Sex differences in mind

Last week **Simon Baron-Cohen** provoked much controversy after declaring that the female mind is not suited to science. Here he defends his findings. But while it is possible to discern trends in the sexes, he says there can be no excuse for prejudice.

The field of sex differences in psychology in the 1960s and '70s was so conflict-ridden as to make an open-minded debate about any possible role of biology contributing to psychological sex differences impossible. Those who explored the role of biology – even while acknowledging the importance of culture – found themselves accused of defending an essentialism that perpetuated inequalities between the sexes, and of oppression. This was no climate in which scientists can ask questions about mechanisms in nature.

Today, the pendulum has settled sensibly in the middle of the nature-nurture debate, and scientists who care deeply about ending inequality and oppression can at the same time talk freely about biological differences between the average male and female brain and mind. These differences are subtle and are to do with the relative proportions of different drives in the typical male and female mind.

The field of sex differences in mind needs to proceed in a fashion that is sensitive to this history of conflict by cautiously looking at the evidence and being careful not to overstate what can be concluded. As we will see, the data actually requires us to look at each individual on their own merits, as individuals may or may not be typical for their sex.

Systemizing is our most powerful way of understanding and predicting the law-governed inanimate universe. Empathizing is our most powerful way to understand and predict the social world. Ultimately, empathizing and systemizing depend on separate, independent regions in the human brain.Systemizing and empathizing are two key dimensions that define the male and female brain. We all have both systemizing and empathizing skills.

This essay concerns itself primarily with those on the extreme male brain end of the spectrum. Individuals who have this psychological profile may be talented systemizers, but they are often, at the same time, "mind-blind".

The evidence reviewed here suggests that not all men have the male brain and not all women have the female brain. Expressed differently, some women have the male brain, and some men have the female brain. My central claim here is only that more males than females have a highly systematizing, and more females than males have a highly empathizing brain – that is, their empathy is stronger than their systematizing.

What is the evidence for female superiority in empathizing? Studies consistently show that sex differences of a small but statistically significant magnitude have been found. On average, girls show more concern for fairness, while boys share less. In one study, conducted by Charlesworth and Dzur, boys showed fifty times greater competition than their female counterparts, and girls showed twenty times greater turn taking. Other studies have found that boys prefer rough and tumble; that girls from the age of one year show greater concern for others through sad looks, sympathetic vocalizations, and comforting; and that women are better at decoding nonverbal communication. Women score higher than men on questionnaires designed to measure emphatic response. Perhaps the ultimate example of a lack of empathy is murder. Daly and Wilson analysed homicide records dating back over seven-hundred years. They found that "male-on-male" homicide was thirty to forty times more frequent than "female-on-female" homicide.

And the evidence for the systematizing male? The relevant domains to explore include any fields that are in principle rule-governed. Thus, chess and football are good examples of systems, but faces and conversations are not. So Jennings finds that boys are more interested than girls in toy vehicles, weapons, building blocks, and mechanical toys. Meanwhile, some occupations are almost entirely male. These include metalworking, weapon making, and boat building. The focus of these jobs is on creating systems. On average, men score higher than women in an assembly tasks; they have superior motoric skills (throwing and catching a ball); and men are better at map-reading. The Swiss child psychologist Jean Piaget devised a task involving a bottle that is tipped at an angle. Individuals are asked to predict the water level. Women more often draw the water level aligned with the tilt of the bottle and not horizontal, as is correct.

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The gender differences demand an explanation. One-year-old boys strongly prefer to watch a video of cars going past, an example of predictable mechanical systems, than to watch a film showing a human face. Little girls show the opposite preference. Some investigators argue that, even by this age, socialization may have caused these sex differences. Although evidence exists for differential socialization contributing to sex differences, this is unlikely to be a sufficient explanation. Connellan and colleagues showed that among one-day-old babies, boys look longer at a mechanical mobile, which is a system with predictable laws of motion, than at a person's face, an object that is next to impossible to systemize. One-day-old girls show the opposite profile. These sex differences are therefore present very early in life. This raises the possibility that, while culture and socialization may partly determine the development of a male brain with a stronger interest in systems or a female brain with a stronger interest in empathy, biology may also partly determine this.

What are the implications of such research for our view of women in science? This research suggests we should not expect that the sex ratio in occupations such as maths or physics to ever be fifty-fifty, if we leave the work place to simply reflect the numbers of applicants of each sex who are drawn to such fields. The assumption here is that just as if you leave toys out on the carpet and film if boys and girls spontaneously choose to play with the same or different toys, you find that more boys play with the toys that involve systemizing (constructional or mechanical toys, for example) and more girls play with the toys that involve empathizing (caring for dolls, say).

So it might be that we will always see more males spontaneously choosing to apply to work in fields that involve systemizing (science, engineering, auto-mechanics, etc) and more females spontaneously choosing to work in fields that involve empathy (telephone help lines for those with mental health crises, such as the Samaritans).

Of course, the question of how one determines if a person's choice is "spontaneous" or determined by cultural or biological factors is extremely hard to pin down. The study of newborn babies which found that more newborn boys spontaneously look for longer at a mechanical mobile, and more newborn girls spontaneously look for longer at a human face, suggests biology plays one part in leading to this 'bias' in attention to things rather than emotions (in boys) and vice versa (in girls). But this is not to minimize the major role that culture also plays in amplifying such partly innate differences as the child grows up.

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There is a need to separate the scientific question ("Are there sex differences in mind?") from the social policy agenda ("How can we achieve equal representation of women in science, or in any field?"). This is because they can be considered separately. If we want a particular field to have an equal representation of men and women, which may be ethically desirable in terms of equality of opportunity, equality of status, equality of income, or ensuring balance in the work-place, then we need to put in place social policies that will bring about that outcome. In other fields, it will not be necessary to intervene with policy. Medicine is a good example of a science where female applicants now outnumber male ones, probably because it is a science that favours a brain with good systemizing together with good empathy; this brain type is actually more common among females. But mathematics and physics may have little or no role for empathy, and so favour a highly systematizing brain, more common in males.

The research teaches us that there is no scientific justification for stereotyping, since none of the studies allow one to predict an individual's aptitudes or interests on the basis of their sex. This is because – at risk of repetition – they only capture differences between groups *on average*. Individuals are just that – they may be typical or atypical for their group (in this case, their sex). The applicant for the job in your science department may be a woman with a more typically "male" brain, or may be a man with a more typically "female" brain. Which means that to prejudge an individual on the basis of their sex is, as the word "prejudge" suggests, mere prejudice. We need to look at applicants on the basis of who they are as individuals, not on the basis of their sex, when judging their aptitude.

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