

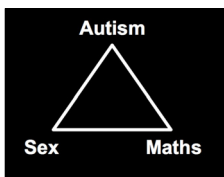
he's been stung by his bees—but the resulting polka-dotted diary reveals the scale of the problem and, as further tragedy strikes, it seems there cannot be an ingenious solution.

Yet Dr Barrie makes the same error as Holmes—who admits of one grave mistake that, “I successfully deduced the facts but failed to grasp their meaning”. The correct diagnosis is not spotting that Holmes is very ill, or that his

housekeeper wants another job, or that his client in Japan has lied. Observation is only half the story. The solution—or at least some solace—comes in working out what they need. In doing so, *Mr Holmes* stops being a detective and becomes a doctor.

Simon Guerrier

Autism, maths, and sex: the special triangle



X+Y (A Brilliant Young Mind)

Directed by Morgan Matthews
Running time: 111 min

For *Beautiful Young Minds* see
<http://tiny.cc/syj5yx>

For more on the **special triangle**
see *Scientific American* 2012;
307: 72–87

For more on **sex differences**
in autism see
Public Library of Science Biology
2011; 9: 1–10

For more on **steroidogenic**
activity in autism see
Molecular Psychiatry 2015;
20: 369–76

For more on **attenuation**
of sex difference see
PLoS One 2014; 9: e102251

X+Y is a semi-fictional film about a child called Nathan who loves maths, who also has an autism spectrum condition, and is also male. If these three aspects of Nathan's character were just a one-off coincidence, it wouldn't be important to draw attention to it. But in the real world of clinical psychiatry, such associations occur more often than chance, and call out for an explanation. X+Y is an emotionally gripping drama that the director Morgan Matthews stresses is loosely based on a real person called Daniel Lightwing, whom I diagnosed with Asperger Syndrome in our clinic in Cambridge. His visit to our clinic was unusual because he requested we allow in a film crew as he was part of the documentary called *Beautiful Young Minds*, also directed by Morgan Matthews, and on which the film X+Y (released in the USA as *A Brilliant Young Mind*) is based.

Beautiful Young Minds was shown on the BBC in 2007, and followed six young British students as they competed for selection into the British team of the International Mathematics Olympiad. Of the six teenagers, all were male and half were portrayed as being on the autism spectrum—way too small a sample from which to draw conclusions. Nevertheless, the “special triangle” between sex, autism, and mathematics is attracting new research interest.

In X+Y, Nathan loves maths; Daniel loved mathematics too. The clinical word for “loving” a subject is to say the person is “obsessed” with it. When I met Daniel he was a maths student at Trinity College, Cambridge. He told me that whilst at school, for him no other subjects were worth studying. He thought he was wasting his time at school having to sit through lessons in other subjects, since if the goal of education was to discover truth, and if truth can only actually be discovered by using the tools of logic and the scientific method, then maths is the ultimate logical science, where pure truths can be revealed. Luckily Daniel's school allowed him to go as far as he wanted in maths, even if he was neglecting his other subjects.

In X+Y, Nathan is selected to represent Britain in the International Maths Olympiad, and Daniel was too, where he won a silver medal. Nathan, like Daniel, struggles to understand people, have conversations or participate in chit-chat, or infer what others might be thinking or feeling. Instead he prefers to stick to the more predictable, rule-based or factual world of maths. Social-communication difficulties lie at the heart of autism spectrum conditions. This can mean

the person either says very little, seeming uncommunicative, or might say too much, not being sensitive to their listener. They might seem undiplomatic as they speak the truth, without thinking about the impact of their words on their listener or without sugaring the pill. Chit-chat holds little interest for them as such conversation flits from one topic to another, like a butterfly seemingly randomly jumping from one flower to another, whereas maths or logical argument proceeds with a linear logic that ensures each step follows on from the last, as night follows day.

In X+Y, Nathan's love of mathematics allows him to show his academic potential when his social disability might otherwise leave him socially isolated, and the same is true of Daniel. And like people with autism spectrum conditions, the diagnostic criteria are met because Nathan (and Daniel) needs order and repetition, more so than the average person. Unexpected change, which an average person could cope with, causes them stress. But whereas for many people on the autism spectrum, their passion or obsession may not have an obvious value in society, in the case of Nathan and Daniel, their obsession is mathematics, on which we as a society place high value. For the fictional character as for the real person with Asperger Syndrome, mathematics becomes their passport into social inclusion and success.

So what is the evidence for the ‘special triangle’ between autism, sex, and mathematics? First, autism is diagnosed far more often in males than in females, and males are over-represented at higher levels of mathematical ability. Most studies report the sex ratio in autism to be about 4:1 (male:female), although the possibility of under-diagnosis of Asperger Syndrome in females means that the true sex ratio in autism may be closer to 2:1, still more common in males; on the SAT-Math test, the sex ratio at the 99th percentile is 2:1 (m:f). This difference is likely to reflect genetic or prenatal steroid hormonal factors. Among all Fields Medal winners (the equivalent of the Nobel Prize in mathematics), 54 out of 55 have been male. Whilst social factors may have contributed to this extreme sex ratio, it is plausible that biology also contributes. Second, people with autism and mathematicians also share a love of patterns, also known as strong systemising.

Third, mathematicians score higher on tests of autistic traits, and have higher rates of diagnosed autism, compared

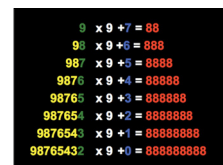
with people in the general population. Fourth, fathers and grandfathers of children with autism are over-represented in the fields of science, technology, engineering and mathematics. And autism is more common in geographical areas where parents work in these subjects. The special triangle means that autism and mathematical ability may share aspects of sex-linked biology.

X+Y brings out this special triangle in a highly engaging way. Critics argue that films like this (or books like *The Curious Incident of the Dog in the Night-Time*) misrepresent the autism spectrum, as the special triangle may only apply to subgroup known as Asperger Syndrome rather than classic autism, and even then, may only apply to a subgroup of those with Asperger Syndrome (those whose obsession focuses on maths). My own view is that such films or books still have an important value for three reasons. First, they highlight connections between different parts of the mind that co-occur more often than chance

and which beg explanation. Second, they portray the positive side of autism (a love of patterns and remarkable attention to detail, seen even in classic autism), rather than a sole focus on the unquestionably disabling social-communication aspects. Third, the possibility remains that the lessons we can learn from Asperger Syndrome—or even just the subset who love maths—may teach us about the whole of the autism spectrum, if it is a spectrum united by some common underlying causes.

Daniel Lightwing has been courageous in allowing his life story to be turned into first a documentary, and now a terrific drama. Like director Morgan Matthews, Daniel sees the value of using film to communicate to a wider public, celebrating the positive aspects of autism whilst raising awareness of the disability and the special needs such individuals have, and the support that can make a real difference.

Simon Baron-Cohen



Books

Keys to recovery

James Rhodes is a rare beast: an accomplished classical pianist who is also recognisably a human being. A committed smoker who performs Chopin in jeans and trainers, Rhodes seems refreshingly grounded in comparison with the clinically perfect, white-tied Wigmore Hall virtuosi or the bland pop stars of the “crossover” classical world. That he is so despite a childhood featuring the most brutal and prolonged sexual abuse is a testament to the redemptive power of music, which Rhodes repeatedly credits with having saved his life.

In one of the many intensely moving passages in *Instrumental*, a searing memoir of music and madness, Rhodes relates his childhood discovery of the Bach-Busoni *Chaconne* in D minor—an oasis of magnificent desolation which becomes his “safe place” amidst the horrors of rape, a “force field that only the most toxic and brutal pain could penetrate.” Many will identify with the moment of epiphany that initiates a lifelong passion for music, but few can have attached such desperate intensity to music’s capacity to shine a light in the darkest of places.

Music, and the piano in particular (which Rhodes describes as an “entire universe” in 88 keys), offered solace to the largely self-taught pianist during his abuse at prep school and the spiral of destructive behaviour that followed, but even Bach and Beethoven could not completely overcome the proliferating consequences of his childhood: multiple surgeries, depression and suicidal ideation, alcoholism and drug addiction, self-harm, and sexuality confusion, amidst many other conditions and

disorders. This tragic litany is accompanied by the long list of treatments Rhodes undergoes and by the accumulating wreckage of a blighted life, ranging from lost friendships to a broken marriage and separation from his son. He eventually secures a semblance of mental stability and a glittering career as recitalist, recording artist and TV presenter (complete with celebrity fans and groupies, or “Rhodettes”), but acknowledges that he is “only ever two weeks away from a locked ward.”

Despite the dark intensity of his narrative, Rhodes is an amusing and self-deprecating companion; at one point he describes Liszt as “the wanker who is responsible for making pianists perform full-length recitals from memory”. The mention of Liszt is apposite, for Rhodes’ approach to concertising, which involves chatting informally to audience members and playing for those in the cheaper seats, is strongly reminiscent of Liszt’s own iconoclastic approach to music. Rhodes sees classical music not only as a resource for healing, but also as in need of healing from both dumbing-down and elitism—a process that, like recovery from mental illness, can only begin by facing up to its problems. This book was almost banned from release by legal measures taken by Rhodes’ first wife, on the grounds that its contents could harm his son. The recent overturning of these measures is a victory not just for free speech, but for all survivors of child rape and those who, like Rhodes, believe passionately in the continued importance and relevance of classical music.

Conor Farrington



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James Rhodes
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