

Sex Differences: Applying the Naturalist Paradigm[®]

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In this essay, I argue that men and women are born to exhibit a host of different behaviors that resist change, and these should be incorporated into social conventions (laws, customs, rearing, schooling, work, etc.). Embracing these differences in complex behavior would improve the welfare of both sexes, but many people resist this, clinging to the myth created by sociologists that culture accounts for readily observed differences. They claim the sexes would be practically indistinguishable were it not for learned behavior, were it not for gender bias. After more than half a century in which this misguided notion directed social change, society is still male-dominated. Rather than helping, the gender bias myth impedes efforts to elevate women's welfare, and it persists because most people are unfamiliar with new scientific findings that shatter its premise.

Before proceeding, note that sex, and not gender, is the proper term for this discussion. "Traditionally, *gender* has been used primarily to refer to the grammatical categories of 'masculine,' 'feminine,' and 'neuter,' but in recent years the word has become well established in its use to refer to sex-based categories, [which] is supported by the practice of many anthropologists, who reserve *sex* for reference to biological categories, while using *gender* to refer to social or cultural categories" (American Heritage Dictionary). Anthropologists make their living by studying culture, and this usurpation of a grammatical term serves their self-interest. Social and cultural categories related to males and females are largely woven from the cloth of biology, and the biological term sex encompasses all differences between males and females, including reproduction and my focus here, complex behavior.

Despite sociologists' claims, sexual dimorphism in complex behavior is largely innate as opposed to learned, that is, the traits are inherited via genes, largely independent of environmental context, and will not change much, if at all. I call this the naturalist position, and its extension the naturalist paradigm. The brain's form and function, its physiology and how it works, vary dramatically between the sexes because of biological factors.

These innate sex differences in complex behavior include emotion, emotion processing, perception, spatial ability, verbal ability, reasoning, negative affect, risk taking, nurturance, empathy, systemization, memory, vision, hearing, processing

faces, pain perception, navigation, neurotransmitter levels, and stress hormone action on the brain (Cahill 2006; Schmitt 2005).

To persuade you to join me in adopting the naturalist position, I begin by discussing the larger context, and then proceed to the biological evidence, a catalogue of differences, what they mean and don't mean, more on the myth of gender bias, and illustrations of social change under the naturalist paradigm.

The Context

Most social conventions rely on an understanding of human behavior, so ignoring any inherited, context-independent, and intransigent dimensions results in counter-productive efforts, discriminatory conventions, or, in some cases, harm to individuals. Examples include using the normal criminal justice system to handle sexual deviates and sociopaths, assuming homosexual behavior is learned, treating normal people as if they all have equal intelligence and learning capacity, treating addictive behavior as if everyone has the same capacity for choice, misunderstanding reactions to racial differences, ignoring the determinants of choice behavior in favor of various concepts of free will, refusing to accept hierarchical behavior as natural, treating teenagers as fully mature, and advising parents their children's personalities and "coming of age" behaviors are significantly malleable.

This issue joins a larger one asking how society should apply science, especially findings that challenge popular practices or beliefs. Constructionists and essentialists answer differently, the former viewing scientific facts as merely "constructions" of human minds and culture. Essentialists believe scientific truths reflect actual properties of the objects of study, and are not simply human interpretations or mental creations (Mealey 2000). They believe the business of science is to explain how the world really works, not how it ought to work according to some wishful schema or other. It is imperative to understand each person's unique strengths and weaknesses, many of which result from their evolved nature... including sex differences in complex behavior.

Finally regarding this issue's larger context, I dismiss claims that the naturalist paradigm commits what has been called the "naturalistic fallacy," a straw man concocted by sociologists. Of course we should avoid claiming we "ought" to do something solely on the basis of what "is"—David Hume's famous "is-ought" moral dilemma—but ignoring natural truth is worse, and should be derided as sophistry. Society is better off for its dreams and lofty ideals, but worse off

for the efforts of sophists who refuse to incorporate natural truth in trying to reach these worthy goals. Nazi programs of racial purity and the eugenics movement, more straw men, are horrible historical examples, but they represent political abuses of science, not bad science (Brune 2001).

Biological Evidence

The science supporting the naturalist position is powerful, but only became available in the past few years, suggesting we forgive sociologists for clinging to their myth. Biologically, that myth is largely founded on the belief that the human brain is unique in that undifferentiated neurons migrate to the cerebral cortex, the seat of our advanced intellect, where they undergo a “proliferate and prune” process, are structured in form and function by the environment, and not the genetic architecture. In other words, sociologists claim that humans are born with a “blank slate” for a mind, and culture (learning) molds them into individuals (Pinker 2002). As late as 2002 scientists reported that, “Genes encoded on the sex chromosomes are not thought to contribute directly to sex differences in brain development” (Carruth 2002). New evidence based on advanced tools and techniques changed that view.

As we all know, females have two X chromosomes, one from each parent, while the male has an X from the mother and a Y from the father. Biologists once judged this dimorphism to be of limited functional consequence because the second X chromosome in females was inactivated and the Y chromosome was thought to contain few genes. That view changed in 2003, when the Y chromosome was sequenced and found to contain many functional genes (Skaletsky 2003). The X chromosome was sequenced in 2005 (Ross 2005), completing the final outline and launching more detailed studies into what it means to have XX (female) or XY (male) chromosomes. In the first few days after fertilization, the human embryo develops in a sexually ambiguous manner, but then the newly-discovered Y-chromosome gene *Sry* is activated, after which testes, organs and other tissues differing between males and females, including the brain, set off on their sex-specific development paths (Wilhelm 2006). If the *Sry* gene is absent, the gonad develops as an ovary, and the body, unexposed to testicular hormones, forms a feminine configuration. Sex-specific differences in the brain were once attributed to the action of steroid hormones produced by the gonads. Although these are still important factors, recent data suggest genetic differences have a direct, rather than “down stream” role (Wilhelm 2006).

With two X chromosomes, the female must avoid over expression of a shared gene, so one X chromosome is silenced (X inactivation) early in fetal development (Ross 2005). The recently-completed genetic sequence of the X chromosome confirms that an unusually large number of its genes code for proteins important to brain function (Check 2005). Not coincidentally then, mental retardation is significantly more common in males (with their single X chromosome) than in females (who have two X chromosomes, one of which is used to repair the other’s defective gene related to brain function). And the X chromosome genes linked to mental disabilities play crucial roles in normal brain functions, like learning, memory and the growth of brain cells (Ropers 2005).

More evidence that genes on the X chromosomes are involved in higher cognitive functions comes from a British study of 4,000 sets of monozygotic twins (commonly, identical twins). Some traits linked to antisocial behavior (peer problems, and poor verbal ability) were found to be more alike in male twins than in female twins. This follows if you consider identical twin sisters will express different X chromosome genes due to the random inactivation process, whereas males “are stuck with what they have;” they should be more similar. Dizygotic (fraternal) twins showed the reverse pattern of correlations, which is also consistent with the X chromosome playing an important role in higher cognitive functions (Loat 2004).

About 15% of the female’s X chromosome genes escape the inactivation process, meaning the female and male genome varies in at least four ways. First, the Y chromosome endows the male with at least several dozen genes absent in the female. Second, the incomplete nature of X inactivation means at least 15% of X-linked genes are expressed at characteristically higher (but often variable) levels in females than in males. Third, a minimum of an additional 10% of genes show heterogeneous X inactivation and thus differ in expression levels among females, whereas all males express a single copy of such genes. And fourth, the random nature of X inactivation indicates females, but not males, are mosaics of two cell populations with respect to X-linked gene expression (Carrel 2005). And, remember, an unusually large number of genes on the X chromosome are involved in brain functions.

Evidence from the study of Turner’s syndrome is also revealing of the genetic variations effecting human cognition. This disorder effects females in which all or part of one X chromosome is deleted. In one study involving 80 females with Turner’s

syndrome and a single chromosome, members of the group whose single X chromosome was inherited from the father exhibited superior verbal and higher-order executive functions skills, which mediate social interactions (compared to the others in the study whose single X chromosome was inherited from the mother). Thus, it was suggested there is a genetic locus for social cognition, which is paternally imprinted and not expressed from the maternally derived X chromosome (Skuse 1997).

Many scientists believe the sex chromosomes are actually evolutionary antagonists, which accounts for the sexual dimorphism in complex behavior (Arnold 2004). (Conflict in sex-specific genes has been shown in the fruit fly, *Drosophila* (Pischedda (2006).) Evolution probably involves a constant tug-of-war between XY and XX cells, creating on the one hand sex differences in gene expression meant to differentiate XY and XX cells in some tissues (for example, it is essential for gonad differentiation), while on the other hand keeping XY and XX cells as equivalent as possible in other tissues (which is important for processes depending on X- and Y-specific genes, but taking place in tissues with equivalent functions in males and females). The very fact single genes often control distinct and not necessarily related processes in different cell types means sex differences in the expression of those genes may produce adaptive effects in some but maladaptive effects in other tissues. Evolution is likely to favor the emergence of sexually dimorphic processes that would counter the latter effects, which processes include those of the brain (De Vries 2004).

Moving beyond X and Y chromosomes, one of the oldest sociological studies notes the difference between men and women regarding aggressive behavior, and new evidence finds a biological base. Emotion in men and women is regulated by a network involving the amygdala, hypothalamus, and other brain structures, with the orbital frontal region modulating this emotional outpouring. Importantly, the amygdala is involved in excitatory (quickly responsive) aspects of emotional behavior. This led to the prediction women would have higher orbital relative to amygdala volume than men, and recent magnetic resonant imaging (MRI) studies confirmed this difference. Women have a larger volume of their frontal cortex devoted to emotional modulation than men, which corresponds to the observed sexual dimorphism in aggressive behavior (Gur 2002).

Related to this, men who score highest on a test measuring psychopathic tendencies have lower volume in this frontal lobe (Matsui 2000), and prefrontal gray matter is smaller in people exhibiting

antisocial personality disorder, generally those with low arousal, poor fear conditioning, lack of conscience, and decision-making deficits (Raine 2000).

More physiological evidence is found in the amygdala. This part of the brain is crucial to enhanced memory associated with emotionally arousing events, and functional magnetic resonant imaging (fMRI) studies reveal sexual dimorphism in hemispheric lateralization; men's memory of arousal utilizes the right hemisphere, whereas women use the left (Cahill 2004). In earlier studies of the same arousing events, but using impairing chemical intervention, women were found to be more impaired in local memories and men more impaired in global ones (Cahill 2003).

Older observational studies have also shown that men and women differ as to their spatial skills, and new research reveals a biological source. In a visual object reconstruction test utilizing fMRI, scientists found that men engage predominantly the brain's right hemisphere, whereas women show left-hemisphere preponderance. The right hemisphere has long been associated with spatial/synthetic strategies (in both sexes), whereas the left hemisphere is employed in verbal/analytic strategies. This correlates with observed sex differences in spatial (males) and verbal (female) skills (Georgopoulos 2004).

In a related study, it was discovered that sex differences exist in the functional organization of the brain for language. In tests of letter recognition, rhyming, and semantic categorization, fMRI scans revealed different brain activations between men and women, with more lateralization (using only one side of the brain) in men, compared to more diffuse brain activation in women (Shaywitz 1995).

Tests of general working memory show no sexual differentiation, despite physiological differences in the parts of the brain involved in working memory. New evidence using fMRI demonstrated significant sex effects in the pattern and magnitude of signal-intensity changes during working memory tests, despite comparable levels of performance. Women were more likely than men to show significantly greater activations in the prefrontal regions, which are the regions of the brain encoding and retrieving visuospatial, semantic, and phonological information. Furthermore, sex differences were also noted in activation of Broca's area, the part of the brain involved in language processing. Men and women might have the same capacity for working memory, but they achieve it by using different parts of the brain (Goldstein 2005).

Furthermore regarding intelligence, individual variations in gray matter and white matter volumes in specific areas of the brain are strongly related to general intelligence (Haier 2004), but from a population standpoint, men and women show no intelligence variations, despite having different gray and white matter volumes in the areas critical to overall intelligence. In men, intelligence/gray matter correlations are strongest in frontal and parietal lobes, whereas the strongest correlations in women are in the frontal lobe along with Broca's area. Men and women apparently achieve similar general intelligence results with different brain regions (Haier 2005; Allen 2003).

Studies using fMRI have also shown significantly greater cortical thickness in women compared to men, even after correcting for individual differences in brain size (being bigger, men's brains are also bigger overall). This suggested a dimorphic organization in male and female brains involving the cortical mantle, and, in the analysis of these scientists, "may have functional significance and possibly account for gender-specific abilities and/or behavioral differences between sexes" (Luders 2005). The corpus callosum links the brain's two hemispheres, and sexual dimorphism has been found in the size of this structure in adults (Tuncer 2005) and in its height in neonates (Hwang 2004). Other imaging and postmortem research shows sexual dimorphism in several other specialized areas of the brain, including the cerebrum, Broca's area (the brain's "language center"), hippocampus, caudate, thalamic nuclei, anterior cingulate gyrus, parietal lobe and corpus callosum (Goldstein et al 2001).

Lastly, we recognize that human studies revealing the brain's sexually dimorphic form and function involved noninvasive techniques, but the fact that male and female brains differ in exactly the same way across the globe, and regardless of culture, demands a genetic explanation. Nonetheless, more invasive research like genetic manipulation would be helpful. Fortunately, this valuable research is possible in laboratory animals, and importantly to human translation, new genetic research reveals we share a surprisingly large number of genes with other animals—more proof of evolution. And this evidence for genetically-directed sexually dimorphic behavior is exceptionally strong.

First in this recall of animal studies is one revealing that the immature cerebral cortex in rats self-organizes into local neuronal clusters long before it is activated by patterned sensory inputs from the environment (Dupon 2005). Also in rats, the neurons extracted from female cortexes survived longer in a

culture medium than did male neurons, indicating the effects of sex are not limited to parts of the brain mediating reproduction (Zhang 2003). Tests on adult laboratory rats demonstrate a direct effect on the brain by the male-only *Sry* gene, without any mediation by gonadal hormones. Genetic analysis (called microarray analysis) identified more than 50 genes that show a sex-specific pattern in the brain at an embryonic stage too early for any environmental or gonadal hormone influence (Dewing 2006). Male and female rats differ in their responses to acute stress, with males increasing the growth of neuronal spines and females suppressing such growth. Female rats are less vulnerable to the disruptive effects of stress, which is traceable to sexual differences in the hippocampus (Bowman 2001). In prairie voles, a few genes determine whether the male mammal will exhibit monogamous or polygamous behavior (Hammock 2005). Recent work on the fruit fly (*Drosophila*) reveals a gene that controls the male's courting behavior. Importantly, the neurons involved in this behavior also exist in the developing female brain, but die out at maturity because they lack this male-only gene. When genetically-manipulated to introduce the gene's protein, female fruit flies exhibit male courtship behavior (Kimura 2005). Interestingly, this same gene has been found to be responsible for sex differences in aggression and dominance (Vrontou 2006).

New research on primate brains reveals anatomical differences between the sexes, which correspond with the different social roles of males and females. Evolution through sexual selection has resulted in males having larger brain structures in areas known to control aggression and physical conflict. Female brains, on the other hand, have enlarged brain structures used in social maneuvering, their primary means of sexual selection (Lindenfors 2007; see Dunbar 2007 for an analysis).

In summary, "It is now known that there is considerable variety in the nature of structural sexual dimorphisms in the brain and these include the size of specific brain regions, the extent of dendritic arborization, differences in the density and pattern of synaptic connections (e.g. spine and somatic synapses), size, number and phenotype of neurons in a particular region and astrocyte morphology. Functionally, the structural sexual dimorphisms in individual brain regions give rise to sex differences in neuronal circuitry and thus differentiation of the responses to outside influences (Wilson 2007)." Scientific research conducted within the past few years has revealed previously undetected sexual dimorphism, indicating the differences uncovered so

far represent only a fraction of those likely existing in the human brain (Cahill 2006). This new evidence is confirming the biological basis for older, observation-heavy research, and finally answering the troubling question of why some behavior resists even the most extensive efforts to change it, why nearly half a century of applying the gender bias myth has still left us with a male-dominated society. And by male-dominated, I mean our social conventions favor those behavioral characteristics more common to males than females.

The Behavioral Differences

So, what are these innate behavioral differences between men and women? Here is a quick summary of decades-old observations, which have been extensively replicated, have proven to be persistent in the face of teaching different behavior, are now buttressed by physiological findings, but which most sociologists still insist are products of cultural bias (this list is provided by Baron-Cohen 2002, who provides references of all original research):

1. Sharing and turn-taking. On average, girls show more concern for fairness, whereas boys share less. In one study, boys showed fifty times more competition, while girls showed twenty times more turn-taking.
2. Rough and tumble play. Boys show more “rough housing” (wrestling, mock fighting, etc.) than girls do.
3. Responding empathically to distress. Girls from 1 year old show greater concern through more sad looks, sympathetic vocalizations and comforting. More women than men also report frequently sharing the emotional distress of their friends. Women also show more comforting, even of strangers, than men do.
4. Using a “theory of mind.” By 3 years of age, little girls are already ahead of boys in their ability to infer what people might be thinking or intending.
5. Sensitivity to facial expressions. Women are better at decoding non-verbal communication, picking up subtle nuances from tone of voice or facial expression, or judging a person’s character.
6. Empathy. Women score higher than men on tests of empathy.
7. Values in relationships. More women value the development of altruistic, reciprocal relationships. In contrast, more men value power, politics, and competition. Girls are more likely to endorse cooperative items on a questionnaire and to rate the establishment of intimacy as more important than the establishment of dominance. Boys are more likely than girls to endorse competitive items and to rate social status as more important than intimacy.
8. Disorders of empathy. Disorders such as psychopathic personality disorder and conduct disorder are far more common among males.
9. Aggression. Males show far more ‘direct’ aggression (pushing, hitting, punching, etc.) whereas females tend to show more ‘indirect’ aggression (gossip, exclusion, etc.).
10. Murder. Male on male homicide is 30-40 times more frequent than female on female homicide.
11. Dominance hierarchy. Males are quicker to establish hierarchies of dominance.
12. Language style. Girls’ speech is more cooperative, reciprocal and collaborative. Girls are able to keep a conversational exchange with a partner going for longer. Boys’ talk is more single-voiced discourse (presenting their own perspective alone), whereas female speech style is more double-voiced discourse.
13. Emotional talk. Women’s conversation involves much more talk about feelings, whereas men’s conversation with each other tends to be more object- or activity-focused.
14. Parenting style. Fathers are less likely than mothers to hold their infant in a face-to-face position. Mothers are more likely to follow through the child’s choice of topic in play, whereas fathers are more likely to impose their own topic. And mothers fine-tune their speech more often to match what the child can understand.
15. Face preference and eye contact. From birth, females look longer at faces, and particularly at people’s eyes, and males are more likely to look at inanimate objects.
16. Language ability. Females have also been shown to have better language ability in general than males.
17. Toy preferences. Boys are more interested than girls in toy vehicles, weapons, building blocks and mechanical toys, all of which are open to being systemized.
18. Math, physics, and engineering. Males on average score 50 points higher than females on the SAT’s math portion. Taking only those people scoring above 700, the sex ratio is 13:1 (men to women).
19. Constructional abilities. On average, men score higher on tests for assembling a 3-D mechanical apparatus, and at constructing block buildings from 2-D blueprints. Boys show more interest in playing with Lego blocks, and boys as young as 3 years are also faster at copying 3-D models of

- outsized Lego pieces, and older boys, from the age of 9, are better at imagining what a 3-D object will look like if it is laid out flat. They are also better at constructing a 3-D structure from just an aerial and frontal view in a picture.
20. Field dependency. Females are more field dependent—that is, women are relatively more distracted by contextual clues, rather than considering each variable within the system separately. They are more likely than men to erroneously say a rod is upright if it is aligned with a frame (that is tilted).
 21. Attention to relevant detail. Attention to relevant detail is superior in males. On average, males are quicker and more accurate in locating the target embedded within a larger, complex pattern. Males, on average, are also better at detecting a particular feature (static or moving).
 22. Mental rotation. Males are quicker and more accurate in predicting how an object will appear after it is rotated.
 23. Map reading. Boys perform at a higher level than girls in map reading. Men can also learn a route in fewer trials, just from looking at a map, correctly recalling more details about direction and distance. If you ask school children to make a map of an area they have visited only once, boys' maps have a more accurate layout of the features in the environment than girls' maps. More of the girls' maps make serious errors in the location of important landmarks. The boys tend to emphasize routes or roads, whereas the girls tend to emphasize specific landmarks (the corner shop, etc.). Boys emphasize directional cues, whereas girls' emphasize landmark cues.
 24. Motor systems. If you ask people to throw or catch moving objects (target directed tasks) such as playing darts or intercepting balls flung from a launcher, males tend to be better. Equally, if you ask men to judge which of two moving objects is traveling faster, men are on average more accurate.
 25. Mechanics. When asked which direction levers will move when an internal mechanism (of cog wheels and pulleys) of one type or another is used, men score significantly higher on this test than women.

Finally, sex differences in perceptual and motor skills are worthy of special note, because use of the sensory system involves no conscious awareness—it does not involve the cognitive system. Thus, it is immune to any purported effects of cultural bias. Sex differences at the sensory level are found in newborns, and it is widely held by most scientists (including

sociologists) that the sensory system greatly influences later, more complex behavior. Thus, if sex differences are found here, it is easier to postulate sex differences in complex behavior, which does require conscious awareness. Sex differences have been found in hearing (including loss due to age), odor perception, visual acuity, taste perception, and touch sensitivity. While these findings in the sensory system do not prove sex differences in more complex behavior, they make it even more unlikely such differences are attributable to cultural bias (Halpern 2000).

What They Mean and Don't Mean

Foremost among the things to remember when considering these behavioral differences is this: they are population indicators (females or males). This means there are individual exceptions, a lot of them in the case of some behaviors. But this same caveat applies to all genetically-based characteristics, like disease susceptibility and maladies of the brain (e.g., schizophrenia, autism, and anti-social behavior). While this means nothing absolute can be said about any individual's behavior, characteristics can be surmised, and will be correct for most individuals in the population. These genetically-endowed characteristics are part of what makes you a unique person, regardless of the fact that many of them are shared by most others in a selected population (males and females, in this case). Everyone should be treated as an individual, of course, but we cannot escape the fact that at least the initial focus of most social conventions and institutions is necessarily directed at or applied to populations, so these group characteristics are extremely important.

Furthermore, the naturalist position does not entail genetic determinism. Genes are designed to interact with the environment, often expressed or inactivated depending on what is encountered, so saying complex behavior is genetically determined is not correct. We can only say with absolute confidence that all behavior is expressed within the framework constructed by genes, and the rigidity of that framework varies with the behavior involved (e.g., autonomic behavior, like breathing and constricting the heart, is performed in rigid compliance with genetic instructions).

There (probably) is no single gene for aggressive or nurturing behavior (for instance), only sets of alleles (different genes at the same DNA location) usually associated with these behaviors, which are resistant to most environmental influences or cultural interventions. The probability that a certain genotype (the sum total of a person's alleles) will result in a particular behavioral expression varies

by type of behavior, which is the same principle we find with, say, the alleles producing schizophrenia. If you have these genes, your chances of suffering schizophrenia are very high (and certain, or extremely rigid in the terminology I am using here, if you have the genes for Huntington's disease).

Along these same lines, the alleles responsible for psychopathic behavior have been identified, but are only expressed—a psychopath is “born”—if an extremely abusive environment is encountered during childhood. Importantly, those who experience the same environment but do not have these genes do not become psychopaths (Caspi 2002).

So genes alone do not determine behavior, but environmental determinism is equally false. Aggressive or nurturing behavior is not solely due to learning, culture or the socialization process (as just noted regarding psychopaths). The “right” genetic framework is required. An influential study widely endorsed by sociologists reported “virtually every aspect of early human development, from the brain's evolving circuitry to the child's capacity for empathy, is affected by the environments and experiences that are encountered in a cumulative fashion, beginning in the prenatal period and extending throughout the early childhood years” (Shonkoff 2000). This statement is not wrong, but it says nothing about how much the environment can actually change the brain's functional development, and new scientific discoveries provide this answer: “Not much.”

In summary of what the scientific findings mean, we can now say that every human has behavioral propensities resulting from their genotype, and, while it was once common to say the genomes of two randomly selected people exhibit 99.9% nucleotide identity, in today's reality, this statement holds only if one is comparing two males, or two females (Skaletsky 2003).

The Gender Bias Myth

Before discussing social changes suggested by the naturalist paradigm, I examine the mistaken concepts of gender bias. It originated in the 1950's with the work of behavioral scientists like B.F. Skinner and James Watson. Watson is famous for saying he could take any baby and make him into a doctor, lawyer, etc., and, while most sociologists have moved away from this extreme view, they still refuse to give nature its due. A commentary by Ben Barres included in the prestigious scientific journal *Nature* neatly illustrates the gender bias myth (Barres 2006). He focuses on women in science, but his arguments are universal to the howls of those denying modern scientific evidence.

Barres contends social bias largely accounts for the under representation of women in science, and not innate differences as suggested by those he mentions, former Harvard President Larry Summers, Peter Lawrence, and scientist Steven Pinker (Lawrence and Pinker wrote scathing rebuttals to Barres' commentary in the 3 August 2006 edition of *Nature*). Barres calls the view espoused by these men (and supported by this essay) the “Larry Summers Hypothesis,” which is itself a cheap, theatrical association with a single controversial speech; in fact, Summers is not a biologist, but an economist. A better term is the one I've used, the naturalist hypothesis.

To his discredit, Barres introduces a straw man, equating the view that there are innate behavioral differences between the sexes with racial prejudice. This is unworthy of the sociologists' otherwise honestly-intended arguments. After all, both naturalists and sociologists seek to change our male-dominated culture, but equating an alternative perspective with racism is malicious and slanderous, supported by emotion, and not facts.

Barres next repeats another deceit common to sociologists, saying, “I am suspicious when those who are at an advantage proclaim that a disadvantaged group of people is innately less able.” Well, I am suspicious too, because that is... not what is posited by naturalists. The distinctive, innate character of either sex does not make them inferior or less good. In fact, the female's unique, innate behavior makes her ideally suited for as many productive life pursuits as it might make her less suited (the same should be said about men), but none of this remotely suggests inferiority.

Barres also says, “Despite powerful social factors that discourage women from studying maths and science from a very young age, there is little evidence that gender differences in maths abilities exist, are innate or are even relevant to the lack of advancement of women in science.” He fails to even give a hint as to what these “powerful social factors” are, and cites only one study of children plus one of women who won a prestigious science award, conveniently omitting the hundreds of peer-reviewed, replicated scientific studies showing that differences in math abilities exist, even after adjusting for possible learning prejudices (gender bias). On average, males score 50 points higher than females on the SAT's math portion (Baron-Cohen 2002).

Barres next repeats his convenient omission when responding to assertions that women are more emotional than men, saying, “There is absolutely no science to support this contention.” He needs to do more research, because his statement is patently false.

There are many reputable, replicated studies proving this important difference in behavior, which Baron-Cohen (2002 and 2003) details.

In summary, the gender bias position is scant on scientific evidence, intentionally omits hundreds of contradictory findings, and almost totally relies on emotion-laden research showing real and alleged wrongs committed against women. Thus, the only solid argument they have is this: women are not treated as well as they should be. And, of course, this has nothing to do with the science of behavioral differences between the sexes. In fact, were the naturalist paradigm widely accepted and used to bring about social change, women would be better off. "If female skills and abilities are devalued, the fault lies in the society that we have created, not in the biology that has created us" (Halpern 2000).

Social Change

Society cannot change much of human behavior, therefore, it must adapt to nature in order to achieve the lofty goals our higher intellect permits, like ending a male-dominated culture that disadvantages women. But the naturalist paradigm does not insist we ignore the individual in favor of group characteristics. That charge better applies to those who think an individual can become anything they want if they only apply themselves via learning, or that an individual is solely made by, say, bad parents or other poor learning environments (part and parcel of the gender myth). Under that dogma, there is no individual, as such, only a malleable human. Whether we like it or not, most social conventions first apply themselves at the group level (think of parenting advice, school admissions criteria, hiring, promotion, etc. to see what I mean). Only later can individuals be treated as such, and, as I'll discuss below, the naturalist paradigm is superior at recognizing individuals.

I begin with the concepts behind using the naturalist paradigm, and an example from a related realm illustrates the first of these. It is easy to see sexual dimorphism in physical strength, and facing this natural, immutable truth resulted in helpful social changes. Today, women are not disadvantaged as a group in competing for many jobs, say firefighter, because society altered the job, improved the equipment, then changed its qualifications rather than fitting the person to it, which had favored men as a group. Of course, many women were never handicapped because they are bigger and stronger than many men, but the existence of those exceptional women did not dissuade society from ameliorating the real disadvantages faced by more women than men.

(Sadly, many groups buying into the gender-bias myth and championing women's rights refuse to recognize that they are often fighting for a minority among their constituency.)

Another important concept is this: scientific knowledge should be used to create opportunities. No natural fact regarding normal human behavior (of either sex) precludes opportunity creation, which is neatly illustrated by an even more controversial behavior showing no sexual dimorphism, general intelligence. As noted by the American Psychological Association (APA), "Individuals differ from one another in their ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by taking thought. Concepts of 'intelligence' are attempts to clarify and organize this complex set of phenomena." Scientists call this ability general intelligence, or *g* (Gray 2004). Given that we desire a humane society, this admission of difference only means societal conventions and institutions should be designed to ensure that general intelligence is not the only human attribute providing an avenue to individual well being. After all, the skills measured by *g* are not the only characteristic we should value in a human being (a social judgment). Unfortunately, society now overwhelmingly favors those of superior general intelligence (e.g., the large salaries following academic success). This is a subject for social change, but outside this essay's purview because, while men and women do process information differently, measures of general intelligence show no differentiation by sex.

Nevertheless, the concept is the same for the sexually dimorphic behavior that does exist. Most social conventions evolved or were designed in less enlightened eras, when men dominated all parts of society. As a result, our culture is male-dominated, which means our social conventions are framed within the context of behavior more common to men than women. It's good to continue our work toward ending this era, but pretending women can behave like men in all aspects of behavior if only freed from gender bias will not correct the situation. It will, in fact, exacerbate the problem.

School settings example this. There is strong evidence that men and women have different learning styles, particularly in language and math. Females have better verbal skills and males better math skills, although they do not vary in the general intelligence incorporating these two cognitive components; men and women compensate for their particular "deficiency". Furthermore, there is a strong relationship between student perceptions of the

classroom's social climate and their educational outcomes (Haertel 1981), and, among other related behaviors effecting the classroom's social climate, boys are more aggressive. As a result, girls more often have a negative perception of the social climate, with their education suffering. This and other evidence suggest that separate classrooms, curriculum and teaching methods for boys and girls are advisable. Many of England's public schools have been separated by sex for years, but only within the past few years has American law permitted the same for public schools. The results in England are impressive, with boys from boy's schools scoring better in verbal skills and girls from girl's schools showing improved math skills.

An enlightened correspondent inadvertently provided another example of using the naturalist paradigm in framing social conventions. He expressed frustration with my views, saying, "Women are just as courageous in their convictions as men, and that's what it takes to succeed in a field dominated by men." As far as I know there is no sex difference in "steadfastness of convictions," but more men than women definitely interact with society in an assertive manner. They are more vocal and aggressive in having their convictions heard and followed. And it is this "assertive manner" that leads to success in most work places. After all, why does it matter how strong (or valuable) your convictions are if your nature precludes voicing them as stridently as others? This especially characterizes the business world, or at least larger businesses. If you're not aggressive in stating and practicing your convictions, you're less likely to succeed. (And it's bitter irony to see many businesses driven to failure by a "dynamic"—that's assertive—executive).

But why must society, especially our business and academic institutions, value assertiveness (male) more than attributes like empathy, emotion, and establishing warm relationships (female)? As we saw in the firefighter example, many women are not disadvantaged because they are as strong as many men, but more women than men... are disadvantaged. A major reason society still overvalues assertiveness is because the gender bias myth teaches that things like assertiveness, emotion, and empathy are socially constructed behaviors, and we need only reform the learning environment for women to compete in a male-dominated field. Thus, male domination is perpetuated; women as a population and as individuals with unique behavioral propensities are slighted.

Along this same line, a new study shows women's competitive success is lower than men in

mixed-sex settings, despite no sex differences in risk aversion (the study was conducted to eliminate the effects of risk aversion). It was determined that more women than men dislike competition, especially in mixed-sex settings, whereas men favor it (Niederle 2005). Success in many jobs is measured on some competitive basis or another. In such a setting, more women than men are at a disadvantage because society bought into the gender myth, and fails to adopt the naturalist paradigm. What is wrong with admitting most women will not fare as well in a competitive environment as most men? Well, there is something wrong with it. Employment success in terms of earnings is currently structured to favor those who succeed in a competitive environment, and this puts more women than men at a disadvantage. We overvalue individual competitiveness (males) and undervalue cooperation (females), thus abetting a male-dominated culture.

Businesses and other institutions can and should reform themselves in accordance with the naturalist paradigm, without running afoul of anti-discrimination laws. Neither males nor females should be singled out for special treatment; rather, each individual's measurable work-related behavior should be evaluated. But this array of behaviors must be reconsidered since they currently favor males (as discussed above). From a catalogue of all traits, both desirable and undesirable in the work setting, select the ones that are measurable and important to the job in question (e.g., gets along with others, seeks cooperation, or is assertive). Reject the gender-bias myth, and ensure the list contains an equal number of behaviors more women than men exhibit as well as behaviors more men than women exhibit (of course, many desirable behaviors on the list are not sexually dimorphic; include them as well). This may require the introduction of heretofore unrecognized behavior, but that is the point of this effort. Give each measurable behavior a weight of some sort, which relates to the behavior's business value, again ensuring that the total weights for female-dominated and male-dominated traits are equal—another aspect of this project that will probably require a major reassessment. All of these traits, now including those favoring more women than men, should become an important part of human resources management systems. This may involve rethinking individual job designs, but, again, the business would benefit from this kind of overhaul (e.g., reducing the value of "wins sales," and increasing the value of "builds customer relations"). Individual performances are then evaluated on this more inclusive and complete behavioral matrix, thus ensuring no sexual bias. This

“forces” an appreciation for the valuable contributions made by those who possess traits more often associated with women than men. For instance, female-dominated behavioral displays like sharing with co-workers, acting empathically, valuing relationships, expressing emotion at appropriate times, and possessing language skills should be valuable to all good businesses and institutions, which, if rewarded properly, would elevate the status of more women than men. (See Goleman 2005 and 2006 to better understand the value of some female-dominated traits.)

The naturalist paradigm should also apply to all areas in which women are underrepresented. The only thing that can be said about them is this: the cause needs to be identified. But the investigation must be conducted in the context of the naturalist paradigm, must include an admission that most women might not be suited nor attracted to the area in question (or men not suited to it in the case of male underrepresentation). Natural sex differences in behavior causes male and female concentrations in many life pursuits, which means they do not result from unfair bias. We should never insist all labor activities reflect the same percentage of women and men as there are in society as a whole, but we should always investigate such occurrences to ensure they are caused naturally and do not result from unfair bias.

Earnings disparities are closely related to this discussion, and sex pay disparities are mostly due to society’s failure to properly value traits more common to women than men. My earlier discussion about expanding the financially-rewarded behaviors to include female-dominated ones will go a long way toward reducing sex pay disparities, but a major inequality remains. Society has made little headway in properly valuing the labor-intensive job of child rearing, and women are more ideally suited to this role than men because (among other reasons) nurturing behavior is the most important “job qualification.” Women have superior nurturing skills, so more females than men are good at and desire work in child-rearing. As a result, more women than men occupy the under-valued child rearing role. Suggesting a solution to this problem is beyond the scope of this essay, but insisting women are behaviorally identical to men (or men as suitable for child-rearing as women) simply exacerbates the under-appreciation of nurturing skills. The “mommy track” is a problem only because society has yet to solve the problem of undervaluing child-rearing.

These are but a few examples of how society can use the natural truth that men and women have significant differences in instinctive behavior, and

why ignoring it jeopardizes the lofty goal of designing social institutions granting everyone equal opportunity in maximizing their well being. All social conventions and institutions should be evaluated within the context of the naturalist paradigm.

“Some have a dream that, one fine day, there will be equal numbers of men and women in all jobs, including those in scientific research. But I think this dream is Utopian; it assumes that if all doors were opened and all discrimination ended, the different sexes would be professionally indistinguishable. The dream is sustained by a cult of political correctness that ignores the facts of life—and thrives only because the human mind likes to bury experience as it builds beliefs. Here I will argue . . . that men and women are born different. Yet even we scientists deny this, allowing us to identify the ‘best’ candidates for jobs and promotions by subjecting men and women to the same tests. But since these tests favor predominantly male characteristics, such as self-confidence and aggression, we choose more men and we discourage women. Science would be better served if we gave more opportunity and power to the gentle, the reflective, and the creative individuals of both sexes. And if we did, more women would be selected, more would choose to stay in science, and more would get to the top” – Peter Lawrence (2006)

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