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—*Calgary Herald*

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—*Washington Post Book World*

“This is an often provocative, compellingly written look at how male and female differences may influence social behavior—both in the mainstream and at the margins—told with a rare combination of wit and insight.”

—Deborah Blum, author of *Love at Goon Park: Harry Harlow and the Science of Affection* and *Sex on the Brain*

THE ESSENTIAL DIFFERENCE

Male and Female Brains
and the Truth About Autism

SIMON BARON-COHEN



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In memory of
Robert Greenblatt
(1906–1987)
(Augusta Georgia Medical School)
who combined endocrinology with humanity

and

Donald Cohen
(1940–2001)
(Yale Child Study Center)
who studied autism and cared for children in need

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I first wrote about the extreme male brain theory of autism in 1997.¹ I didn't dare present the ideas in public until Cure Autism Now organized a scientific meeting at Rutgers University in March 2000. They encouraged their invited speakers, of whom I was one, to present their most provocative ideas. To my surprise, the conference participants did not simply smile politely at my theory, but engaged with it and encouraged me to pursue it. In March 2001 I presented it to the Institutes of Psychiatry and Cognitive Neuroscience in London. The positive reactions I received there, particularly from Uta Frith, encouraged me further to believe that these ideas were ready for a wider audience. Similar reactions at Autism India in Chennai (January 2001) and at the Autism Conference in Madrid (May 2001) gave me the sense that the psychological sex differences in question are universal.² Feedback from other such presentations, such as the Child Psychiatry teaching program in Pristina, Kosovo (May 2002), and the Child Psychiatry Conference in Rome (June 2002), resulted in a brief paper to the cognitive science community on this topic.³ This book expands these early communications for a broader readership.

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1

The Male and Female Brain

The subject of essential sex differences in the mind is clearly very delicate. I could tiptoe around it, but my guess is that you would like the theory of the book stated plainly. So here it is:

The female brain is predominantly hard-wired for empathy. The male brain is predominantly hard-wired for understanding and building systems.

I hope to persuade you in the rest of this book that this theory has growing support.

Even on page one, however, I can imagine that some readers are alarmed. Will this theory provide grist for those reactionaries who might wish to defend existing inequalities in opportunities for men and women in society? The nervousness of those readers might not dissipate until they are persuaded that this theory can be used progressively. Equally, I can imagine that some readers may be willing to go halfway down the track with me, willing to explore the once-taboo idea that there are sex differences in the mind. Yet, as we discover the ultimate causes of such sex differences, these readers may find things that they would prefer not to see. Some might hope that these sex differences are solely due to experience; but what if they also reflect inborn biological factors? Moreover, if there are indeed fundamental sex differences in the mind, are these differences modifiable? Or should any differences be celebrated, rather than feared?

I will explore issues such as these in the following chapters. But first, let me expand on the two central claims of the theory.

The Female Brain: Empathizing

Empathizing is the drive to identify another person's emotions and thoughts, and to respond to them with an appropriate emotion. Empathizing does not entail just the cold calculation of what someone else thinks and feels (or what is sometimes called mind reading). Psychopaths can do that much. Empathizing occurs when we feel an appropriate emotional reaction, an emotion *triggered by* the other person's emotion, and it is done in order to understand another person, to predict their behavior, and to connect or resonate with them emotionally.

Imagine if you could recognize that Jane is in pain but this left you cold, or detached, or happy, or preoccupied. That would not be empathizing. Now imagine you not only see Jane's pain, but you also automatically feel concern, wince, and feel a desire to run across and help alleviate her pain. This is empathizing. And empathizing extends to recognizing, and responding to, any emotion or state of mind, not just the more obvious ones such as pain. Empathy arises out of a natural desire to *care* about others. Where this desire springs from is a matter of some debate, and one I postpone until Chapters 7 and 8.

In this book I will consider the evidence that, on average, females spontaneously empathize to a greater degree than do males. Note that I am not talking about all females: just about the average female, compared to the average male. Empathy is a skill (or a set of skills). As with any other skill, such as athleticism, or mathematical or musical ability, we all vary in it. In the same way that we can think about why someone is talented, average or even disabled in these other areas, so we can think about individual differences in empathy. We can even think of empathy as a trait, such as height, since that is also something in which we all differ. And in the same way that you can measure someone's height, so you can measure differences in empathizing between individuals. In Chapter 4 I will look at a number of methods used for measuring these differences.

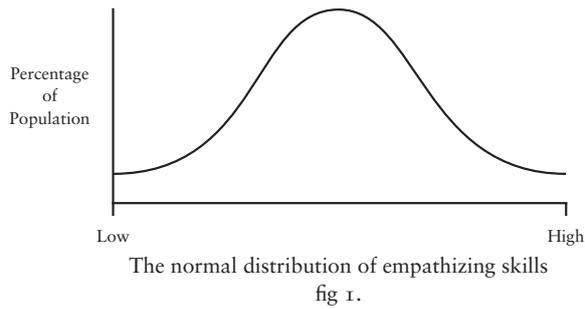
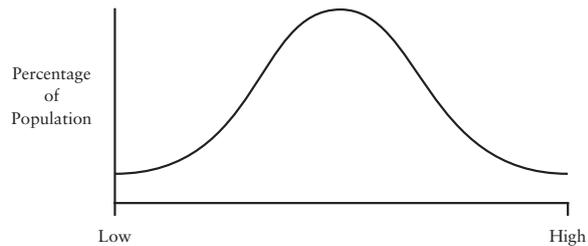


Figure 1 shows you this idea visually. Most people fall in the center of the range. But the tails of this bell curve show that some people may have significantly less empathy than others (those at the left-hand tail of the distribution), while those at the right-hand tail may be blessed in this regard. We will discover whether females really are blessed with the brain **type E** (for empathizing) as we go deeper along the trail.

The Male Brain: Systemizing

Systemizing is the drive to analyze, explore, and construct a system. The systemizer intuitively figures out how things work, or extracts the underlying rules that govern the behavior of a system. This is done in order to understand and predict the system, or to invent a new one.

Systems can be as varied as a pond, a vehicle, a plant, a library catalog, a musical composition, a cricket bowl, or even an army unit. They all operate on inputs and deliver outputs, using “if-then” correlational rules. A simple example is a light dimmer. Imagine the light is the input. If you rotate the dimmer clockwise a little (operation), then the bulb on the ceiling gets brighter (output 1). If you rotate it further, the bulb gets even brighter (output 2). “If-then” correlational rules allow you to predict the behavior of most inanimate systems. By monitoring the input, operation, and output you can discover what makes the system work more or less efficiently, and the range of things it can do. Just as empathizing is powerful enough to



The normal distribution of systemizing skills
fig 2.

cope with the hundreds of emotions that exist, so systemizing is a process that can cope with an enormous number of systems.

I will argue that, on average, males spontaneously systemize to a greater degree than do females. Again, note that I did not say “all males.” I am only talking about statistical averages, and we can learn from the exceptions to this rule, too. But for now, let’s call the male brain **type S** (for systemizing).

Just as we introduced the notion that in the population we all differ in how much empathy we have, so there are individual differences in our ability to systemize. Most of us fall in the center of the graph in Figure 2, but a few lucky individuals fall in the extreme right-hand end. Others find systems (like car engines, computers, science, math, or engineering) really puzzling, and they are at the other end—the left-hand tail—of the distribution. We will see later on if it really is the case that males (on average) are higher up the scale on measures of systemizing.

Systemizing Versus Empathizing

Is it possible to systemize a person? Systemizing works very well if you are trying to understand a system within a person, such as their ovaries. You can discover, for example, that among twenty-year-old pregnant women, one in ten will have a miscarriage, while among thirty-five-year-old pregnant women, the rate has risen to one in five. At the age of forty, one in three will have a miscarriage, and just two years later, at forty-two, nine out of ten women will miscarry. In this example, I have systemized a woman’s

fertility, in other words, I have treated it as a system that is lawful. The input is the woman's ovaries, the operation is the increase in a woman's age, and the output is a woman's risk of miscarriage.

Systemizing can also work to a useful degree if you are trying to understand a human group as a system, such as the pattern of traffic accidents on a particular freeway or patterns of voting behavior; hence the term traffic "system" or electoral "system." These systems, like any other, can be lawful, finite, and deterministic.

However, systemizing gets you almost nowhere in most day-to-day social interaction. Some philosophers suggest our everyday understanding of people (our "folk psychology") is rule-based, containing such if-then rules or generalizations as "if someone has a hard day, then they will be grumpy." Yet our behavior and emotions are not governed by rules to any useful degree. How do you explain that some people feel great after a hard day? Furthermore, the kinds of rules you can extract are of almost no use when it comes to making sense of, or predicting, the *moment-by-moment* changes in a person's behavior. Consider the rule "if people get what they want, they will be happy." Say that you followed the rule and gave Julia what she said she wanted for her birthday; why is she *still* not happy? Systemizing just cannot get a foothold into things like a person's fluctuating feelings.

While the natural way to understand and predict the nature of events and objects is to systemize, the natural way to understand a person is to empathize. Let's try empathizing Julia in our last example. Although it was her birthday and she got the present she wanted, it was also the week she was expecting news about her hospital test. Perhaps it wasn't good news. Maybe you should have asked her how she was, and tuned into her feelings, her mental world. Simple laws of how people will behave are next to useless even in this apparently simple interaction.

As you can see, systemizing and empathizing are wholly different kinds of processes. You use one process—empathizing—for making sense of an individual's behavior, and you use the other—systemizing—for predicting almost everything else. To systemize you need detachment in order to monitor information and track which factors cause information to vary. To empathize you need some degree of attachment in order to recognize that you are interacting with a person, not an object, but a person with feelings, and whose feelings affect your own.

Ultimately, systemizing and empathizing depend on independent sets of regions in the human brain. They are not mystical processes but are grounded in our neurophysiology.

The Main Brain Types

In 1987 Vancouver psychologist Doreen Kimura asked the question, “Are men’s and women’s brains really different?” She continued, “It would be amazing if men’s and women’s brains were not different, given the gross morphological and often striking behavioral differences between women and men.”¹ Kimura is a good example of traditional researchers in this area who have emphasized two different dimensions in defining the male and female brain: language (female superiority) and spatial ability (male superiority). I do not deny the importance of language and spatial ability in defining sex differences, but I do believe that two neglected dimensions are empathizing and systemizing. Moreover, language superiority in women may exist because of their stronger empathizing ability, and good spatial ability in men may be just one instance of their stronger systemizing. But more of that later.

We all have both systemizing and empathizing skills. The question is: How much of each have you got? When it comes to measurement, you need good rulers or tests for each of these domains of skill. Later in the book, you will come across two of our tests: the Systemizing Quotient (SQ) and the Empathy Quotient (EQ). The difference between someone who scores higher than someone else on one of these measures is important, and we will look at such differences. But for now, one can envision three types of brain immediately. Think of these as three broad bands of individuals:

- Individuals in whom empathizing is stronger (more developed) than systemizing. For shorthand, $E > S$ (where $>$ means “greater than”). This is what I will call the female brain, or a brain of type E.
- Individuals in whom systemizing is stronger than empathizing. For shorthand, $S > E$. This is what I will call the male brain, or a brain of type S.
- Individuals in whom systemizing and empathizing are both equally strong. For shorthand, $S = E$. This is what I will call the balanced brain, or a brain of type B.

Which are you? Type E, type S, or type B? You can guess for now, but this is not about how you would like to see yourself. It's about how you actually score on different measures of these skills. We might all fantasize or delude ourselves that we are fit and strong, and can run fast enough to catch a bus. But when you are actually put to the test, how do you make out?

Let us now imagine two less common types of brain:

1. Individuals with the extreme male brain, that is, those who are extreme type S. For shorthand, $S \gg E$. (The double-arrow symbol means there is a very large difference between skills in the two areas.) In their case, systemizing is normal or even hyper-developed, while empathizing is hypo-developed. In other words, these individuals may be talented systemizers but at the same time they may be "mindblind."² In Chapter 10 I will look at individuals on the autistic spectrum to see if they fit the profile of the extreme male brain.
2. Individuals with the extreme female brain, that is, those who are an extreme of type E. For shorthand, $E \gg S$. These people have normal or even hyper-developed empathizing skills, while their systemizing is hypo-developed. In other words, these individuals may be wonderful empathizers, accurately tuning into the minds of others with amazing rapidity, but at the same time they may be "systemblind." In Chapter 12 I will ask if an extreme of the female brain really exists and, if so, whether this psychological profile leads to any particular difficulties.

Let me stick with the idea of autism as an extreme of the male brain for a moment, while I give you a taster of who you will meet later on our journey. Imagine a person who is so good at systemizing that they notice the same names of cameramen appearing in the credits of different television films. How are they keeping track of so much information in the small print on television? Or imagine a person who is so good at systemizing that they can tell you that if March 22 is a Tuesday, then so will November 22 be. How have they managed to figure out the rules governing calendars to this extraordinary degree of detail? But now imagine that these super-systemizers have major difficulties in empathizing. They may not understand that just because *they* regard someone as their friend, it

may not be mutual. Or they may not realize that their wife is upset unless she is actually crying.

Your Sex Does Not Dictate Your Brain Type

Let's say that I can see you right now. Naturally, just by looking at you, even just at your face, I can tell whether you are male or female. I do not for a moment assume that knowing your sex will tell me anything about which type of brain you, as an individual, have.

The evidence I will review suggests that not all men have the male brain, and not all women have the female brain. In fact, some women have the male brain, and some men have the female brain. The central claim of this book is only that *more* males than females have a brain of type S, and *more* females than males have a brain of type E.

So it should be some reassurance to you if you are male and going for a job interview in the caring professions, or if you are female and going for a job interview in the technical professions, that your interviewer should assume nothing about your skills for these jobs from your sex alone. I, for example, am male, but would be totally unsuited to a job in technical support for any kind of system (computers or otherwise). I was drawn to the helping profession of clinical psychology—a female-dominated world. I rely on a wonderful woman called Traci at Trinity College for advice on how to fix my computer. And I rely on two top women scientists, Svetlana and Rebecca, for advice on how to understand the biochemistry of hormones. (I'll introduce you to Svetlana and Rebecca properly in Chapter 8, as they both have interesting stories to share.)

When I talk about sex differences in the mind, I am dealing only with statistical averages. And if there is one point to get across at the outset, it is this: looking for sex differences is not the same as stereotyping. The search for sex differences enables us to discover how social and biological influences act on the two sexes in different ways, but it does not tell us about individuals. If we find that, on average, men are taller, heavier, stronger, faster, hairier, have larger heads and longer forearms than women, it does not mean that we won't find some women who are exceptions to these norms. (My grandfather's brother, the endocrinologist Robert Greenblatt,

documented some striking examples of such exceptions in his writings.³) Stereotyping, in contrast, judges individuals according to a set of assumptions about a group, and is pernicious. We recognize it as such in the context of racism, sexism, ageism, and classism, and for good reasons. Stereotyping reduces individuals to an average, whereas science recognizes that many people fall outside the average range for their group.

Mars and Venus

Some books on sex differences take a rather light-hearted approach. Although it may make amusing reading, it is not helpful scientifically to imagine that “men are from Mars and women are from Venus.” For one thing, the joke about our coming from two different planets distracts us from the serious fact that both sexes have evolved on the same planet and yet tend to display differences in the way we think. We need to know why this is, and in Chapter 9 I look at the possibility that the two sexes’ minds evolved to be adapted to different niches as a result of different evolutionary pressures. Moreover, the view that men are from Mars and women Venus paints the differences between the two sexes as too extreme. The two sexes are different, but are not *so* different that we cannot understand each other.⁴

There is a further reason why I think a serious book on this topic is needed. Humor is important, and satire has its place, but light-hearted jibing at the opposite sex can easily spill over into sexism. For example, recently on British television I heard the following joke by a female talk-show host: “Women are from Venus, men are dumb.” A few women in the audience laughed. Her female co-presenter then asked, “Do we really need men? What use are they?” To which the first presenter replied, “I’ve heard men are trainable and can make good house pets.” In some ways, this sort of sexist abuse of men by women is astonishing, and would never be tolerated if the subject of the joke was a woman, or was black, Jewish, or gay. Later that day, my teenage son showed me a book he was reading. The book fell open to a page containing the following joke: “Why did God create women? Because dogs can’t open the fridge to get the beer.” Such sexist humor is deplorable, and when we hear women producing it against men, it comes across as the humor of the victim-turned-victimizer. It is not that I think

that the topic of sex differences can't be the focus of humor, but I do think it is important that we do not repeat old forms of oppression in a new guise.

The Politics of Studying Sex Differences

Responsible scientists in this field are careful not to perpetuate the mistaken attitudes of former generations by assuming that sex differences imply that one sex is inferior overall. At the beginning of the twentieth century Gustav Le Bon made the mistake of concluding that female inferiority “was so obvious that no one can contest it for a minute.”⁵ One hundred years later, it is easy to contest Le Bon's position. Psychological sex differences are often (though not always) found, yet there are some domains in which women excel compared to men and other domains in which men excel compared to women. *Overall* intelligence is not better in one sex or the other, but the profiles (reflecting relative strengths in specific domains) are *different* between the two sexes. I am investigating the claim that women are better at empathizing and men are better at systemizing, but that this does not mean that one sex is more intelligent overall.

In earlier decades the very idea of psychological sex differences would have triggered a public outcry. The 1960s and 70s saw an ideology that dismissed psychological sex differences as either mythical, or if real, non-essential—that is, not a reflection of any deep differences between the sexes *per se*, but a reflection of different cultural forces acting on the sexes. But the accumulation of evidence from independent laboratories over many decades persuades me that there are essential differences that need to be addressed. The old idea that these might be wholly cultural in origin is nowadays too simplistic.

We must be wary, of course, of assuming that sex differences are only due to biology. To do this would be to commit the opposite error to that seen in the 1960s when it was frequently assumed that all sex differences reflected socialization. Like some people reading this book, I would like to believe that, deep down, men and women's minds do not differ in essence. That would be a very satisfying truth. It would mean that all those centuries of inequality between the sexes that the world has witnessed—inequalities that continue today—could in principle be swept away by fairer

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