Can We Finally Stop Talking About ‘Male’ and ‘Female’ Brains?

Recent research is making it clearer than ever that the notion that sex determines the fundamentals of brain structure and behavior is a misconception.

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In 17th and 18th century Europe, the rise of egalitarian ideals created the need for a scientific account of women’s inferior status. Thus was born gender biological complementarity — the notion that, as historian of science Londa Schiebinger explains in The Mind Has No Sex, “Women were not to be viewed merely as inferior to men but as fundamentally different from, and thus incomparable to, men.” It has been with us in one way or another, roping in science to explain the gender status quo, ever since.

At its core is the persistent belief that men’s and women’s natures can be usefully and meaningfully carved into two categories or “natural kinds,” that are distinct, timeless, and deeply biologically grounded. Today’s version of this idea continues a centuries long quest to find the source of this hypothesized divergence in abilities, preferences, and behavior in the brain: You can find this notion at work, for instance, in popular books like John Gray’s “Men Are from Mars, Women Are from Venus” in the 1990s, Louann Brizendine’s “The Female Brain” and “The Male Brain” the following decade, and last year’s “Results at the Top: Using Gender Intelligence to Create Breakthrough Growth” by Barbara Annis and Richard Nesbitt.

But a version of the same assumption is also sometimes subtly present in scientific research. Consider, for example, Cambridge University psychologist Simon Baron-Cohen’s influential Empathizing-Systemizing theory of brains and the accompanying “extreme male brain” theory of autism. This presupposes there is a particular “systemizing” brain type that we could meaningfully describe as “the male brain,” that drives ways of thinking, feeling, and behaving that distinguish the typical boy and man from the typical “empathizing” girl and woman.

Or consider studies that report sex differences in brain structure in terms of two different classes of brains. Thus, a globally publicized study by Madhura Ingalhalikar and colleagues on the human connectome — that is, the enormous set of connections between the different regions of the brain — which concluded that “male brains are structured to facilitate connectivity between perception and coordinated action, whereas female brains are designed to facilitate communication between analytical and intuitive processing modes.”

The problem with these approaches is the implicit assumption that sex differences, whether in brain structure, function, or behavior, ‘add up’ consistently in individuals to create “male brains" and “female brains,” and “male natures” and “female natures.”

In 2015, one of us, Daphna Joel, led an analysis of four large data sets of brain scans, and found that the sex differences you see overall between men’s and women’s brains aren’t neatly and consistently seen in individual brains. In other words, humans generally don’t have brains with

mostly or exclusively “female-typical” features or “male-typical” features. Instead, what’s most common in both females and males are brains with “mosaics” of features, some of them more common in males and some more common in females.

Daphna Joel and colleagues then applied the same kind of analysis to large data sets of psychological variables, to ask: Do sex differences in personality characteristics, attitudes, preferences, and behaviors add up in a consistent way to create two types of humans, each with its own set of psychological features? The answer, again, was no: As for brain structure, the differences created mosaics of feminine and masculine personality traits, attitudes, interests, and behaviors. For example, in the data set on 4,860 adolescents from the National Longitudinal Study of Adolescent Health, the variables on which young women and men differed the most included worry about weight, depression, delinquency, impulsivity, gambling, involvement in housework, engagement in sports, and a femininity score. So far, so gender normative. But: Not a single person had only feminine or only masculine scores on these variables. Rather, what was typical of both men and women (70 percent of them, to be exact) was a mosaic of feminine and masculine characteristics.

And in October this year, an analysis from the same lab of more than 2,100 human brains, using algorithms that group together mathematically similar brains into clusters or “types,” demonstrated that the brain “types” typical of females are also typical of males, and vice versa. Large sex differences were found only in the prevalence of some uncommon brain “types.”

In this conceptualization, if autism is indeed more prevalent in males, this may be associated with a difference between the sexes in the odds that a rare combination of brain characteristics makes an appearance, rather than with the typical male brain being a little more “autistic" than the typical female brain. Indeed, a recent study found that males with autism spectrum disorder had an atypical combination of “female-like” and “male-like” brain activity patterns.

The key point here is that although there are sex differences in brain and behavior, when you move away from group-level differences in single features and focus at the level of the individual brain or person, you find that the differences, regardless of their origins, usually “mix up” rather than “add up.” (The reason for this mixing-up of characteristics is that the genetic and hormonal effects of sex on brain and behavior depend on, and interact with, many other factors.) This yields many types of brain and behavior, which neither fall into a “male” and a “female” type, nor line up tidily along a male-female continuum. Even when you home in on only two psychological characteristics, people don’t fall in line on a continuum from, say, extreme systemizer or “things-oriented” — supposedly the “male” pole — to extreme empathizer or “people-oriented”— the “female” pole. Rather, as recent studies have shown, people’s self-reported tendency to empathize tells you almost nothing about their self-reported tendency to systemize, and people may be highly oriented toward both things and people, to mainly one of these, or to neither.

The notion of fundamentally female and male brains or natures is a misconception. Brains and behavior are the product of the combined, continuous interactions of innumerable causal influences, that include, but go well beyond, sex-linked factors.

The claim that science tells us that the possibility of greater merging of gender roles is unlikely because of "natural" differences between the sexes, focuses on average sex differences in the population — often in combination with the implicit assumption that whatever we think men are "more" of, is what is most valuable for male-dominated roles. (Why else would organizations offer confidence workshops for women, rather than modesty training for men?) But the world is inhabited by individuals whose unique mosaics of characteristics can't be predicted on the basis of their sex. So let's keep working on overcoming gender stereotypes, bias, discrimination, and structural barriers before concluding that sex, despite being a poor guide to our brains and psychological characteristics, is a strong determinant of social structure.