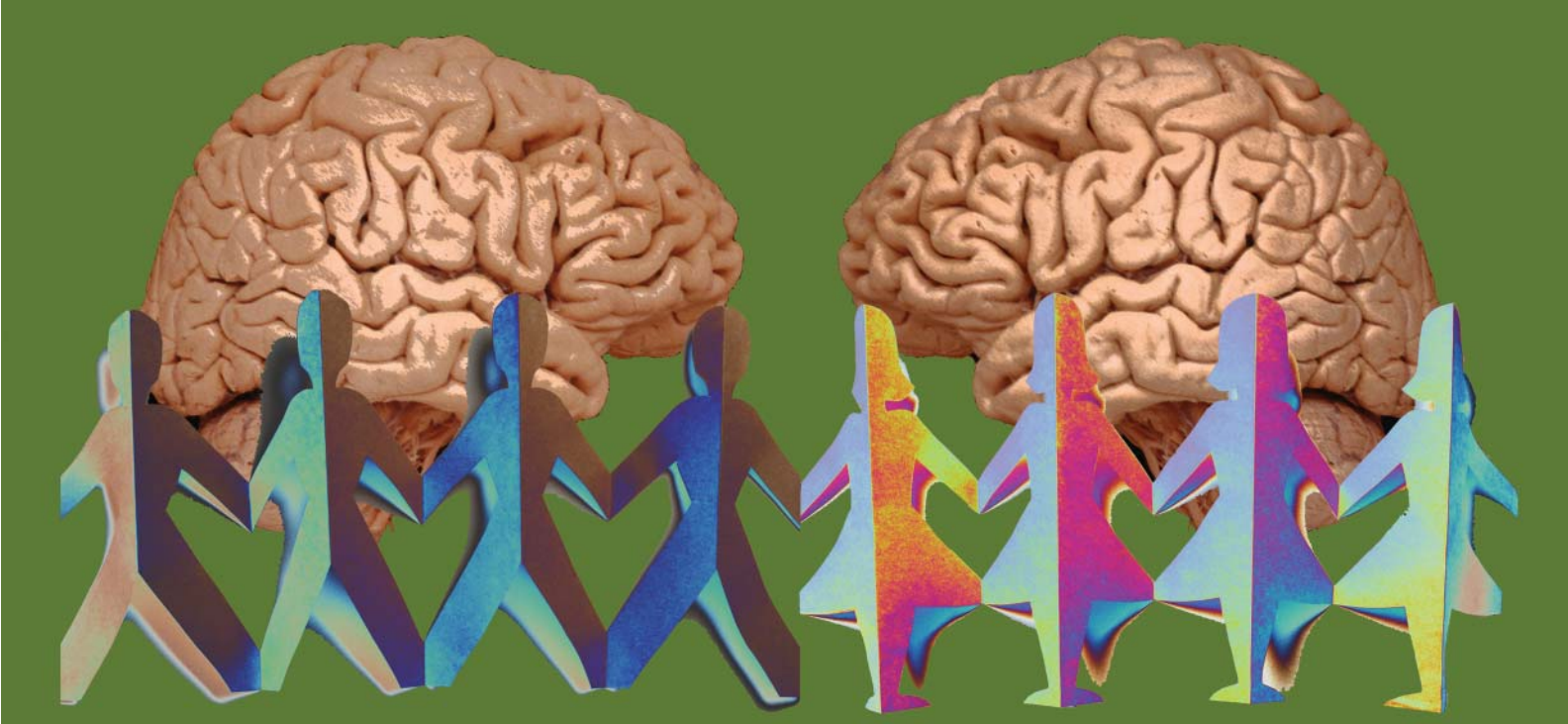

The Essential Difference: The Male and Female Brain

Simon Baron-Cohen

The field of gender differences in psychology is not new, though today it enjoys greater academic freedom than in past decades. The 1960s and 70s, while socially liberating, also made an open-minded debate about any possible role of biology contributing to psychological gender differences impossible. Those who explored the role of biology — even while acknowledging the importance of culture — found themselves accused of oppression and of defending an essentialism that perpetuated inequalities between the sexes. It was not a climate in which scientists could 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 also talk freely about biological differences between the male and female brain and mind.

A new theory, known as the empathizing-systemizing (E–S) theory, claims that the female brain is predominantly hard-wired for empathy and that the male brain is predominantly hard-wired for understanding and building systems. "Empathizing" means the drive to identify another person's emotions and thoughts and to respond to those with an appropriate emotion. The empathizer intuitively figures out how people are feeling and thus how to treat them with care and sensitivity. "Systemizing" means the drive to analyze and explore a system, to extract underlying rules that govern the behavior of a system, and to construct systems. The systemizer intuitively figures out how things work, or what the underlying rules are that control a system. Systems can be as varied as a pond, a vehicle, a computer, a plant, a library catalogue, a musical instrument, a math equation, or even an army unit. They all operate on inputs and deliver outputs, using rules.

According to this new theory, a person (whether male or female) has a particular "brain type." There are three common brain types. For some individuals, empathizing is stronger than systemizing. This is called a brain of type E, but we can also call it the female brain, because more females than males show this profile. For other individuals, systemizing is stronger than empathizing. This is called a brain of type S, but we can also call it the male brain, because more males than females show this profile. Yet other individuals are equally strong in their systemizing and empathizing. This is called the "balanced brain," or a brain of type B (Figure 1 illustrates these profiles diagrammatically).

THE EMPATHIZING BRAIN

The evidence for a female advantage in empathizing comes from many different areas. For example, given a free choice of which toys to play with, more girls than boys will play with dolls, enacting social and emotional themes. When children are

The E–S Model

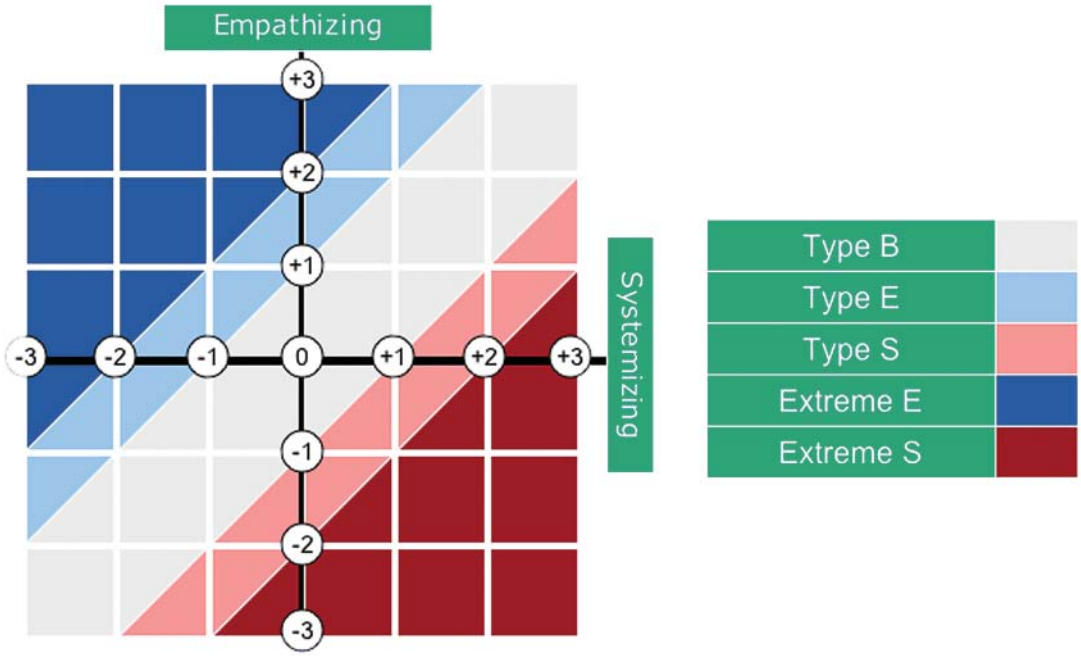

Figure 1.

put together to play with a little movie player that has only one eyepiece, overall boys tend to get more of their fair share of looking down the eyepiece. They just shoulder the other boys out of the way. Or if you let children play with those big plastic cars that they can drive, what you see is that more little boys play the "ramming" game. They deliberately drive the vehicle into another child. The little girls ride around more carefully, avoiding the other children more often. This behavior suggests the girls are being more sensitive to others.

Baby girls as young as twelve-months old respond more empathically to the distress of other people, showing greater concern through more sad looks, sympathetic vocalizations, and comforting. This tendency echoes what you find in adulthood: More women report frequently sharing the emotional distress of their friends. Women also show more comforting than men do. When asked to judge when someone might have said something potentially hurtful — a faux pas — girls score higher from as young as seven-years old. Women are also better at decoding nonverbal communication, picking up subtle nuances from tone of voice or facial expression, or judging a person's character.

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Gender differences also appear in aggression. Males tend to show far more direct aggression (pushing, hitting, punching). Females tend to show more indirect (relational, covert) aggression, which includes gossip, exclusion, and cutting remarks. It could be said that to punch someone in the face or to wound them physically requires an even lower level of empathy than a verbal snipe.

Two other ways to reveal a person's empathizing skill are to see how they (as a newcomer) join a group of strangers, and to see how they (as a host) react to a new person joining their group. These behaviors have been cleverly investigated in children by introducing a new boy or girl to a group of children already playing together. If the newcomer is female, she is more likely to stand and watch for a while, to check out what is going on, and then to try to fit in with the ongoing activity. Her trying to fit in usually leads to the newcomer being readily accepted into the group. If the new-

comer is a boy, he is more likely to hijack the game by trying to change it, directing everyone's attention on to him. And even by the age of six, girls are better at being a host. They are more attentive to the newcomer, while boys often just ignore the newcomer's attempt to join in. Boys are more likely to carry on with what they are already doing, perhaps preoccupied by their own interests.

How early are such sex differences in empathy evident? Certainly, by twelve months of age, girls make more eye contact than boys. But a study from Cambridge University shows that at birth girls look longer at a face, and boys look longer at a suspended mechanical mobile. Furthermore, the Cambridge team found that how much eye contact children make is in part determined by a biological factor, prenatal testosterone. This correlation has been demonstrated by measuring this hormone in amniotic fluid.

THE SYSTEMIZING BRAIN

Boys, from toddlerhood onward, are more interested in cars, trucks, planes, guns and swords, building blocks, constructional toys, and mechanical toys — systems. They seem to love to put things together, to build toy towers or towns or vehicles. Boys also enjoy playing with toys that have clear functions — buttons to press, things that will light up, or devices that will cause another object to move.

The same sort of pattern is seen in the adult workplace. Some occupations are almost entirely male: metal-working, weapon-making, crafting musical instruments, or the construction industries, such as boat-building. The focus of these occupations is on constructing systems. Professions such as mathematics, physics, and engineering, which require high systemizing, are also largely male-chosen disciplines.

Some psychological tests also show the male advantage in systemizing. For example, in the Mental Rotation Test, you are shown two shapes, and asked if one is a rotation or a mirror image of the other. Males are quicker and more accurate on this test. Map-reading has been used as another test of systemizing. Men can learn a route in fewer trials, just from looking at a map, correctly recalling more details about direction and distance. If you ask boys to make a map of an area that they have only visited once, their maps have a more accurate layout of the features in the environment — for example, showing which landmark is southeast of another.

If you ask people to put together a three-dimensional mechanical apparatus in an assembly task, on average men score higher. Boys are also better at constructing block buildings from two-dimensional blueprints. These are constructional systems. The male preference for focusing on systems again is evident very early. The Cambridge study found that one-year-old boys show a stronger preference to watch a film of cars (mechanical systems) than a film of a person's face (with lots of emotional expression). Little girls showed the opposite preference. And one-day-old boys look far longer at a mechanical mobile.

Culture and socialization certainly play a role in determining if you develop a male brain (stronger interest in systems) or female brain (stronger interest in empathy). But these studies of infancy strongly suggest that biology also partly determines this.

BIOLOGICAL CAUSES

Some of the most convincing evidence for biological causes for gender differences in the brain comes from studies of the effects of hormones. At one time, women were prescribed a synthetic female hormone (diethylstilbestrol) in an attempt to prevent repeated spontaneous miscarriages. Boys born to such women are more likely to show female-typical, empathizing behaviors, such as caring for dolls. And if a female rat is injected at birth with testosterone, she shows faster, more accurate maze learning, compared to a female rat who has not been given such an injection. So masculinizing the rat hormonally improves her spatial systemizing.

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Some important lessons have been learned from studies of clinical conditions. Male babies born with IHH (idiopathic hypogonadotrophic hypogonadism) have very small testes (and therefore very low levels of testosterone), and they are worse at spatial aspects of systemizing than are normal males. Other male babies born with Androgen Insensitivity (AI) Syndrome (testosterone is an androgen) are also worse at systemizing. Compare these with female babies born with CAH (congenital

adrenal hyperplasia), who have unusually high levels of androgens and who have enhanced spatial systemizing.

Leaving aside these clinical conditions, evidence exists for the effects of hormones on the mind in the typical child. A Cambridge study found that toddlers who had lower fetal testosterone had higher levels of eye contact. Eye contact may be related to sociability and empathizing. And a group of Canadian researchers found that the higher your prenatal testosterone, the better you do on the Mental Rotation (systemizing) Test.

The E–S theory does not stereotype. Rather, it may help us explain why individuals are typical or atypical for their gender. It also may help us understand the childhood neurological conditions of autism and Asperger Syndrome, which appear to be an extreme of the male brain. Such individuals may have severe impairments in empathizing, yet normal or even talented systemizing.

Earlier studies of psychological gender differences have focused on what is sometimes called "the holy trinity": spatial ability, mathematical ability, and verbal ability. The first two of these are areas where males perform at a higher level, while the last typically shows a female advantage. However, spatial and mathematical abilities involve systemizing and so may simply be further evidence for the E–S theory. Verbal ability may have nothing to do with empathy, in which case it will need to be regarded as an additional dimension along which the sexes differ psychologically. However, good empathizing and good verbal skills both facilitate communication, so verbal and empathy skills may not be truly independent.

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