Sometimes two such nonoverlapping groups occur. As scientist Robert M. Sapolsky has observed, if you take two groups of anthrax victims, only one group of which has been treated with antibiotics, there will be no overlap in survival rates at all: The untreated victims will die within forty-eight hours. Period. This is an example of what Sapolsky calls a "powerful fact": By knowing which group an anthrax victim is in—treated or untreated—you will be able to predict with absolute certainty whether he or she will die of the disease.26

But when we get into the realm of abilities and qualities—such as doing well in math, the likelihood of roaring at the children, having a sense of humor, needing friends and family, being able to love, or being able to pack a suitcase—the overlap between men and women is always far greater than the difference, if any. Sapolsky plotted the actual results of a famous study that claimed to find clear evidence of a male superiority in math among junior high school students, and the result looked like this:

![Graph showing distribution of math scores for female and male students.]

"Anyone who can look at the graph," Sapolsky says, "and claim that it provides any predictiveness about how an individual boy or girl will do in math either has an ideological axe to grind or his own ability to reason mathematically is severely impaired." Moreover, if the small percentage of males who are math prodigies is removed from this sample, the distribution of scores for males and females is identical.

Thus, male "superiority" in math is an example of a "fact" that is not powerful at all, because it does not help us predict how an individual boy or girl, man or woman, will do. "Yet how many people ever see the data this way?" Sapolsky asks. "In most branches of science, reporting a difference with this little predictiveness would get you laughed out of the business. . . . Of the teachers, administrators, parents, and guidance counselors who believe that science has shown that boys are better at math than girls, how many know the predictiveness of this fact?"27

Suppose, therefore, that we move away from the narrow and limited question of "Do men and women differ, and if so, who's better?" and ask instead: Why is everyone so interested in differences? Why are differences regarded as deficiencies? What functions does the belief in differences serve? The answers begin to emerge in the following story from the halls of science, where we can see how even "pure" biological research is besmirched by the dusty fingerprints of those who conduct it.

- **Brain: Dissecting the differences**

It must be stated boldly that conceptual thought is exclusive to the masculine intellect . . . [but] it is no deprecation of a woman to state that she is more sensitive in her emotions and less ruled by her intellect. We are merely stating a difference, a difference which equips her for the special part for which she was cast . . . Her skull is also smaller than man's; and so, of course, is her brain.28

—T. Lang, *The Difference Between a Man and a Woman*

In recent years the sexiest body part, far and away, has become the brain. Magazines with cover stories on the brain fly off the newsstands, and countless seminars, tapes, books, and classes teach people how to use "all" of their brains. New technologies, such as PET scans, produce gorgeous photographs of the brain at work and play. Weekly we hear new discoveries about this miraculous organ, and it seems that scientists will soon be able to pinpoint the very neuron, the very neurotransmitter, responsible for joy, sadness, rage, and suffering. At last we will know the reasons for all the differences between women and men that fascinate and infuriate, such as why men won't stop to ask directions and why women won't stop asking men what they are feeling.
In all this excitement, it seems curmudgeonly to sound words of caution, but the history of brain research does not exactly reveal a noble and impartial quest for truth, particularly on sensitive matters such as sex and race differences. Typically, when scientists haven't found the differences they were seeking, they haven't abandoned the goal or their belief that such differences exist; they just moved to another part of the anatomy or a different corner of the brain.

A century ago, for example, scientists tried to prove that women had smaller brains than men did, which accounted for women's alleged intellectual failings and emotional weaknesses. Dozens of studies purported to show that men had larger brains, making them smarter than women. When scientists realized that men's greater height and weight offset their brain-size advantage, however, they dropped this line of research like a shot. The scientists next tried to argue that women had smaller frontal lobes and larger parietal lobes than men did, another brain pattern thought to account for women's intellectual inferiority. Then it was reported that the parietal lobes might be associated with intellect. Panic in the labs—until anatomists suddenly found that women's parietal lobes were smaller than they had originally believed. Wherever they looked, scientists conveniently found evidence of female inferiority, as Gustave Le Bon, a Parisian, wrote in 1879:

In the most intelligent races, as among the Parisians, there are a large number of women whose brains are smaller in size to those of gorillas than to the most developed male brains. This inferiority is so obvious that no one can contest it for a moment; only its degree is worth discussion.¹⁹

We look back with amusement at the obvious biases of research a century ago, research designed to prove the obvious inferiority of women and minorities (and non-Parisians). Today, many researchers are splitting brains instead of weighing them, but they are no less determined to find sex differences. Nevertheless, skeptical neuropsychologists are showing that biases and values are just as embedded in current research—old prejudices in new technologies.

The brain, like a walnut, consists of two hemispheres of equal size, connected by a bundle of fibers called the corpus callosum. The left hemisphere has been associated with verbal and reasoning ability, whereas the right hemisphere is associated with spatial reasoning and artistic ability. Yet by the time these findings reached the public, they had been vastly oversimplified and diluted. Even the great neuroscientist Roger Sperry, the grandfather of hemispheric research, felt obliged to warn that the “left-right dichotomy . . . is an idea with which it is very easy to run wild.”³⁰ And many people have run wild with it: Stores are filled with manuals, cassettes, and handbooks that promise to help people become fluent in “whole-brain thinking,” to beef up the unused part of their right brain, and to learn to use the intuitive right brain for business, painting, and inventing.

The fact that the brain consists of two hemispheres, each characterized by different specialties, provides a neat analogy to the fact that human beings consist of two genders, each characterized by different specialties. The analogy is so tempting that scientists keep trying to show that it is grounded in physical reality. Modern theories of gender and the brain are based on the idea that the left and right hemispheres develop differently in boys and girls, as does the corpus callosum that links the halves of the brain.

According to one major theory, the male brain is more “lateralized,” that is, its hemispheres are specialized in their abilities whereas females use both hemispheres more symmetrically because their corpus callosum is allegedly larger and contains more fibers. Two eminent scientists, Norman Geschwind and Peter Behan, maintained that this sex difference begins in the womb, when the male fetus begins to secrete testosterone—the hormone that will further its physical development as a male. Geschwind and Behan argued that testosterone in male fetuses washes over the brain, selectively attacking parts of the left hemisphere, briefly slowing its development, and producing right-hemisphere dominance in men. Geschwind speculated that the effects of testosterone on the prenatal brain produce “superior right hemisphere talents, such as artistic, musical, or mathematical talent.”³¹

Right-hemisphere dominance is also thought to explain men's excellence in some tests of “visual-spatial ability”—the ability to imagine objects in three-dimensional space (the skill you need for mastering geometry, concocting football formations, and reading maps). This is apparently the reason that some men won't stop and...
ask directions when they are lost; they prefer to rely on their right brains, whereas women prefer to rely on a local informant. It is also supposed to be the reason that men can’t talk about their feelings and would rather watch television or wax the car. Women have interconnected hemispheres, which explains why they excel in talk, feelings, intuition, and quick judgments. Geschwind and Behan’s theory had tremendous scientific appeal, and it is cited frequently in research papers and textbooks. Science hailed it with the headline “Math Genius May Have Hormonal Basis.”

The theory also has had enormous popular appeal. It fits snugly, for example, with the Christian fundamentalist belief that men and women are innately different and thus innately designed for different roles. For his radio show “Focus on the Family,” James Dobson interviewed Donald Joy, a professor of “human development in Christian education” at Asbury Theological Seminary, who explained Geschwind and Behan’s theory this way:

JOY: . . . this marvelous female brain, is a brain that’s not damaged during fetal development as the male brain is, but the damage gives a specialization to the male brain which we don’t get in the female.

DOBSON: I want to pick up on that concept of us brain-damaged males. [laughter, chuckling]

JOY: . . . It’s giving a chemical bath to the left hemisphere and this connecting link between the two hemispheres that reduced the size and number of transmission passages that exist here . . . So males simply can’t talk to themselves across the hemispheres in a way that a woman does.

DOBSON: So some of the sex differences that we see in personality can be tracked back to that moment.

JOY: Oh, absolutely. And when we’re talking about this now, we’re talking about a glorious phenomenon because these are intrinsic sex differences . . . this is glorious because we are fearfully and wonderfully differentiated from each other.

DOBSON: Let’s look at ’em, name ’em.

JOY: We’re, we’re mutually interdependent. Every household needs both a male brain and a female brain, for example. The woman’s brain works much like a computer . . . lateral trans-

mission in her brain allows her to consult all of her past experience and give you an instant response. She can make a judgment more quickly than a male can. . . . [but how she arrives at it] hidden even from her, because it is like a computer, all it gives is the answer, it doesn’t give you the process.

The male brain, Joy added, is more like an “adding machine,” in which facts are totaled and a logical solution presents itself. So males are good at logical reasoning, and females at intuitive judgments, because of the prenatal “chemical bath” that affects the male brain.

The same explanation and language—down to the same joke that men are “brain-damaged”—turns up in a book by two Christian fundamentalists, The Language of Love, published by Dobson’s organization. The authors, Gary Smalley and John Trent, write:

Specifically, medical studies have shown that between the eighteenth and twenty-sixth week of pregnancy, something happens that forever separates the sexes . . . researchers have actually observed a chemical bath of testosterone and other sex-related hormones wash over a baby boy’s brain. This causes changes that never happen to the brain of a baby girl . . . The sex-related hormones and chemicals that flood a baby boy’s brain cause the right side to recede slightly, destroying some of the connecting fibers [sic: the authors have it backward; the theory actually says that the left side is affected]. One result is that, in most cases, a boy starts life more left-brain oriented [sic]. Because little girls don’t experience this chemical bath, they leave the starting blocks much more two-sided in their thinking . . .

Now wait a minute, you may be thinking. Does this mean that men are basically brain-damaged?

Well, not exactly. What occurs in the womb merely sets the stage for men and women to “specialize” in two different ways of thinking. And this is one major reason men and women need each other so much. (Emphases in original.)

Now it may be true that men and women, on the average, differ in the physiology of their brains. It may even be true that this
most women spend the majority of their days and nights camped out on the right side of the brain [which] harbors the center for feelings, as well as the primary relational, language, and communication skills... and makes an afternoon devoted to art and fine music actually enjoyable.\textsuperscript{17}

You can hear the chuckling from men who regard art museums and concert halls as something akin to medieval torture chambers, but I'm sure that the many men who enjoy art and fine music, indeed, who create art and fine music, would not find that last remark so funny. Geschwind and Behan, of course, had argued that male specialization of the right hemisphere explained why men excel in art and fine music. But since Smalley and Trent apparently do not share these prissy female interests, they relegate them to women—to women's brains.

The two hemispheres of the brain do have different specialties, but it is far too simple-minded (so to speak) to assume that human abilities clump up in opposing bunches. Most brain researchers today believe that the two hemispheres complement one another, to the extent that one side can sometimes take over the functions of the side that has been damaged. Moreover, specific skills often involve components from both hemispheres: one side has the ability to tell a joke, and the other has the ability to laugh at one. Math abilities include both visual-spatial skills and reasoning skills. The right hemisphere is involved in creating art, but the left hemisphere is involved in appreciating and analyzing art. As neuropsychologist Jerre Levy once said, "Could the eons of human evolution have left half of the brain witless? Could a bird whose existence is dependent on flying have evolved only a single wing?"\textsuperscript{38}

These qualifications about the interdependence of brain hemispheres have not, however, deterred those who believe that there are basic psychological differences between the sexes that can be accounted for in the brain. So let's consider their argument more closely.

The neuroscientist Ruth Bleier, who at her untimely death was Professor of Neurophysiology at the University of Wisconsin, carefully examined Geschwind and Behan's data, going back to many of their original references.\textsuperscript{39} In one such study of 507 fetal brains of 10 to 44 weeks gestation, the researchers had actually stated that...
they found no significant sex differences in these brains. If testosterone had an effect on the developing brain, it would surely have been apparent in this large sample. Yet Geschwind and Behan cited this study for other purposes and utterly ignored its findings of no sex differences.

Instead, Geschwind and Behan cited as evidence for their hypothesis a study of rats' brains. The authors of the rat study reported that in male rats, two areas of the cortex that are believed to be involved in processing visual information were 3 percent thicker on the right side than on the left. In one of the better examples of academic gobbledygook yet to reach the printed page, the researchers interpreted their findings to mean that "in the male rat it is necessary to have greater spatial orientation to interact with a female rat during estrus and to integrate that input into a meaningful output." Translation: When having sex with a female, the male needs to be able to look around in case a dangerous predator, such as her husband, walks in on them.

Bleier found more holes in this argument than in a screen door. No one knows, she said, what the slightly greater thickness in the male rat's cortex means for the rat, let alone what it means for human beings. There is at present no evidence that spatial orientation is related to asymmetry of the cortex, or that female rats have a lesser or deficient ability in this regard. And although Geschwind and Behan unabashedly used their limited findings to account for male "superiority" in math and art, they did not specifically study the incidence of genius, talent, or even modest giftedness in their sample, nor did they demonstrate a difference between the brains of geniuses and the brains of average people.

Bleier wrote to Science, offering a scholarly paper detailing these criticisms. Science did not publish it, on the grounds, as one reviewer put it, that Bleier "tends to err in the opposite direction from the researchers whose results and conclusions she criticizes" and because "she argues very strongly for the predominant role of environmental influences." Apparently, said Bleier, one is allowed to err in only one direction if one wants to be published in Science. The journal did not even publish her critical Letter to the Editor.

At about the same time, however, Science saw fit to publish a study by two researchers who claimed to have found solid evidence of gender differences in the splenium (posterior end) of the corpus callosum. In particular, they said, the splenium was larger and more bulbous in the five female brains than in the nine male brains they examined, which had been obtained at autopsy. The researchers speculated that "the female brain is less well lateralized—that is, manifests less hemispheric specialization—than the male brain for visuospatial functions." Notice the language: The female brain is less specialized than, and by implication inferior to, the male brain. They did not say, as they might have, that the female brain was more integrated than the male's. The male brain is the norm, and specialization, in the brain as in academia, is considered a good thing.

Generalists in any business are out of favor these days.

This article, which also met professional acclamation, had a number of major flaws that, had they been part of any other research paper, would have been fatal to its publication. The study was based on a small sample of only fourteen brains. The researchers did not describe their methods of selecting the brains in that sample, so it is possible that some of the brains were diseased or otherwise abnormal. The article contained numerous unsupported assumptions and leaps of faith. For example, there is at present absolutely no evidence that the number of fibers in the corpus callosum is even related to hemispheric specialization. Indeed, no one knows what role, if any, the callosum plays in determining a person's mental abilities. Most damaging of all, the sex differences that the researchers claimed to have found in the size of the corpus callosum were not statistically significant, according to the scientific conventions for accepting an article for publication.

Bleier again wrote to Science, delineating these criticisms and also citing four subsequent studies, by her and by others, that independently failed to find gender differences of any kind in the corpus callosum. Science failed to publish this criticism, as it has failed to publish all studies that find no gender differences in the brain.

Ultimately, the most damning blow to all of these brain-hemisphere theories is that the formerly significant sex differences that brain theories are attempting to account for—in verbal, spatial, and math abilities—are fading rapidly. Let's start with the famed female superiority in verbal ability. Janet Hyde, a professor of psychology at the University of Wisconsin, and her colleague Marcia Linn re-
viewed 165 studies of verbal ability (including skills in vocabulary, writing, anagrams, and reading comprehension), which represented tests of 1,418,899 people. Hyde and Linn reported that at present in America, there simply are no gender differences in these verbal skills. They noted: "Thus our research pulls out one of the two wobbly legs on which the brain lateralization theories have rested." 45

Hyde recently went on to kick the other leg, the assumption of overall male superiority in mathematics and spatial ability. No one disputes that males do surpass females at the highly gifted end of the math spectrum. But when Hyde and her colleagues analyzed 100 studies of mathematics performance, representing the testing of 3,985,682 students, they found that gender differences were smallest and favored females in samples of the general population, and grew larger, favoring males, only in selected samples of precocious individuals. 46

What about spatial abilities, another area thought to reveal a continuing male superiority? When psychologists put the dozens of existing studies on spatial ability into a giant hopper and looked at the overall results, this was what they reported: Many studies show no sex differences. Of the studies that do report sex differences, the magnitude of the difference is often small. And finally, there is greater variation within each sex than between them. As one psychologist who reviewed these studies summarized: "The observed differences are very small, the overlap [between men and women] large, and abundant biological theories are supported with very slender or no evidence." 47

Sometimes scientists and science writers put themselves through contortions in order to reconcile the slim evidence with their belief in sex differences in the brain. The authors of a popular textbook on sexuality, published in 1990, acknowledge that "sex differences in cognitive skills have declined significantly in recent years." Then they add: "Notwithstanding this finding, theories continue to debate why these differences exist." Pardon? Notwithstanding the fact that there are few differences of any magnitude, let's discuss why there are differences? Even more mysteriously, they conclude: "If Ge- schwind's theory is ultimately supported by further research, we will have hard evidence of a biological basis for alleged sex differences in verbal and spatial skills." 48 "Hard evidence" for alleged sex differ-
The answers are no, for three reasons. First, theories of sex differences in the brain cannot account for the complexities of people’s everyday behavior. They cannot explain, for instance, why, if women are better than men in verbal ability, so few women are auctioneers or diplomats, or why, if women have the advantage in making rapid judgments, so few women are air-traffic controllers or umpires. Nor can brain theories explain why abilities and ambitions change when people are given opportunities previously denied to them. Two decades ago, theorists postulated biological limitations that were keeping women out of men’s work like medicine and bartending. When the external barriers to these professions fell, the speed with which women entered them was dizzying. Did everybody’s brain change? Today we would be amused to think that women have a brain-lateralization deficiency that is keeping them out of law school. But we continue to hear about the biological reasons that keep women out of science, math, and politics. For sex differences in cognitive abilities to wax and wane so rapidly, they must be largely a result of education, motivation, and opportunity, not of innate differences between male and female brains.

Second, the meanings of terms like “verbal ability” and “spatial reasoning” keep changing too, depending on who is using them and for what purpose. For example, when conservatives like Dobson speak of women’s verbal abilities, they usually mean women’s interest in and willingness to talk about relationships and feelings. But in studies of total talking time in the workplace, men far exceed women in the talk department. In everyday life, men interrupt women more than vice versa, dominate the conversation, and are more successful at introducing new topics and having their comments remembered in group discussions. What does this mean for judgments of which sex has the better “verbal ability”?

Third, the major key problem with biological theories of sex differences is that they deflect attention from the far more substantial evidence for sex similarity. The finding that men and women are more alike in their abilities and brains than different almost never makes the news. Researchers and the public commit the error of focusing on the small differences—usually of the magnitude of a few percentage points—rather than on the fact that the majority of differences are very small. For example, this is what the author of a scientific paper that has been widely quoted as supporting sex differences in brain hemispheres actually concluded:

Thus, one must not overlook perhaps the most obvious conclusion, which is that basic patterns of male and female brain asymmetry seem to be more similar than they are different.49

Everyone, nevertheless, promptly overlooked it.

The habit of seeing women and men as two opposite categories also leads us to avoid the practical question: How much ability does it take to do well in a particular career? When people hear that men are better than women in spatial ability, many are quick to conclude that perhaps women, with their deficient brains, should not try to become architects or engineers. This reaction is not merely unfortunate; it is cruel to the women who do excel in architectural or engineering ability. The fields of math and science are losing countless capable women because girls keep hearing that women aren’t as good as men in these fields.

None of this means that biology is irrelevant to human behavior. But whenever the news trumpets some version of “biology affects behavior,” it obscures the fact that biology and behavior form a two-way street. Hormones affect sexual drive, for instance, but sexual activity affects hormone levels. An active brain seeks a stimulating environment, but living in a stimulating environment literally changes and enriches the brain. Fatigue and boredom cause poor performance on the job, but stultifying job conditions produce fatigue and boredom. Scientists and writers who reduce our personalities, problems, and abilities to biology thereby tell only half the story, and miss half the miracle of how human biology works.

Ruth Bleier, who after all was herself a neuroscientist, put the whole matter in perspective this way:

Such efforts directed at the callosum (or any other particular structure in the brain, for that matter) are today’s equivalent of 19th-century craniology: if you can find a bigger bump here or a smaller one there on a person’s skull, if you can find a more bulbous splenium here or a more slender one there . . . you will know something significant about their intelligence, their
personality, their aspirations, their astrological sign, their gender and race, and their status in society. We are still mired in the naive hope that we can find something that we can see and measure and it will explain everything. It is silly science and it serves us badly.⁸⁰

Once defined as fundamentally different from—and inferior to—men in body, psyche, and brain, women have tried various ways of coping with being "the other." The most common approach, the one that most women today have adopted, has been to try to prove that they are as good as, as competent as, as intelligent as, as valued as, the men who set the norm. Of course, after a while all the efforts to be "as something as" men get tiring. In 1991, after twenty-five years of trying to be accepted by her male colleagues, Dr. Frances K. Conley, a tenured professor in the department of medicine at Stanford and one of the few female neurosurgeons in the country, resigned her post. She had had enough of being called "hon," of having other surgeons fondle her in the operating room, of the relentlessly "hostile" environment, of having her opinions dismissed as evidence of her "PMS." Dr. Conley resigned because, she wrote, "I was tired of being treated as less than an equal person."⁸¹ (She has since returned to her job at Stanford, with renewed conviction in the importance of persistence.)

And so, weary of the seemingly fruitless struggle to be like men and repeatedly having to demonstrate their human competence, many women have set off in a separatist direction to define their own standards of excellence and to redeem qualities and experiences that had long been disparaged. This approach has offered a beguiling, exhilarating, luminous alternative to the impossibility of measuring up. Yet it too has its perils, as we shall see next.

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Beautiful Souls and Different Voices

Why women are not superior to men

When the War in the Persian Gulf broke out in January 1991, a reporter from a major newspaper called me to discuss what I knew about the much-publicized "gender gap" in attitudes toward war. "What is it about women's nature," he wanted to know, "that makes them more likely to oppose war?" I thought about the thousands of women in the military, many of whom were, for the first time in history, in the thick of the battle; the women interviewed on television and writing to the newspapers, enthusiastically endorsing the war effort; the women who were busily draping yellow ribbons over every tree in their neighborhood; and the men and women who were organizing protests against the war. I declined the interview.

A few years ago, Richard Restak wrote an essay to explain why he thought the increased number of women in medicine will reduce health care costs and humanize the profession. "If you combine a woman physician's natural intuitional and emotional assets," he said, "with her willingness to work for less income and her willingness to settle for less autonomy, health care planners are provided with a means to achieve several important goals."