COMMENT

JESSICA DIMMOCK/VII

Working with autistic scientist Michelle Dawson (right) has helped Laurent Mottron (left) change his entire perception of the condition.

The power of autism

Recent data — and personal experience — suggest that autism is an advantage in some spheres, including science, says **Laurent Mottron**.

Most grant proposals, research papers and reviews on autism open with, "Autism is a devastating disorder". Mine do not.

I am a researcher, clinician and lab director concentrating on the cognitive neuroscience of autism. Eight autistic people have been associated with my group: four research assistants, three students and one researcher.

Their roles have not been limited to sharing their life experiences or performing mindless data entry. They are there because of their intellectual and personal qualities. I believe that they contribute to science because of their autism, not in spite of it.

Everyone knows stories of autistics with extraordinary savant abilities, such as Stephen Wiltshire, who can draw exquisitely detailed urban landscapes from memory after a helicopter tour. None of my lab members is a savant. They are 'ordinary' autistics, who as a group, on average, often outperform non-autistics in a range of tasks, including measures of intelligence.

THE AUTISM ENIGMA
Sorting fact from fiction
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As a clinician, I also know all too well that autism is a disability that can make daily activities difficult. One out of ten autistics cannot speak, nine out of ten have no regular job and four out of five autistic adults are still dependent on their parents. Most face the harsh consequences of living in a world that has not been constructed around their priorities and interests.

But in my experience, autism can also be an advantage. In certain settings, ▶

autistic individuals can fare extremely well. One such setting is scientific research. For the past seven years, I have been a close collaborator of an autistic woman, Michelle Dawson. She has shown me that autism, when combined with extreme intelligence and an interest in science, can be an incredible boon to a research lab.

I first met Dawson when we were interviewed together for a television documentary about autism. Some time later, after disclosing to her employers that she was autistic, she experienced problems in her job as a postal worker and so had learned everything about how the legal system deals with employees with disabilities. I recognized her skill for learning and asked her to become a research assistant in my lab. When she edited some of my papers, she gave exceptional feedback and it was clear that she had read the entire bibliography. The more she read, the more she learned about the field. Almost ten years ago, I offered her an affiliation to the lab. We've now co-authored 13 papers and several book chapters.

TESTING ASSUMPTIONS

Since joining the lab, Dawson has helped the research team question many of our assumptions about and approaches to autism — including the perception that it is always a problem to be solved. Autism is defined by a suite of negative characteristics, such as language impairment, reduced interpersonal relationships, repetitive behaviours and restricted interests. Autism's many advantages are not part of the diagnostic criteria. Most educational programmes for autistic toddlers aim to suppress autistic behaviours, and to make children follow a typical developmental trajectory. None is grounded in the unique ways autistics learn.

In cases where autistic manifestations are harmful — when children bang their heads on the walls for hours, for example — it is unquestionably appropriate to intervene. But often, autistic behaviours, although atypical, are still adaptive.

For instance, one sign of autism is using another person's hand to ask for something, such as when a child places her mother's hand on the refrigerator to ask for food, or on the door knob to ask to go outside. This behaviour is unusual, but it lets children communicate without language.

Even researchers who study autism can display a negative bias against people with the condition. For instance, researchers performing funcional magnetic resonance imaging (fMRI) scans systematically report changes in the activation of some brain regions as deficits in the autistic group — rather than evidence simply of their alternative, yet sometimes successful, brain organization.

Similarly, variations in cortical volume have been ascribed to a deficit when they appear in autism, regardless of whether the cortex is thicker or thinner than expected[1].

When autistics outperform others in certain tasks, their strengths are frequently viewed as compensatory of other deficits, even when no such deficit has been demonstrated empirically.

"Too often, employers don't realize what autistics are capable of, and assign them repetitive, almost menial tasks."

Without question, autistic brains operate differently. Most notably, they rely less on their verbal centres. When non-autistic people look at an image of a saw, for example, their brains are activated in regions that process both visual information and language.

In autistics, there is comparatively more activity in the visual-processing network than in the speech-processing one[2], and this seems to be a robust characteristic of autism, across a wide array of tasks[3]. This redistribution of brain function may nonetheless be associated with superior performance[4] (see fMRI images below).

These differences may also have downsides, such as difficulties with spoken language. But they can confer some advantages. A growing body of research is showing that autistics outperform neurologically typical children and adults in a wide range of perception tasks, such as spotting a pattern in a distracting environment[5].

Other studies have shown that most autistic people outperform other individuals in auditory tasks (such as discriminating sound pitches[6]), detecting visual structures[7] and mentally manipulating complex three-dimensional shapes. They also do better in Raven's Matrices, a classic intelligence test in which subjects use analytical skills to complete an ongoing visual pattern. In one of my group's experiments, autistics completed this test an average of 40% faster than did non-autistics[4].

A CHANGED MIND

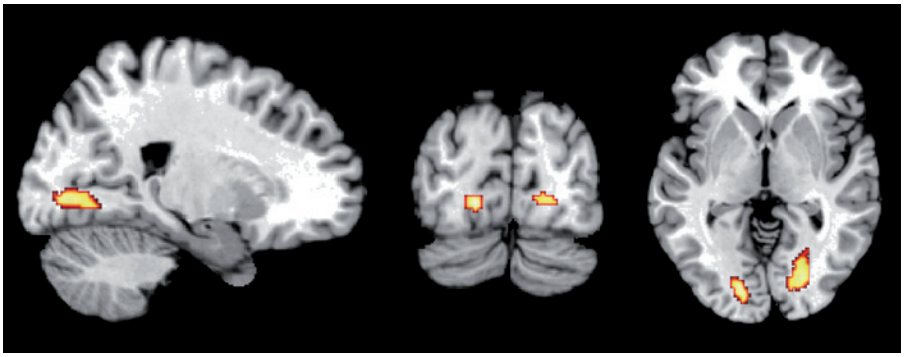
A few years ago, my colleagues and I decided to compare how well autistic and non-autistic adults and children performed in two different types of intelligence test: non-verbal ones, such as Raven's Matrices, that need no verbal instructions to complete, and tests that rely on verbal instructions and answers. We found that non-autistics as a group performed consistently in both types of test — if they scored in the 50th percentile in one, they tended to score around the 50th percentile in the other. However, autistics tended to score much higher in the non-verbal test than in the verbal one (see 'Autistic intelligence') — in some cases, as many as 90 percentile points higher[8].

Despite autistics' success in Raven's Matrices, I, too, used to believe that verbal tests were the best measures of intelligence. It was Dawson who opened my eyes to this 'normocentric' attitude. She asked me: if autistics excel in a task that is used to measure intelligence in non-autistics, why is this not considered a sign of intelligence in autistics?

It is now amazing to me that scientists continue to use, as they have for decades, inappropriate tests to evaluate intellectual disability among autistics,which is routinely estimated to be about 75%. Only 10% of autistics have an accompanying neurological disease that affects intelligence, such as fragile-X syndrome, which renders them more likely to have an intellectual disability.

I no longer believe that intellectual disability is intrinsic to autism. To estimate the true rate, scientists should use only those tests that require no verbal explanation. In measuring the intelligence of a person with a hearing impairment, we wouldn't hesitate to eliminate components of the test that can't be explained using sign language; why shouldn't we do the same for autistics?

Of course, autism affects other functions, such as communication, social behaviour and motor abilities. These differences can render autistics more dependent on others, and make everyday life much more difficult. None of my arguments above is intended to minimize that.



SOURCE: REF. 4

For certain tasks, autistics use their brains differently: these fMRI images depict the perceptual regions of the brain activated more among autistics than non-autistics during a non-verbal intelligence test.

SOURCE: REF. 8

Too often, employers don't realize what autistics are capable of, and assign them repetitive, almost menial tasks. But I believe that most are willing and capable of making sophisticated contributions to society, if they have the right environment. Sometimes the hardest part is finding the right job — but organizations are now arising to address this problem. For example, Aspiritech, a non-profit organization based in Highland Park, Illinois, places people who have autism (mainly Asperger's syndrome) in jobs testing software (www.aspiritech.org). The Danish company Specialisterne has helped more than 170 autistics obtain jobs since 2004. Its parent company, the Specialist People Foundation, aims to connect one million autistic people with meaningful work (www.specialistpeople.com).

Many autistics, I believe, are suited for academic science. From a young age, they may be interested in information and structures, such as numbers, letters, mechanisms and geometrical patterns — the basis of scientific thinking[9]. Their intense focus can lead them to become self-taught experts in scientific topics. Dawson, for example, does not have a scientific degree, but she has learned and produced enough in a few years of reading neuroscience papers to conduct certain types of research. At this point, she deserves a PhD.

INSTANT RECALL

Research has consistently shown that, on average, autistics present strengths that can be directly useful in research. They can simultaneously process large pieces of perceptual information, such as large data sets, better than non-autistics can[10]. They often have exceptional memories: most non-autistic people can't remember what they read ten days ago; for some autistics, that's an effortless task. Autistic people are also less likely to misremember data. This comes in handy in science: whereas the methodologies used in studies of face-perception in autism are for me terribly similar, Dawson can instantaneously recall them.

Many autistics are good at spotting recurrent patterns in large amounts of data, and instances in which those patterns have been broken. In my lab, Dawson noticed a discrepancy in the standards applied to various types of treatments: to develop a drug, researchers must conduct elaborate studies including randomized controlled trials, but this is not a requirement for behavioural interventions for autistics, despite the huge costs of such interventions (up to US$60,000 a year for each individual) and their potential negative consequences.

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Read Dawson's essay on behavioural therapies:
go.nature.com/c6d9mj

It is thus worrying that some countries, including France, have proposed mandatory interventions that aim to get autistics to adopt 'typical' learning and social behaviours, which have not been tested using the standards applied to other areas in science.

Dawson's keen viewpoint also keeps the lab focused on the most important aspect of science: data. She has a bottom-up heuristic, in which ideas come from the available facts, and from them only. As a result, her models never over-reach, and are almost infallibly accurate, but she does need a very large amount of data to draw conclusions. By contrast, I have a top-down approach: I grasp and manipulate general ideas from fewer sources, and, after expressing them in a model, go back to facts supporting or falsifying this model. Combining the two types of brains in the same research group is amazingly productive.

Because data and facts are paramount to autistic people, they tend not to get bogged down by the career politics that can sidetrack even the best scientists. They prefer not to seek popularity, promotions or vast numbers of papers; they may post their best ideas on the web rather than publish them.

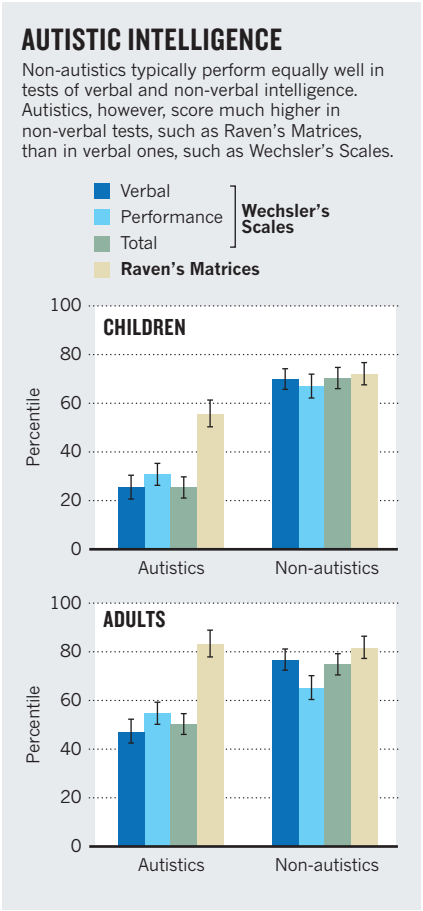
In 2004, Dawson gained recognition within the autistic community and among autism researchers and clinicians after posting online an essay detailing the ethical shortcomings of the intensive behavioural therapies used with autistic children.

Of course, autistics will not thrive in all careers. Given their social differences, they will often struggle in people-oriented fields, such as retail or customer service. Ideally, autistic individuals would have mediators who could help settle situations that trigger anxiety in them — typically anything unscheduled or hostile, such as changes to an existing plan, computer problems or negative criticism.

Despite these caveats, Dawson and other autistic individuals have convinced me that, in many instances, people with autism need opportunities and support more than they need treatment. As a result, my research group and others believe that autism should be described and investigated as a variant within the human species. These variations in gene sequence or expression may have adaptive or maladaptive consequences, but they cannot be reduced to an error of nature that should be corrected.

The hallmark of an enlightened society is its inclusion of non-dominant behaviours and phenotypes, such as homosexuality, ethnic differences and disabilities. Governments have spent time and money to accommodate people with visual and hearing impairments, helping them to navigate public places and find employment, for instance — we should take the same steps for autistics.

Scientists, too, should do more than simply study autistic deficits. By emphasizing the abilities and strengths of people with autism, deciphering how autistics learn and succeed in natural settings, and avoiding language that frames autism as a defect to be corrected, they can help shape the entire discussion. ■



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