which overinterpretation can occur. And I certainly don't think that research into sex differences in the brain is wrong or pointless. There *are* sex differences in the brain (although, as we've seen, agreeing on what these are is harder than you might think);[43] there are sex differences in vulnerabilities to certain psychological disorders, and hopefully greater understanding of the former might help to illuminate the latter. My point is simply this: that neither structural nor functional imaging can currently tell us much about differences between male and female minds. As Rutgers University psychologist Deena Skolnick Weisberg has recently argued, we should "remember that neuroscience, as a method for studying the mind, is still in its infancy. It shows much promise to be someday what many people want to make it into now: a powerful tool for diagnosis and research. We should remember that it has this promise, and give it the time it needs to achieve its potential—without making too much of it in the meantime."[44]

Are early twenty-first-century neuroscientific explanations of inequality—too little white matter, an unspecialized brain, too rapacious a corpus callosum—doomed to join the same garbage heap as measures of snout elongation, cephalic index, and brain fiber delicacy? Will future generations look back on early twenty-first-century interpretations of imaging data with the same shocked amusement with which we regard early twentieth-century speculations about the relevance of sex differences in spinal cord size? I suspect they will, although only time will tell. But to any scientist considering trying to relate sex differences in the brain to complex psychological functions . . . well, let's just say, "Remember Dr. Charles Dana."

And it *is* important to remember him. For as we'll see in the next chapter, the speculations of a few scientists quickly evolve into the colorful fabrications of popular neurosexism—the subspecialty within the larger discipline of neurononsense to which we now turn.

From Fine, C. "Delusions of Gender" (2011) Norton

BRAIN SCAMS 14

My husband would probably like you to know that, for the sake of my research for this chapter, he has had to put up with an awful lot of contemptuous snorting. For several weeks, our normally quiet hour of reading in bed before lights out became more like dinnertime in the pigsty as I worked my way through popular books about gender difference. As the result of my research, I have come up with four basic pieces of advice for anyone considering incorporating neuroscientific findings into a popular book or article about gender: (1) unless you have a time machine and have visited a future in which neuroscientists can make reverse inferences without the nagging anxieties that keep the more thoughtful of them awake at night, do not suggest that parents or teachers treat boys and girls differently because of differences observed in their brains; (2) if you don't know what a reverse inference is, read the previous chapter of this book; (3) exercise extreme caution when making the perilous leap from brain structure to psychological function; and (4) don't make stuff up.

When it comes to selecting examples from those who have failed to follow one or more of these four simple rules, one's choices abound. Possibly my favorite illustration of a self-serving projection of prejudices onto brain jargon is a section in John Gray's *Why Mars and Venus Collide* in which he discusses the inferior parietal lobe (IPL). In men, says Gray, the left IPL is more developed, while in women it is the right side that is larger. It will be no surprise to anyone, I am sure, to learn that "[t]he left side of the

brain has more to do with more linear, reasonable, and rational thought, while the right side of the brain is more emotional, feeling, and intuitive." But it *is* extraordinary just how differently the IPL serves its master and its mistress. According to Gray a man's large left IPL, being involved in the "perception of time," explains why he becomes impatient with how long a woman talks. By contrast, the IPL also "allows the brain to process information from the senses, particularly in selective attention, like when women are able to respond to a baby's crying in the night."[1] Perhaps deliberately, we are left in the dark as to whether the male inferior parietal lobe enables a man to do the same.

In *Leadership and the Sexes*, Michael Gurian and Barbara Annis inform executives that "women's brains tend to link more of the emotional activity that is going on in the middle of the brain (the limbic system) with thoughts and words in the top of the brain (the cerebral cortex). Thus a man might need many hours to process a major emotion-laden experience [*I . . . just . . . got . . . fired. . . . I . . . am . . . sad . . . and . . . angry.*], whereas a woman may be able to process it quite quickly [*Oh, crap!*]."[2] A further neurophysiological disadvantage for men may be found in another of Gurian's books, *What Could He Be Thinking?* Implicitly drawing on a working metaphor of *The Brain as Pinball Machine*, he explains how in men the "signal" of an emotional feeling, having made it to the right hemisphere, "may well get stopped, disappearing into neural oblivion because the signal found no access to a receptor in a language center in the left side of the brain." This doesn't happen in the female brain because, according to Gurian, while men have just one or two language centers in the left hemisphere, women have as many as seven such centers, dotted all over the brain, as well as a 25 percent larger corpus callosum. (Despite this embarrassment of neurological riches, the contrast Gurian draws between male and female brain function leaves me speechless.) And so, in men, a feeling signal is much less likely to hit the jackpot of contact with a neuron involved in language.[3]

We also discover in *Leadership and the Sexes* that when a woman leader asks her colleagues, "What do you all think?" this is a typically female "white matter" question. It seems that white matter isn't just involved in integrating information from different parts of the brain, but also from different people in the office.[4] Brain differences may also be behind a female-leadership problem-solving style: when a female leader "knows what to do, she's not as worried as a man might be about proving it with data." Gurian and Annis suggest that "[o]ne reason for this intuitiveness may be that she has a larger *corpus callosum* connecting both hemispheres of the brain." By contrast, male leaders favor a problem-solving style that, in part, "relies on more linear data and proof."[5]

Perhaps my own corpus callosum runs to a smaller size than the standard female issue, but I find these intuitive leaps from brain structure to psychological function unconvincing, as noted in the previous chapter. Why should arriving at a solution to a problem through an analysis of data and proof require any less integration between hemispheres? As an example of just how wrong our intuitions can be in these matters, despite the popular assumption that a more lateralized brain will be worse at multitasking, neurobiologist Lesley Rogers and her colleagues found precisely the opposite to be the case in chicks.[6] Chicks with more lateralized brains were better at simultaneously pecking for food grains and looking out for predators (the established chick equivalent of frying a steak while making a salad).

While it may not be too surprising to discover self-appointed "thought-leaders" dressing up stereotypes in neuroscientific finery, it is more of a shock to see this in an alumnus of Harvard Medical School, the University of California–Berkeley, and Yale School of Medicine. Step forward Louann Brizendine, director of the University of California–San Francisco Women's Mood and Hormone Clinic. Her book, *The Female Brain*, cites literally hundreds of academic articles. To the unwary reader, both she and the book seem reliable and authoritative. And yet, as a review of the book in *Nature* comments, "despite the author's extensive academic credentials, *The Female Brain* disappointingly fails to meet even the

most basic standards of scientific accuracy and balance. The book is riddled with scientific errors and is misleading about the processes of brain development, the neuroendocrine system, and the nature of sex differences in general." The reviewers later go on to say that, "[t]he text is rife with 'facts' that do not exist in the supporting references."[7] This is a common discovery made by people who take the time to fact-check Brizendine's claims. Mark Liberman, a professor at the University of Pennsylvania with no special interest in gender issues, has nonetheless been provoked to provide many detailed but humorous critiques of pseudoscientific claims about gender differences on his online Language Log. His patient corrections of Brizendine's many false assertions about sex differences in communication is a chore that, as he puts it, "is starting to make me feel like the circus clown that follows the elephant around the ring with a shovel."[8]

But despite these forewarnings, when I decided to follow up Brizendine's claim that the female brain is wired to empathize, it nonetheless proved to be an exercise that turned up surprise after surprise. I tracked down every neuroscience study cited by Brizendine as evidence for feminine superiority in mind reading. (No, really, no need to thank me. I do this sort of thing for pleasure.) There were many such references, over just a few pages of text, creating the impression it was no mere opinion, but scientifically established fact, that the female brain is wired for empathy in a way that the male brain is not. Yet fact-checking revealed the deployment of some rather misleading practices. For example, let's work our way through the middle of page 162 to the top of page 164 in her book. We kick off with a study of psychotherapists, which found that therapists develop a good rapport with their clients by mirroring their actions.[9] Casually, Brizendine notes, "All of the therapists who showed these responses happened to be women."[10] For some reason, she fails to mention that this is because only female therapists, selected from phone directories, happened to be recruited for the study.

Brizendine's next claim—that girls have an advantage in understanding others' feelings—does find support in the work of Erin McClure and Judith Hall, which she cites. These researchers both conducted meta-analyses that found advantages for females in decoding nonverbal expressions of emotion.[11] The edge is, however, moderate. McClure's meta-analysis suggests that about 54 percent of girls will perform above average in facial emotion processing, compared with 46 percent of boys. Hall's review of research with tests such as the PONS nonverbal decoding task (which we encountered in Chapter 2) suggests that if you randomly chose a boy and a girl, over and over, more than a third of the time the boy would outperform the girl. Brizendine does not understate these findings, then, when she says that "[g]irls are years ahead of boys" in these abilities.[12] She then speculates that mirror neurons may lie behind these skills, enabling girls to observe, imitate, and mirror the nonverbal cues of others as a way to intuit their feelings. (Mirror neurons are neurons that respond to another animal's actions as though the animal-observer itself were acting. Some scientists think that mirror neurons may provide the neural grounding for understanding people's minds. Other scientists are dubious about the whole concept.) The study she cites here does explore the potential role of the mirror system in intuiting others' mental states—but not specifically in females.[13] Indeed, its participants (some of whom had autism-spectrum disorders) were all male.

A little later, readers are told that "brain-imaging studies show that the mere act of observing or imagining another person in a particular emotional state can automatically activate similar brain patterns in the observer—and females are especially good at this kind of emotional mirroring."[14] Cited as support for this feminine superiority in emotional mirroring is a 2004 neuroimaging study by cognitive neuroscientist Tania Singer and colleagues, who compared brain activation when someone was either receiving a painful electric shock to the hand or was aware that a loved one was receiving the same painful electric shock to the hand.[15] Singer and colleagues found that some brain regions were activated both by being shocked and watching someone else be shocked. If you

think I'm going to be nitpicky about what any sex differences in activation in this study *mean*, you're wrong. Actually, the problem of interpretation is rather more basic. Only women were scanned.

Continuing the theme of women's special sensitivity to the pain of others in the next paragraph, Brizendine informs us that when a woman, for example, responds empathically to the stubbed toe of another, she is "demonstrating an extreme form of what the female brain does naturally from childhood and even more in adulthood—experience the pain of another person."[16] Brizendine marshals two functional neuroimaging studies as support for this claim. The first is Singer's 2004 study of females' empathic responses to pain. The second is a study by Tetsuya Iidaka and colleagues, who asked participants to judge the gender of faces showing positive, negative, or neutral expressions. They compared brain activations in young versus old participants, but not in females versus males.[17] (Her third citation is a review of anxiety and depression in childhood and adolescence. It doesn't discuss responses to others' pain, or gender differences in this capacity, although the authors note that "[b]ecause females are known to be more emotionally responsive than males to the problems of *others*, a wider range of interpersonal contexts may arouse them.")[18]

In the last part of this page range, Brizendine describes Singer's 2004 study, and states that "the same pain areas of [the women's] brains that had activated when they themselves were shocked lit up when they learned their partners were being strongly shocked."[19] She references the Singer 2004 study here, naturally, but also another functional neuroimaging study by the same research team, published in 2006.[20] This study was similar, but instead of being a romantic partner who was shocked, it was a confederate who had played either fairly or unfairly in a game just before. In this study, both men and women were scanned. Again, empathy-related responses were seen in reaction to the pain of another, although in men this was only the case when the confederate had played fairly. Having referenced these two studies, Brizendine concludes that "[t]he women were feeling their partner's pain. . . . Researchers have been unable to elicit similar brain responses from men."[21] She has, however, just cited a study that *did* elicit similar brain responses from men, albeit only in response to people they liked.

By this point the reader may have a poor opinion indeed of the male neurological capacity for empathy—especially since earlier on in the chapter Brizendine suggests that females may have more of the neurons that enable mirroring. She writes that "[a]lthough most of the studies on this topic have been done on primates, scientists speculate that there may be more mirror neurons in the human female brain than in the human male brain." Look to the notes at the back of the book and no fewer than five scholarly references appear to affirm this claim.[22] The first study is in Russian. Although it did compare the sexes, from the abstract I would lay a substantial bet on it not offering much insight into gender differences in mirror neurons, as it was a postmortem study of neuron characteristics in the frontal lobes. (One would, I imagine, have to see mirror neurons in action to be able to identify them.) Three further studies did indeed look at some aspect of what is thought to be the mirror neuron system. However, none of them compared males and females, or speculated about possible differences between the sexes. And that leaves just one remaining citation, which is "personal communication" with Harvard-based cognitive neuroscientist Lindsay Oberman, entitled "There may be a difference in male and female mirror neuron functioning." When I emailed Dr. Oberman to confirm, to my surprise, she informed me that not only had she never communicated with Brizendine, but went on to write that, "to the contrary, I have looked at many of my studies and have not found evidence for better mirror neuron functioning in females."[23] (Once you've picked your jaw up off the floor, don't forget to briefly think about the 5 percent rule I mentioned in Chapter 12, in which only sex *differences* get reported.)

What is deliciously ironic about all of this is that Brizendine presents herself as the reluctant but fearless messenger of truth:

> In writing this book I have struggled with two voices in my head—one is the scientific truth, the other is political correctness. I have chosen to emphasize scientific truth over political correctness even though scientific truths may not always be welcome.[24]

When I am in the mood to be irked, I flip through Brizendine's book. Perhaps because of the particular stage of life I happen to be in, I found myself most enraged by her claim that only when "the children leave home, the mommy brain circuits are finally free to be applied to new ambitions, new thoughts, new ideas."[25] But it's the sexism that bursts through the doors of preschools and schools, cleverly disguised in neuroscientific finery, that I find most disturbing. As neuroimaging takes its first steps on the long journey to understanding how neuronal firing yields mental abilities, you will find no shortage of so-called experts willing to explain the educational implications of differences in boy wiring and girl wiring. The medal for the most outrageous claim must surely go to an American educational speaker. According to reports sent to Mark Liberman's Language Log, this educational consultant has been informing audiences that girls see the details while boys see the big picture because the "crockus"—a region of the brain that does not exist—is four times larger in girls than in boys.[26]

I should reassure you that most people who talk about the educational implications of sex differences in the brain do limit themselves to regions recognized by the majority of the scientific community. I also have little doubt that many of them have the very best intentions behind their use of the brain science literature. They want to improve educational outcomes for children of both sexes. Those who promote single-sex schools may certainly have good reasons for their cause that have nothing to do with the brain. But promoting that cause by projecting gender stereotypes onto brain data is worse than useless.

Perhaps the most influential of this group of educational speakers is Leonard Sax of the National Association for Single Sex Public Education (NASSPE), and author of two books that argue a brain-based need for single-sex schooling. Sax has a punishing speaking schedule, that so far has included the United States, Canada, Australia, and New Zealand, as well as countries in Europe—and some schools are clearly impressed. NASSPE has been involved in about half of the 360 single-sex public school programs in the United States, and Sax has told *New York Times* journalist Elizabeth Weil that about 300 of them "are coming at this from a neuroscience basis."[27] Let's take a closer look at what that means.

Take English class, for example. In the girls' class, you will find teachers asking their students to reflect on story protagonists' feelings and motives: *how would you* feel *if*? . . . sort of questions. But not in the boys' classroom, because "[t]hat question requires boys to link *emotional* information in the amygdala with *language* information in the cerebral cortex. It's like trying to recite poetry and juggle bowling pins at the same time. You have to use two different parts of the brain that don't normally work together." The problem for boys and young children, according to Sax, is that emotion is processed in the amygdala, a primitive, basic part of the brain—"that makes few direct connections with the cerebral cortex."[28] (In fact, the amygdala appears to be richly interconnected with the cerebral cortex.)[29] This supposedly renders them incapable of talking about their feelings. But in older girls, emotion is processed in the cerebral cortex, which conveniently enables them to employ language to communicate what they're feeling. The implications for teaching are clear: *girls to the left, phylogenetically primitive ape-brains to the right!* Yet this "fact" about male brains—variants of which I have seen repeated several times in popular media—is based on a small functional neuroimaging study in which children stared passively at fearful faces.[30] It's doubtful whether any negative emotion was involved during the study (except perhaps boredom);[31] the children were not asked to speak or talk about what they were feeling and, critically, brain activity was not even measured in most of the areas of the brain involved in processing

emotion and language.[32] As Mark Liberman has pointed out, "the disproportion between the reported facts and Sax's interpretation is spectacular."[33] Even if studies *did* show what Sax claims (questionable),[34] why on earth would we assume that the language parts of the brain wouldn't get involved if the child wished to speak? Shifting information from A to B is, after all, what axons and dendrites are *for*. Yet Sax describes with admiration a boy-brain-friendly English class in which boys study *The Lord of the Flies* by reading the text not with an eye on the plot, or characterization, but so as to be able to construct a map of the island.

And it's all happening at a school near you. At a coeducational school in my neighboring suburb, "parallel education" is provided for boys and girls in certain years. As a journalist explains, "teaching boys [math] was more about hands-on practice: drawing, doing the exercise. But in a class with girls, Davey [the middle school principal] discusses the issues for a full 10 minutes at the start of the class, while the graph is put in the context of a relationship between two people."[35] Perhaps Davey has read one of the other "neurofallacies" propagated by Sax, that because boys process math in the hippocampus (another one of those primitive parts of the brain that males so seem to favor), but girls process geometry and math "in the cerebral cortex" (a statement so unspecific as to be a bit like saying, "I'll meet you for coffee in the Northern Hemisphere"), this indicates a need for very different educational strategies. Sax claims that because the primitive hippocampus has "no direct connections to the cerebral cortex" [um, again, not quite right] boys are happy dealing with math "'for its own sake' at a much earlier age than girls are." But for the girls, because they're using their cerebral cortex, "you need to tie the math into other higher cognitive functions."[36] The goal of inspiring children to get excited about math is certainly admirable. But Sax's claim that the results of a neuroimaging study of maze navigation point to a brain-based need to teach girls and boys in these different kinds of ways is simply neurononsense.[37]

Mark Liberman has analyzed in meticulous detail many of

Sax's dubious brain-based educational claims, and has described the way so-called educational experts like Sax and Gurian use scientific data as "shockingly careless, tendentious and even dishonest. Their over-interpretation and mis-interpretation of scientific research is so extreme that it becomes a form of fabrication."[38] While it might be amusing to think up romance stories involving stolid Mr. X-Axis and flighty Ms. Y to amuse the girls, or an interesting challenge to discuss a book without mentioning mental states, the danger is that self-fulfilling prophecies are being delivered alongside the new-look, single-sex curriculum.

Vicky Tuck, while president of the Girls' School Association, UK, recently argued that there are "neurological differences" between the sexes that are "pronounced in adolescence." The practical implication? "You have to teach girls differently to how you teach boys."[39] Is she right? Remember how easily spurious findings of sex differences can lead to premature speculation. Remember what Celia Moore and Geert De Vries have pointed out—sex differences in the brain can be compensation, or a different path to the same destination. Bear in mind that neuroscientists are still quarreling over the appropriate statistical analysis of highly complex data. Recall that many sex differences in the brain may have more to do with brain size than sex per se. Remember that psychology and neuroscience—and the way their findings are reported—are geared toward finding difference, not similarity. Male and female brains are of course far more similar than they are different. Not only is there generally great overlap in "male" and "female" patterns, but also, the male brain is like nothing in the world so much as a female brain. Neuroscientists can't even tell them apart at the individual level. So why focus on difference? If we focused on similarity, we'd conclude that boys and girls should be taught the same way.

You're not convinced? You feel sure these brain differences must be educationally important? Okay, fine. Separate your boys and girls. Or, if you want to be really thorough, because there is overlap with these sex differences, strictly speaking one should

provide separate streaming for, say, Large Amygdalas and Small Amygdalas, or Overactivated versus Underactivated Left Frontal Lobes. And now tell me *how* you tailor your teaching to the size of the amygdala, or to patterns of brain activity to a photo of a fearful face. There is no reliable way to translate these brain differences into educational strategies. It is, as philosopher John Bruer has poetically put it, "a bridge too far": "Currently, we do not know enough about brain development and neural function to link that understanding directly, in any meaningful, defensible way to instruction and educational practice. We may never know enough to be able to do that."[40] And so, instead, we quickly find ourselves falling back on god-awful gender stereotypes.

We never seem to learn.

No discussion of the brain, sex, and education would be complete without mention of the now-notorious theory of Professor Edward Clarke of the Harvard Medical School. In his highly successful nineteenth-century book, *Sex in Education* (subtitled, somewhat ironically as it turned out, *Or, A Fair Chance for Girls*), he proposed that intellectual labor sent energy rushing dangerously from ovaries to brain, endangering fertility as well as causing other severe medical ailments.[41] As biologist Richard Lewontin dryly remarked of this hypothesis, "Testicles, apparently, had their own sources of energy."[42] From our modern vantage point we can laugh at the prejudice that gave rise to this hypothesis. Yet we may have little cause for complacency.

Tuck says she has "a hunch that in 50 years' time, maybe only 25, people will be doubled up with laughter when they watch documentaries about the history of education and discover people once thought it was a good idea to educate adolescent boys and girls together."[43] But when I survey the popular literature, I suspect that this will not be where the people of the future will find their biggest laughs. Frankly, I think they will be too busy giggling in astonished outrage at the claims of early twenty-first-century

commentators who, like their nineteenth-century predecessors, reinforced gender stereotypes with crude comparisons of male or female brains; or who, like Brizendine with her talk of "overloaded brain circuits," attempted to locate social pressures in the brain. (*Here it is, Michael! I finally found the neural circuits for organizing child care, planning the evening meal, and ensuring that everyone has clean underwear. See how they crowd out these circuits for career, ambition, and original thought?*)

I end with a plea. Although, as we'll see in the next chapter, there is something captivating about neuroscientific information, please, no more neurosexism! Follow the four simple steps I set out at the beginning of the chapter or leave the interpretations to the trained professionals. Neuroscience can be dangerous when mishandled, so if you're not sure, be safe.

As the blogger known as Neuroskeptic wisely advises those who peddle neurononsense, "Save yourself . . . put the brain down and walk away."[44]

15 THE "SEDUCTIVE ALLURE" OF NEUROSCIENCE

I once bought a toy drum that promised to stimulate my child's auditory nerve. I took this to mean that it made noise. Clearly, the genius minds behind the marketing had stumbled on the discovery that information sounds far more impressive when couched in the grand language of neuroscience. (By the way, have I mentioned yet that these words of mine you're reading are stimulating your occipital lobe, as well as refining the neural circuitry of your anterior cingulate gyrus and dorsolateral prefrontal cortex? This isn't just a book—it's a neurological workout.) There's something special about neuroscientific information. It sounds so unassailable, so very . . . well, *scientific*, that we privilege it over boring, old-fashioned behavioral evidence. It brings a satisfying feel to empty scientific explanations. And it seems to tell us who we really are.

After Lawrence Summers's controversial suggestion that women might be inherently less capable of high-level science, Steven Pinker and Simon Baron-Cohen were not the only ones to talk brain differences. So did Leonard Sax. Refreshingly, Sax did not argue that brain research hints at an innate female inferiority, on average, in science and math. Instead, he argued that the problem lies in an educational system that teaches boys and girls the same things at the same time. This is a mistake because, as he explained in the *Los Angeles Times*, "while the areas of the brain involved in

language and fine motor skills (such as handwriting) mature about six years earlier in girls, the areas involved in math and geometry mature about four years earlier in boys."[1] Sax argues that teaching should be sensitive to sex differences in the timing of development of the various regions of the brain because "[a] curriculum which ignores those differences will produce boys who can't write and girls who think they're 'dumb at math.'"[2]

Now, I'm all behind Sax's goal of improving educational outcomes for boys and girls. There might be good reasons for single-sex schooling. But what are we to make of his claim that, as he put it to *CBS News*, "[b]oth boys and girls are being shortchanged as a result of the neglect of hard-wired gender differences"?[3]

By now, you will probably be uneasy about the idea that complex psychological skills like language, math, and geometry can be pinpointed to a single part of the brain. It's simply not the case that people use one particular lobe, or a circumscribed area of the brain, to read a novel, or write an essay, or solve an equation, or calculate the angle of a triangle. And, unfortunately, neuroscience has yet to reach the stage at which it can peer into the brain and determine capacity for solving simultaneous equations or readiness to learn calculus. I can understand why this relatively subtle point didn't set off alarm bells in Sax or the editors or journalists who brought comments like this to the public eye. But why did no one query the relevance of Sax's statement on the grounds that boys are clearly *not*, in fact, four years ahead of girls in math—they are not ahead of them at all, as it happens.[4] Nor, of course, is the language ability of a twelve-year-old boy comparable to that of a six-year-old girl. Even if we are happy to relate one part of the brain to complex cognition, clearly, this concept of neural maturation is a very poor index of actual ability—a far worse measure than, say, a math test. So why does this kind of neurononsense get column inches?

One reason may be that neuroscience easily outranks psychology in the implicit hierarchy of "scientificness."[5] Neuroscience, after all, involves expensive, complex machinery. It generates smart-looking three-dimensional images of the brain. The tech-

nicians almost certainly wear white coats. It involves quantum mechanics, for goodness' sake! I ask you, what kind of a match for this is a simple piece of paper on which a six-year-old girl has successfully added 7 and 9? Bioethicist Eric Racine and colleagues coined the term "neuro-realism" to describe how fMRI coverage can make psychological phenomena somehow seem more real or objective than evidence collected in a more ordinary fashion. They describe how, for example, brain activation in the reward centers of the brain while people ate unhealthy food was provided as evidence that "[f]at really does bring pleasure."[6] If patterns of firing in the brain can be seen as better proof of someone feeling pleasure than them selecting the box on the questionnaire marked "Yes, I really enjoyed eating that doughnut," then it's not surprising that children's actual academic skills can be so easily overlooked when brain research is enjoying the spotlight.

I also suspect that because the brain is such a biological organ, with its axons and fat and neurochemicals and electrical impulses, there is the temptation to chalk up whatever sex differences we see in the brain to differences in male and female nature, as Michael Gurian and Kathy Stevens do in *The Minds of Boys*:

> The social thinkers of the 1950s, 1960s, and 1970s did not have PET scans, MRIs, SPECT scans, and other biological research tools available to them. . . . Because they could not look inside the heads of human beings to see the differences in the brains of males and females, they had to lean away from nature-based theory toward social trends theory. They had to overemphasize the power of nurture in gender studies because they didn't have a way to study the actual nature of male and female.[7]

Gurian and Stevens seem to equate "actual nature" with "brain." But really, when you think about it, where else but in the brain would we see the effects of socialization or experience? As Mark Liberman puts it, "how else would socially constructed

cognitive differences manifest themselves? In flows of pure spiritual energy, with no effect on neuronal activity, cerebral blood flow, and functional brain imaging techniques?"[8] The "neuro-curmudgeons" from the James S. McDonnell Foundation have picked up on this "brain = innate" tendency, too. In response to an article in the *New York Times* that claimed from an fMRI study that "a mother's impulse to love and protect her child appears to be hard-wired into her brain" one neuro-curmudgeon put out a plea to "take experience and learning seriously. Just because you see a response [in the brain]—you don't get to claim it's hard-wired."[9]

Another draw of neurononsense is what Yale researchers have referred to as "the seductive allure of neuroscience explanations." Deena Skolnick Weisberg and her colleagues found that people are pretty good at spotting bad explanations of psychological phenomena. Suppose, for example, you read about a study in which researchers found that men performed better than women on spatial reasoning tasks. Would you be satisfied by the circular explanation that "women's poor performance relative to men's explains the gender difference in spatial reasoning abilities"? Probably not. The researchers aren't explaining their result, they're redescribing it: *women are worse at spatial reasoning because women are worse at spatial reasoning.* But simply add neuroscience and the same non-explanations suddenly seem much more satisfying:

> Brain scans of the right premotor area, known to be involved in spatial relational tasks, indicate that **women's poor performance relative to men's** causes different types of brain responses. This **explains the gender difference in spatial reasoning abilities.**

In bold text is the circular explanation that people found unsatisfying. The extra neuroscience bit tells us that spatial reasoning recruits a part of the brain, which should hardly surprise us. But it doesn't tell us *why* women performed worse than men. The explanation is still circular. But the neuroscience disguises

this, even for students enrolled in an introductory cognitive science class, Weisberg and colleagues found.[10] Although it's not yet clear what it is, exactly, about neuroscience that is so persuasive, it's been found that people find scientific arguments more compelling when accompanied by an image showing brain activation rather than, say, a bar graph showing the same information.[11]

All of which should make us very concerned that this talk of brain differences might influence opinion and policy far more than it should. As Weisberg suggests, the seductive nature of neuroscience creates "a dangerous situation in which it may not be the best research that wins debates in the public sphere."[12]

The effects of neuroscience may be personal as well as political. Gender stereotypes are legitimated by these pseudo-scientific explanations. Suddenly, one is being modern and scientific, rather than old-fashioned and sexist. Do you want to claim, in a book for teachers and parents, that "the world of the abstract . . . is explored more by the male brain than the female," thus explaining males' dominance in physics?[13] Why then, go right ahead! So long as the magic word *brain* is there, no further information required. But we have to wonder about the effect of this kind of information as it feeds back into society. As we saw in the first part of this book, the activation of gender stereotypes, even by means as subtle as our suspicion that they have found a home in the minds of others, can have measurable effects on our attitudes, identity, and performance.

Neurosexism may also effect such changes directly. We can currently only speculate on the enervating effect of popular gender-science books on male patterns of leaving the milk to be bought by someone else. But there is evidence that media reports of gender that emphasize biological factors leave us more inclined to agree with gender stereotypes, to self-stereotype ourselves, and even for our performance to fall in line with those stereotypes.[14] For example, one study found that women given a journal article to read that claimed that men are better at math because of innate, biological, and genetic differences performed worse on a GRE-like

math test than women shown an essay saying that men's greater effort underlies their superior performance. Likewise, women who had just read an essay arguing that there are genetically caused sex differences in mathematical ability performed substantially worse on a GRE-like test, compared with women who read that experiential factors explain sex differences in math ability, psychologists Ilan Dar-Nimrod and Steven Heine found. (Being told this information by the experimenter had the same effect.) This damaging effect of the genetic account, the researchers suggest, may stem from people's assumption that genetically based differences are more profound and immutable than differences that arise from social factors. "[M]erely considering the role of genes in math performance can have some deleterious consequences," they conclude. "These findings raise discomforting questions regarding the effects that scientific theories can have on those who learn about them and the obligation that scientists have to be mindful of how their work is interpreted."[15]

"Caveat lector" is Weisberg's advice. Neuroscientists who work in this area have some responsibility for how their findings of sex differences in the brain are interpreted and communicated. When this is done carelessly, it may have a real and significant impact on people's lives. Many neuroscientists do appear to be aware of this. They are appropriately cautious about interpreting sex differences in the brain, and many also take the time to remind journalists of just how far we are from mapping sex differences in the brain onto the mind. (And of course they may find their work being misrepresented, regardless.) Others, however, as we have seen, are more cavalier.

Not everyone would agree that the topic of sex differences in the brain requires a particular sensitivity. For example, sex-difference researcher Doreen Kimura has argued that "[w]e can't allow ourselves to get into a situation in which we say . . . 'This is a finding that won't upset anyone, so I'm willing to generalize from

it, but this other finding may be unpopular, so I need more evidence to support it before reporting it.'"[16] I am not inclined to agree that the content of the research makes no difference to the degree of care scientists should take in generalizing a result, or their concern in how it is popularized by others. I have, for example, heard neuroscientists who work in the area of drug dependency talk about the efforts they go to to prevent simplification or distortion of their findings by the media. This is not because they are worried about "upsetting" people, but because it is a sensitive area, and "brain facts" about dependency can change people's attitudes and feelings about a particular social group. These neuroscientists didn't seem to consider it unreasonable to work under a heavier burden of caution—a burden that I suggest it is also appropriate to place on those who comment on sex differences in the brain.[17]

Finally, there's an urgent need for editors, journalists, and schools to develop far more skeptical attitudes toward claims made about sex differences in the brain. It is appalling to me that one can, apparently, say whatever drivel one likes about the male and female brain, and enjoy the pleasure of seeing it published in a reputable newspaper, changing a school's educational policy, or becoming a best seller. Scientists can help here (as many already are). Weisberg suggests (in relation to the interpretation of imaging studies in general) that we "take a more active stance as scientists, medical practitioners, and researchers." She advocates that researchers become "vocal critics" of misleading articles, put more pressure on "newspaper and magazine writers to cover scientific issues with more depth and nuance," and, to this end, offer their expertise to members of the media.[18]

Neurosexism promotes damaging, limiting, potentially self-fulfilling stereotypes. Three years ago, I discovered my son's kindergarten teacher reading a book that claimed that his brain was incapable of forging the connection between emotion and language. And so I decided to write this book.[19] To make this kind of confident claim about hardwired psychological differences between males and females is to overlook the likelihood of

spurious findings, the teething problems of new technology, the obscurity of the relationship between brain structure and psychological function, and the difficulty of inferring psychological states from neuroimaging data. Dazzled by the seductive scientificness of neuroscience, commentators become blind to low-tech behavioral evidence of gender similarity, or flexibility in response to the social context. And, as we'll explore more in the next chapter, the very concept of hardwiring needs some updating.