shown, P will
 (a) move to the right and stop
 (b) move the left and stop
 (c) move to and fro
 (d) none of these



When the two screws are turned the same amount as shown, the ball will move towards
 (a) F (b) G (c) H (d) J (e) K

41. An example of a 'folk' psychology test

preoccupied

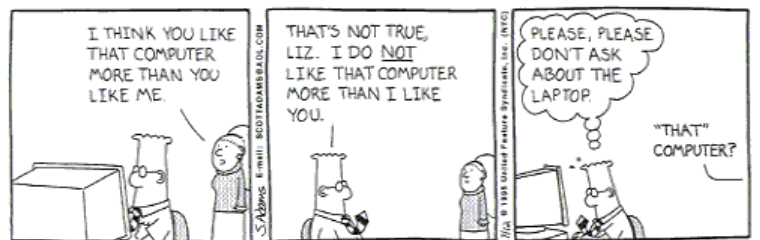
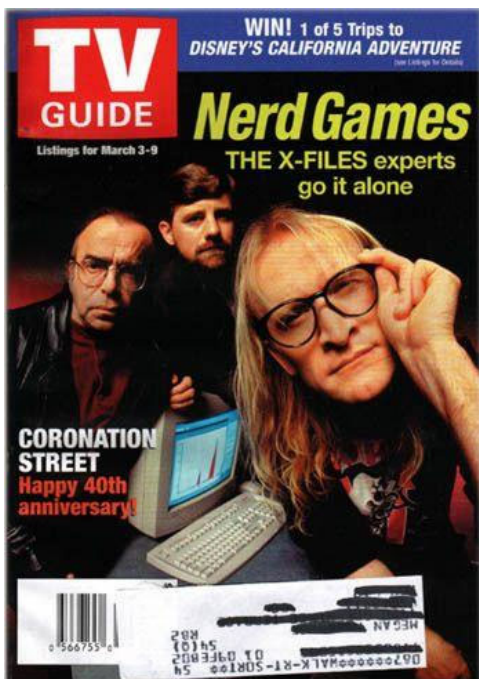
grateful

serious

ashamed



42. Computer geeks and nerds in the media.



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From left to right. The Computer Geeks from the X-Files, Dilbert by Scott Adams and the "Comic book guy" from the Simpsons



43 Bill Gates is bottom left



Microsoft, 1978