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# Gender Differences: A result of differences in the brain or socialization?

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## Abstract

*There are obvious differences between males and females observed in society; aside from physical features, gender differences are present from infancy through adulthood in virtually all areas from childhood play to occupational choices. It is heavily debated as to whether these gender differences are a result of socialization or a result of differences between the male and female brain. This paper will explore both sides of the controversy, outlining the evidence offered by Cordelia Fine and Simon Baron-Cohen in their books "Delusions of Gender: How Our Minds, Society, and Neurosexism Create Difference" and "The Essential Difference: Male and Female Brains and the Truth About Autism." Fine defends the argument that the brain is malleable and influenced by parents, peers, and the environment, while Baron-Cohen defends the argument that there are essential differences between how the male and female brains are organized. Historical evidence, observations, and testing are cited by each author to support their stance on the controversy. As greater technological advancements are made in neuroscience, scientists can continue to study the brain with greater precision and accuracy, and gain further insight to support or refute a side in this debate.*

There are obvious differences between males and females in society; aside from physical features, gender differences are present from infancy through adulthood in virtually all areas from child-

hood play to occupational choices. It is heavily debated as to whether these gender differences are a result of socialization or a result of differences between the male and female brain. This debate is a difficult one to assess because there is adequate evidence for both sides of the controversy. Those taking the side of socialization use the information to show that the brain is malleable and is influenced by parents, peers, and the environment, while those taking the side of essential differences between the male and female brain use the information to yield insight into how the brain is organized.

Cordelia Fine, author of *Delusions of Gender: How Our Minds, Society, and Neurosexism Create Difference*, argues that "What we experience and do create neural activity that can alter the brain, either directly or through changes in gene expression" (Fine 236). The brain's neuroplasticity is what allows it to be molded by socialization. On the other hand, Simon Baron-Cohen, author of *The Essential Difference: Male and Female Brains and the Truth About Autism*, argues that there are innate differences between the male and female brain. His theory is that "The female brain is predominantly hard-wired for empathy. The male brain is predominantly hard-wired for understanding and building systems" (Baron-Cohen 1). In other words, on average more females than males have a brain suited for empathizing and on average more males than females have a brain suited for systemizing. In his argument, he also theorizes about the prevalence of an ex-

treme male brain with advanced systemizing and low empathizing that manifests as autism, and an extreme female brain with advanced empathizing and low systemizing which is still an area for future research. Although Fine and Baron-Cohen, are on opposing sides of the controversy, neither author reduces gender differences to one factor. Both authors support their views with historical evidence, observations, and testing.

The main brain types identified by Baron-Cohen include brain type E or the female brain, brain type S or the male brain, and brain type B or the balanced brain. He also theorizes the existence of an extreme male brain (extreme type S) and the extreme female brain (extreme type E); E represents stronger or more developed empathizing, while S represents stronger or more developed systemizing (Baron-Cohen 6-7). This paper will focus on whether or not there are actually critical differences between the male and female brain that impact behavior, or if gender differences in behavior are due to socialization.

Baron-Cohen uses evolutionary theory to explain the advantages of the male and female brain and why they would have evolved. He explains that “traits usually only come under genetic control when they confer some survival and reproductive advantage to the organism in two battles: surviving to reach adulthood, and being selected to become a parent” (Baron-Cohen 115). Advantages of the male brain include using and making tools, hunting and tracking, tolerating solitude, trading, power, social dominance, expertise, aggression, and leadership. The ability to use and make tools increases both the chances of survival and reproductive success. Tools allow one to more efficiently hunt, fight, build, fix, and work which can increase one’s status in the community. Good systemizing ability is also important for understanding the natural systems involved in hunting and tracking. Hunters must be able to not only identify the tracks of specific animals, but also to create mental maps of the area to avoid getting lost. Natural systems also include the weather,

the wind, and the stars. Understanding these systems will allow for better navigation and survival of harsh conditions (Baron-Cohen 118-119). Psychologist Doreen Kimura also highlights the importance of navigational abilities to male reproductive success. Males tend to have more sexual partners than females, therefore, requiring them to travel greater distances to mate. This leads Kimura to make the argument that navigational differences between men and women emerged due to natural selection for reproductive advantage (Kimura 121). Making tools along with hunting, tracking, and navigation require time spent in solitude. A systemizing brain, as opposed to an empathizing brain that likes to socialize, is better suited for tolerating the solitude required for those aspects of life. Spotting fluctuations in the marketplace is another form of systemizing that is important for trading. The ability to read these buy-sell profitable systems, will increase one’s own wealth, which will in turn increase social rank, leading to better reproductive success. In regards to power, one must understand where they are in the rank, and identify what circumstances would gain rank or cost rank when making decisions. Those of higher social rank have better survival chances because it ensures protection from the group. The reproductive benefit of power is that it creates greater access to females. Darwin’s theory of sexual selection deems females as having the greater role in selection because their investment of time and energy for producing offspring is greater than a male’s. This is why social dominance is important for men’s fertility. Achieving social dominance brings males more power, which in turn, gives them greater access to females. Males achieve social dominance not only through threats or physical force, but also by becoming an expert in something valued by the culture; systemizing allows one to do this. Aggression, entailing a lack of empathy, allows males to control the sexual activities of their partners. This allows them to be polygynous, giving them access to many females. Finally, in regards to lead-

ership, those who can view a team as a system can identify how each individual member functions in the system while identifying and replacing problems within the system. Leaders would have more access to resources and higher social rank, which not only leads to greater chances of survival, but also greater opportunities for reproduction (Baron-Cohen 118-126).

Baron-Cohen goes on to identify the advantages of the female brain which include making friends, mothering, gossip, social mobility, and reading one's partner. Each of these have both survival and reproductive advantages. Making friends helps to form social alliances for protection, while also creating networks for childcare. It also increases community stability which decreases aggression between adults, and increases chances of survival for female and child community members. Having more developed empathizing skills is crucial for mothering because it allows one to have a better read on their child's needs and feelings. When children feel a sense of care and support, they are able to develop a secure attachment. This form of attachment helps infants "not only learn faster but they are more easily accepted into their peer group, they are rated as more popular, and they develop more stable relationships throughout their lives" (Baron-Cohen 128). In doing so, these children will grow into adults who have greater survival and reproductive success. Being attuned to the community gossip helps to reinforce close friendships, gain important information about the community, and develop alliances. When women find a mate, typically they move to mate's community. When in a new community, they have no blood ties to its members, so the ability to be socially mobile and build relationships with those not genetically related to them is important. Finally, reading one's partner helps to reduce spousal aggression, find more sincere mates, judge a mate's intentions, and prolong the relationship, which helps to increase the spread of their genes (Baron-Cohen 126-130). Overall, there were advantages of both the male and female

brain that allowed these traits to survive.

In their books, both Fine and Baron-Cohen discuss many of the same topics, like parenting, toy preferences, hormones, and the brain, but they fall on opposite sides of the spectrum when discussing their origins. When discussing parenting, Fine recognizes that gendered expectations develop even before the birth of a child. Birth announcements, for example, are constructed differently for boys and girls. In a study of 400 birth announcements, "Parents of boys, they found, expressed more pride in the news, while parents of girls expressed greater happiness" because "the birth of a girl more powerfully triggers the warm, fuzzy feelings relating to attachment, while the greater pride in a boy stems from an unconscious belief that a boy will enhance standing in the social world" (Fine 194). There was also a statistically significant difference in the number of birth announcements for boys than girls: more birth announcements were published for boys than for girls. Fine has also found "implicit paternalism" in the choice of baby names. For example, boys were more likely to share a first initial with their father, while girls were equally likely to share a first initial with either parent (Fine 196). Once parenting actually begins, gendered expectations impacted how mothers perceived the physical abilities of their infants. For example, the crawling ability of girls were underestimated, while the crawling ability of boys were overestimated. This suggests the implicit gendered belief that boys are more capable of motor feats than girls. Fine continued to notice difference between the treatment of male and female babies that reflect implicitly held gender stereotypes. For example, "parents encouraged gender-typed activities and play, and discouraged cross-gender behavior" (Fine 202). When cross-gendered behavior did occur, it was more accepted of females than of males. Fine theorizes that even before birth, and continuing through childhood, gendered expectations held by parents impact the behavior of male and female children.

Fine also explored gender neutral parenting where gender associations in the environment were reduced, and where anatomy and reproductive functions were deemed the only differences between what it means to be a boy or a girl by looking at the Bems. Sandra and Daryl Bem were psychologists who chose to raise their son and daughter gender-neutrally. Their decision was “to restrict as much as they could their young children’s knowledge of the ‘cultural correlates’ of gender at least until they were old enough to be critical of stereotypes and sexism” (Fine 214). In Fine’s exploration of the overwhelming lengths it took for the Bems to create a gender neutral environment, she reveals the significant prevalence of gender stereotypes that are present in daily life. The children did not conform to sex-typical dress, accessories, or hairstyles, and the shows they watched and the literature that they read were censored to eliminate the production of gender stereotypes. Within the household, parenting and chores were shared equally between both parents. Although precautions can be taken in the home to eliminate gender stereotypes, Fine references Australian psychologist Barbara David who suggests that parents “cannot be a model for appropriate gender behavior, unless the child’s exposure to the wider world (for example, through friendship groups and the media) suggests that the parent is a *representative* or prototypical male or female” (Fine 217). To elaborate, unless gender stereotypes are eradicated everywhere, gender neutral parenting alone will not eliminate gender stereotypes because “gender is continually emphasized through convention of dress, appearance, language, color, segregation, and symbols” (Fine 227) that children are exposed to outside of the home.

It can be inferred that because Baron-Cohen theorizes that the male and female brain are hardwired differently, he would believe that even complete gender-neutral parenting with no exposure to gender stereotypes would result in boys and girls demonstrating the sex-typical preferences and be-

haviors. He discusses parenting in relation to the differences between how boys and girls are treated by their parents, but does not discuss gender neutral parenting. Parents tend to control boys by punishing, prohibiting, and threatening them more often than girls. Some believe that this is due to how boys have been socialized, while others, like Baron-Cohen theorize that “boys are poorer empathizers than girls, which leads them to be less socially compliant, less skilled at picking up the social cues of boundaries, and requiring more frequent disciplining” (Baron-Cohen 88). Baron-Cohen suggests that the parenting styles of boys and girls are different because their brains are hardwired differently. Parenting styles do not socialize male and female behavior, parenting styles are instead a consequence of the male and female brain. For example, because females are better empathizers, they are better at “social referencing.” This enables girls to “look at a parent’s face to detect whether something is permitted or not” (Baron-Cohen 88). In other words, girls can pick up on social cues, gestures, and facial expressions from their parents, whereas, boys need explicit verbal expression of what is permitted or prohibited. The differences in the male and female brain require parents to parent boys and girls differently.

Fine and Baron-Cohen both look at children’s toy preferences and provide differing views on why children often display sex-typical toy choices. On one hand, Fine attributes sex-typical toy preferences to in-group bias. In-group bias is conforming to the preferences of their own group; females preferring female sex-typed toys, and males preferring male sex-typed toys. Gender is a social category that drives children to belong to the social identity of male or female (Fine 228). Fine references a study constructed by Rebecca Bigler and colleagues to support her views on the influence of in-group bias. In this study, a group of preschoolers from two different classrooms were divided into two groups, one labelled Red group and one labelled Blue group. For three weeks, these preschoolers wore red or blue in accordance

to their group label. In one of the two classrooms, there was no mention of the groups aside from their dress. In the second classroom, the students decorated their cubbies red or blue, lined up with their group (red or blue), and were greeted based on their group label. Children's views became biased based on which group they were assigned to. The bias was stronger in the classroom where the differences in the groups were more present. The part of this study that correlates with Fine's view is that "The children preferred toys they were told were liked by their own group and expressed a greater desire to play with other Red (or Blue) children" (Fine 228). This relates to the in-group bias referred to by Fine because it shows that if boys typically play with one type of toy and girls typically play with another type of toy, a child will most likely desire belonging to their gendered group by choosing to play with the toy that is typically associated with their group.

Whereas Fine suggests that children's sex-typical toy preferences are a result of in-group bias and socialization, Baron-Cohen suggests that children's toy choices do not reflect social influences. Before age two, children already display sex-typical toy preferences, for example, boys will choose a truck over a doll, while girls will choose a doll over a truck, yet they cannot label either a "boy" toy or a "girl" toy (Baron-Cohen 91). This reveals that toy preferences are innate and not socialized because they are apparent before the difference between boy toys and girl toys are acknowledged.

It is suggested by Baron-Cohen that behaviors, like systemizing, can be impacted by levels of fetal testosterone, however, Fine rejects this notion. She points out that the level of prenatal testosterone has no correlation to systemizing skills like mathematics or visuospatial tasks:

Does accuracy on a mental rotation test at age seven correlate with amniotic testosterone? No. Does a four-year-old's skill at copying a block structure, understanding a number facts and con-

cepts, and counting and sorting increase with higher levels of amniotic testosterone? No, it *decreases* in girls, and has no relationship in boys. Puzzle solving? No. Classification skills (for example, "find all the small ones"?) No. A test of spatial ability? No. (Fine 111)

Fine discards Baron-Cohen's opinion on prenatal testosterone based on the fact that she found an underwhelming amount of evidence in support of it.

Baron-Cohen proposes that social behaviors are impacted by hormones, like testosterone, which usually manifest in higher levels in males. For example, in a study of male-to-female transsexuals, the participants showed an increase in indirect or relational aggression (typically associated with females) and a decrease in direct aggression (typically associated with males). This suggests that testosterone influences the form of aggression one demonstrates (Baron-Cohen 99). He then references a study that he and his colleagues conducted to test the influence of prenatal testosterone on behavior. In this study, Baron-Cohen and his colleagues tested amniotic fluid for levels of prenatal testosterone that he received from Addenbrooke's Hospital in Cambridge, a hospital specializing in the analysis of amniotic fluid. The researchers contacted the mothers whose amniotic fluid had been stored and asked them to participate in the study by bringing their toddlers into the lab. They "found that the toddlers (at twelve and twenty-four months of age) who [they] had identified as having lower fetal testosterone, now had higher levels of eye contact and a larger vocabulary" (Baron-Cohen 100). Inferring that eye contact and communication indicate empathizing, Baron-Cohen theorizes that empathizing skills are critically influenced by fetal testosterone. In a follow up study of the toddlers, who were then about four years old, Baron-Cohen found that lower social skills and restricted interests were demonstrated by those who had higher prenatal testosterone. It was interpreted that,

Lower levels of fetal testosterone (seen more commonly in females) lead to better levels of language, communication skills, eye contact, and social skills all signs of better empathizing. And if restricted interests are an indicator of in-depth systemizing, these results clearly show that good systemizing abilities are linked to higher levels of fetal testosterone. (Baron-Cohen 101)

Further support for the notion that higher levels of prenatal testosterone leads to better systemizing is data revealing that these individuals demonstrate better performance on the Mental Rotation Test, a test requiring strong systemizing skills. Whereas Fine proposed that there is little support for the prenatal testosterone theory, Baron-Cohen found much evidence in support of it.

Both Fine and Baron-Cohen discuss the structure of the brain in their books. Fine focuses on the difficulties in studying the brain structures, whereas Baron-Cohen highlights what he found to be structural differences between the male and female brain. In Fine's discussion, she suggests that "There are two ways that males and females can diverge in brain activation: how much activation is seen and where that activation is. Neither piece of information, unfortunately, tells us much about psychological sex differences" (Fine 151). Continuing, she states that activation of an area does not necessarily reveal that anything useful is even happening in the brain; brain activation does not always correlate with critical involvement. Fine makes this argument in regards to the amygdala. When observing brain activity of the amygdala, males and females show different responses when looking at pictures of fearful faces. Baron-Cohen suggests that this reflects an essential difference between the male and female brain, however, Fine argues that this is only a difference in brain activity, not a difference in the brains. Fine actually accuses researchers of reverse inference, or backwards reasoning, for using brain activity to infer

a psychological state (Fine 151). The difficulty of interpreting brain imaging data is also acknowledged by Fine when she states that "There isn't a simple one-to-one correspondence between brain regions and mental processes" (Fine 152). In doing so, the brain is being oversimplified because it is not recognizing the interconnectivity within the brain.

Unlike Fine, Baron-Cohen used structural and functional differences in the brain to support his stance on vital sex differences between the male and female brain. In Baron-Cohen's exploration of the brain, he focused on "which brain regions are known to play a role in empathizing and which play a role in systemizing, and then looked for sex differences in these brain regions" (Baron-Cohen 109). The regions considered to be parts of the "social brain," which are those associated with empathizing, are the amygdala, the orbito- and medial-frontal areas, the superior temporal sulcus, and the corpus callosum. The amygdala impacts one's ability to judge another's emotion. In studying the amygdala of males and females using functional magnetic resonance imaging (fMRI), there were differences between responsiveness of the amygdala when looking at pictures of fearful faces. The orbito- and medial-frontal areas of the prefrontal cortex are activated when trying to determine another person's intentions or thoughts. The superior temporal sulcus is activated when one is being watched by another person, and thus trying to determine that person's mood or intent. The corpus callosum is the brain structure that connects the left and right brain hemispheres, allowing them to communicate. Some studies have shown that the corpus callosum is larger in females than in males. If females do have a larger corpus callosum, it can be inferred that this would allow for faster inter-hemispheric information transfer, like communication or empathizing (Baron-Cohen 110-111). In the article "The Trouble with Sex Differences," Lise Eliot, a professor of neuroscience, rejects the idea that the corpus callosum is larger in females

than males. She stated that one highly publicized postmortem study of the brain revealed this notion, and even though a meta-analysis of 49 studies showed no sex difference between the corpus callosum of males and females, the claim stuck (Eliot 896). Kimura suggests that discrepancies could emerge due to different methods of measuring the brain and the age of the person whose brain is being studied (Kimura 123). In regards to systemizing abilities, brain weight and the hippocampus are associated with it. The male brain is heavier, which could be due to having more neurons in the cortex than women. This can impact systemizing abilities because it could increase the attention to detail that is needed. Baron-Cohen believes that the hippocampus is associated with systemizing because in rats when the hippocampus was damaged, their ability to navigate mazes (a systemizing task) suffered. It has also been reported that the hippocampus was larger in male rats than in female rats. Baron-Cohen suggests that in future research the planum parietale and the preoptic area of the hypothalamus should be studied to test if they play a role in systemizing (Baron-Cohen 112-113). He also highlights Broca's Area which is associated with language. During language tasks, Baron-Cohen notes that Broca's Area in men and women were activated differently. Male brains only showed activation in the left hemisphere, while about 50% of women showed brain activation in both hemispheres (Baron-Cohen 58). Eliot, a critic of essential differences between the male and female brain, does admit that "Structures that do seem to exhibit reliable volumetric sex differences (at least during certain developmental ages) include the amygdala, caudate, and portions of the orbitofrontal cortex" (Eliot 896). Even critics of Baron-Cohen's theory, admit that there are evident differences between the male and female brain.

The topic of sex differences can bring up much controversy due to some of the perceived implications that it is deemed to have regarding sexism and stereotypes. Baron-Cohen defends himself against ideological critiques regarding sexism

and stereotypes early in his book due to his awareness of potential reader concerns on the topic of sex differences. Defining himself as a responsible scientist, he claims that "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" (Baron-Cohen 10). He believes that sex differences can be studied and reported without oppressing either sex. Similar to Ann Cudd's discussion of objectivity in her article "Objectivity and ethno-feminist critiques of science," where she makes the argument that the impact of bias on science can be limited if we acknowledge and recognize that they exist (Cudd 96), Baron-Cohen believes that "It is by acquiring and using knowledge responsibly that sexism can be eliminated" (Baron-Cohen 11). Scientists can do better science when they are consciously aware of the biases that exist in the world. Baron-Cohen also defends himself against the critique that he is just stereotyping men and women by claiming that "stereotyping reduces individuals to an average, whereas science recognizes that many people fall outside the average range for their group" (Baron-Cohen 9). In his book he makes it clear that although more men on average have a systemizing brain, there are also men that have an empathizing brain, and although more women on average have an empathizing brain, there are also women who have a systemizing brain.

Fine allocates a significant portion of her book to criticizing the theory that male and female brains are hardwired differently. Her critiques are ideological, presenting the case that an essential difference between male and female brains is a justification of gender inequality, and therefore, has negative political implications because it suggests female inferiority. For example, the gender wage gap between men and women, where men of the same position and credentials as women usually earn more than women, has "neurological or hormonal roots" (Fine XXI). Fine claims that this theory is supporting a sexist society. She

continues to delve into ideology critique by claiming that a male and female brain “justifies a status quo in which politics, wealth, science, technology, and artistic achievement continue to lie primarily in the hands of (white) men” (Fine 91). Her critiques are entangled throughout her book and will be further discussed in the following pages.

Fine devotes one third of her book to Neurosexism. When neuroscience is used inaccurately and portrays sexist ideologies, it becomes neurosexism. According to Fine, “because the brain is such a biological organ, with its axons and fat and neurochemicals and electrical impulses, there is a temptation to chalk up whatever sex differences we see in the brain to differences in male and female nature” (Fine 170). Fine criticizes the negative personal and political effects of neuroscience when findings are not interpreted and communicated responsibly. The ideological critique of neurosexism presented by Fine is that “Neurosexism promotes damaging, limiting, and potentially self-fulfilling stereotypes” (Fine 174). In other words, males and females will be more inclined to conform to the gender status quo as a result of neurosexism. In the article “Gender Role Stereotypes, Expectancy Effects, and Parents’ Socialization of Gender Differences,” Jacquelynne Eccles, Janis Jacobs, and Rena Harold, review how parents influence self-fulfilling stereotypes in their children based on their perceptions of males and females due to neuroscience. They use the expectancy effect perspective to study parents’ socialization of gender role stereotypes which lead to self-fulfilling prophecies. For example, “gender differences in self-perception of their abilities may lead females and males to select different educational training programs, and to aspire to different occupations” (Eccles, Jacobs, and Harold 184). This self-fulfilling prophecy could be reason for the gender gap in professions like mathematics, physics, and engineering. Although the self-fulfilling prophecy were socialized into their children by their parents’ expectations, these expectations were formed as a result of neuroscience.

Fine also makes the assertion that neuroscientists and other researchers contribute to the “file-drawer phenomenon, whereby studies that do find sex differences get published, but those that don’t languish unpublished and unseen in a researcher’s file drawer” (Fine 134). This phenomenon is a form of biased reporting, or cherry picking. When scientists are consciously only reporting findings that verify their own beliefs, they are partaking in cherry picking; it is conscious form of confirmation bias. Eliot, too, discusses the file-drawer phenomenon. She states that omissions of negative findings contribute to distorted literature and biased reviews, and in turn, reinforce biological essentialism (Eliot 898). The file-drawer phenomenon is just one empirical critique expressed by Fine.

Empirical critiques are made when evidence is challenged. Fine empirically critiques several authors, including Baron-Cohen, based on the data provided or methodologies used in studies. Fine specifically articulates her empirical criticism of Baron-Cohen’s Empathy Quotient and Systemizing Quotient, which he uses to diagnose brain type-E or the female brain and brain type-S or the male brain. Baron-Cohen determines that those who score higher on the Empathy Quotient have a female brain and that those who score higher on the Systemizing Quotient have a male brain; those scoring about equal on both are determined to have a balanced brain. Baron-Cohen reports that women score significantly higher than men on the Empathizing Quotient and that men score significantly higher than women on the Systemizing Quotient. Fine turns to Amanda Schaffer, a journalist, to look at the concerns of these two tests and how the results of the tests are misrepresentative of the actual data which would be a form of cherry picking because it was done consciously. Schaffer found that less than half of the women who have taken the tests have a female brain, therefore, she questions how empathizing can be characteristic of the female brain when less than half of females actually have brain type-E. When

she questioned Baron-Cohen, he “‘admitted that he’s thought twice about his male brain/female brain terminology, but he didn’t disavow it’” (Fine 16), making his decision conscious. Fine goes on to criticize this test by claiming that it is not a valid test of empathizing because it is extremely subjective. Self-report measures, especially in relation to social sensitivity like the Empathizing Quotient, are often inaccurate in regards to their predictive validity; they rarely accurately predict interpersonal activity. Fine continues to critique Baron-Cohen’s measures of systemizing and empathizing by stating that the concept of gender is primed. These measures prime a gender identity by having participants note their sex prior to completing the questionnaire. In doing so, the participants tend to choose the more stereotypical answers for their gender (Fine 9). The items within the questionnaires also present choices that are clearly associated with a particular gender.

Baron Cohen and Jennifer Connellan’s newborn study was also empirically criticized by Fine for its methodology. In their study, they aimed to look at gender differences in infants so that they could rule out socialization as a factor for early gender differences. One hundred and two day-and-a-half old infants were offered to look at a mobile or Connellan’s face. This test was designed “to measure the babies’ interest in the face versus interest in the mobile: empathizing versus systemizing” (Fine 112). Results showed that males looked longer at the mobile, while females looked longer at the face. Baron-Cohen considered the difference in attention on the two to reflect innate, or hardwired, differences. According to Fine, however, his methods were easily scrutinized. For one, each of the stimuli were presented independently rather than simultaneously. This makes it hard to determine which the newborn had a preference for. Another consideration is that babies, in general, do not have very good eyesight and are therefore drawn to top-heavy patterns, like faces. In order to ensure that all stimuli are at the same degree of top-heaviness, the stim-

uli must be viewed from the same angle. In Baron-Cohen and Connellan’s study, the babies were not all tested from the same angle. The final critique of their methodology deals with the effects of experimenter expectancy. Connellan was accused of taking no precautions to eliminate information indicative of the babies’ sexes, which could result in unconscious differential treatment of the babies evident in motions, eye openness, and mutual eye gazes. Knowing the sex of even just some of the newborns being tested could impact the results of the study (Fine 115).

Fine devoted an entire chapter of her book, titled “Brain Scams,” to highlighting her empirical critiques of studies and scientists who take the same stance as Baron-Cohen, believing that the male and female brain are essentially different. Louann Brizendine, a neuropsychiatrist, received much criticism. A major empirical criticism of Louann Brizendine is that her facts are often false or nonexistent in the literature that she cites. When examining Brizendine’s claim, which coincides with Baron-Cohen’s claim that female brains are wired for empathizing, she found that the data often did not compare males and females, that the data was speculative, that the data she presented contradicted the data found in her references, and that her claims were untrue (Fine 161). Eliot also notes that Brizendine’s claims tend to be “bold confabulation[s]” (Eliot 896). This strong criticism accuses Brizendine of fabricating, distorting, and exaggerating data.

It is not only Brizendine who provides false claims in support of her theory. Fine goes on to criticize the absurd claim made by an educational consultant that “girls see the details while boys see the big picture because the ‘crockus’ . . . is four times larger in girls than boys” (Fine 162). The “crockus” does not exist, giving his claim no scientific support. Fine infers that he made this claim as an educational consultant in support of single-sex schools. If authorities can be convinced that males and females have two different brains that learn differently, support can be gath-

ered for single-sex schools. Leonard Sax is another educational speaker from the National Association for Single Sex Public Education who too uses neuroscience, or the brain, to defend the need for single-sex schooling. In Fine's book, she reports the accusations that Sax's claims are fabricated through over-interpretations and misinterpretations of data. Eliot also criticizes Sax for making claims that encourage gender segregation in schools (Eliot 895). Even if structural differences resulted in sex differences, Fine suggests that "there is no reliable way to translate these brain differences into educational practices" (Fine 167). Her criticisms of these men were both empirical due to false evidence and ideological due to the perceived negative implication that it would have (sex segregated schools).

In the introduction, Fine states "When we follow the trail of contemporary science we discover a surprising number of gaps, assumptions, inconsistencies, poor methodologies, and leaps of faith as well as more than one echo of the insalubrious past" (Fine XXVII). In regards to the "insalubrious past," Fine is referencing a completely sexist history where women had no rights and the gender inequalities were even greater than they are today. In the late eighteenth century, facial verticality was used to measure intellect. This idea of facial verticality was used to support women's inferiority to men. Later it was not facial verticality, but the cephalic index, or "the ratio of skull length to skull breadth" (Fine 132) that correlated with female inferiority because it was believed to measure mental capacity. This measurement was later revoked due to the observation that there was no difference between the head shapes of the "inferior" and "superior" social groups (females and males respectively). Next, women were deemed inferior to men due to their brains being smaller and lighter. Eventually, "it became unavoidably evident that one could be slight of brain but substantial of intellect (and vice versa)" and so "the hypothesis was reluctantly abandoned, and the brains searched more intimately for the neural

correlates of female inferiority" (Fine 132). The mid-nineteenth century was considered to be the beginning of the neuroscience of sex differences. Male scientists and medics used their findings to oppress women acting as a source of opposition to women's suffrage and equal education. Neuroimaging technology replaced tape measure and brain sales used in the Victorian era. Fine warns scientists not to fall into the same traps as the professionals in the past because what was in the past deemed modern and sophisticated, is now viewed as absurd and irrational. Fine also highlights the asymmetry of power and status that the sex differences presented by the scientists in the past created. She noted that it was not until the mid to late twentieth century that the "US legislation require that married women be able to apply for credit in their own names. And... that it became possible in the eyes of the law for a British husband to rape his wife" (Fine 79).

Fine even points out the history of male and female dress, and how this has changed over time. Today, blue is considered to be a stereotypically male color, while pink is considered to be a stereotypically female color. This color phenomenon, however, is recent. Through the end of the nineteenth century, children, for the most part, wore unisex white dresses. When colored fabrics were produced for children, the pink-blue labeling of gender was reversed. Pink was deemed a stronger color, and was therefore associated with boys, while blue was reserved for girls because it was delicate, dainty, and a symbol of faith. According to Fine, these associations were created to demonstrate gender distinctions, and continue to do so today. Fine uses the fact that the current pink-blue labeling did not emerge until the mid-twentieth century to support the view that gender color preferences cannot have a genetic or evolutionary origin because these preferences are less than a century old (Fine 208-209).

Baron-Cohen also refers to history in his book. He references a past where "the very idea of psychological sex differences would have triggered

a public outcry” for “the 1960s and 70s saw an ideology that dismissed psychological sex differences as either mythical, or if real, nonessential” (Baron Cohen 10). He suggests that in the past, people held too simplistic of a view, a view that assumed sex differences were solely due to culture. In his book, he does not reduce sex differences to just biology, for he asserts that this would be doing the exact opposite error that was made in the past. Although he argues that the male and female brain are hardwired for systemizing and empathizing respectively, he does not reduce the differences in the behavior of males and females only to biology. Even though he articulates that his research is not stereotyping nor is it oppressive, he felt that even in the 1990s the topic of psychological sex differences was too politically sensitive to be publically debated. For this reason, he waited to complete *The Essential Difference: Male and Female Brains and the Truth About Autism*, and postponed its publication until 2003, a new millennium which he believed was impacted by feminism. With the emergence of feminism, he found that although there were things that men could do better than females, there were also things that women took pride in doing for they could do them better than men. He felt this new millennium would be more accepting of his theory because of the rise of feminism.

Eliot discusses how “sex differences in the brain are real and clinically important but often grossly distorted in popular discourse” (Eliot 895). Sex differences are often misrepresented in, and misinterpreted by, the media and press. She notes the negative political implications that result from uninformed literature or broadcasts, stating that “popular portrayals of sex differences in the brain are riddled with claims that are highly extrapolated, misinterpreted, or just made up but are nonetheless used to justify the differential treatment of boys are girls in school or men and women in the workplace” (Eliot 896). Eliot mentions that even when scientific claims are challenged and proven wrong, if they have already been published

in popular magazines or broadcasted on popular television stations, readers tend to still believe the original claim to be true. This is related to the irrational primacy effect that was discussed in Sara Gorman and Jack Gorman’s, *Denying to the Grave: Why We Ignore the Facts That Will Save Us*. They define this effect as “giving more credence to what we hear or experience first than everything that follows” (Gorman and Gorman 110). When early and, sometimes irrational, findings on sex differences receive high-profile media attention, future perceptions on the topic will likely become colored. Fine reports that the negative impact of misrepresented media attention to topics like sex differences is 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” (Fine 172). These stereotypes are projected throughout various media sources.

Children’s literature, children’s television shows, television advertisements, and movies often reflect sex-typical norms. Fine believes that “The power of the media to dish up a stripped-down, concentrated version of cultural values enables it to represent the higher status of males in this uncomfortable blunt fashion” (Fine 222). For example, in classic picture books women were often pictured wearing an apron, illustrating the sexist stereotypes that women belong in the kitchen or performing household chores (Fine 219). In text, female characters were described as “*beautiful, frightened, worthy, sweet, weak, and scared*... the other gender as *big, horrible, fierce, great, terrible, furious, brave, and proud*” (Fine 220). These adjectives reveal a clear distinction between the attributes that men and women are perceived to have. Female characters are less often represented in the plot of adventure books than males, and are overall less represented than males on TV and in commercials which demonstrates the idea that males are valued more than females in society. In regards to commercials and in on-

line toy advertisements, gender stereotypes are often expressed. Girls are represented playing with princesses, dolls, and kitchen sets, while boys are represented playing with Legos, cars, and action figures. Today's media is plagued with the projection of gender stereotypes.

Fine argues that "Our minds, society, and neurosexism create difference. Together, they wire gender. But the wiring is soft, not hard. It is flexible, malleable, and changeable" (Fine 239). Fine believes that human brains are soft-wired, allowing them to be molded through socialization. Baron-Cohen, on the other hand, argues that, on average, males are hardwired for systemizing and women, on average, are hardwired for empathizing. Based on the evidence presented, it seems that sex differences are almost equally influenced by biology and culture. Sex differences appear to be prewired, where males appear prewired for systemizing and females prewired for empathizing, but these wirings can be either altered or supported based on the culture and social context that one is in. As greater technological advancements are made in neuroscience, scientists can continue to study the brain with greater precision and accuracy, and gain further insight to support or refute a side in this debate.

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