

GENDER DIFFERENCES

In at least some respects, families rear boys and girls differently, with an expectation that the sexes will be different. This observation is widely accepted in socialization science, but sharp disagreement exists over the attribution of causality. The most widespread view today is that differential rearing *causes* behavioral gender differences. Yet this book has drawn attention to other misattributions of causality. In a contrary view, boys and girls may be reared differently because they *are* different, not because rearing has made them so. Ideally, to demonstrate causal influence, an experiment would be first performed: Typical rearing pressures on sons and daughters would be sex-reversed, with an expectation of reversal in sex-typed behaviors. Few parents, though, would allow their sons to be raised as daughters, or vice versa. And ethical considerations prohibit the approval of intentional experimentation on sex-reversed rearing.

Anecdotally, though, voluntary efforts to change gender-linked behaviors through sex-reversed rearing pressures have demonstrated little success, as reported in occasional newspaper stories. Here we can read about one family's efforts (Churchman, 1984):

As I write this, my son—the one with the gray plastic knight's helmet and the purple soccer suit—is playing at rescuing his sister, the self-styled baseball-playing princess. This is what comes, you see, of raising children in a nonsexist manner: absolutely nothing. (p. 9)

Churchman first describes her attempts with her daughter:

We purchased at least \$25 worth of Legos for our daughter, who spent her early years watching Mom and Dad build with them. Occasionally we could get her to pick up one or two bumpy blocks and fit them together. But

then, when she got to a more sophisticated age, she gave them to her brother . . . (p. 9)

Her son proved no more malleable:

Then there was the suggestion I made to our male offspring that he might like to read to his sweet stuffed animals, "like a good daddy." He shot me one of his "get real" looks and said, logically, "They're only stuffed animals, Mom, they can't really see." (p. 9)

Churchman ends her account by describing how her son played with a non-English-speaking Laotian refugee. The boys found a universal basis for friendship by pushing trucks around in the backyard, saying, "Vrroom! Vrroom!"

Churchman's personal experiment failed. But the public, and many social scientists, remain convinced that the differential rearing of boys and girls determines gender differences in behavior. A reason for this cultural belief may be that gender differences are highly visible. More often than women, for example, men get into a car, gun the engine, and make the tires squeal. The statistics on auto crashes confirm that men are worse drivers, or at least that they have more accidents than women. Rates of all sorts of crimes are substantially greater in males than in females (Wilson & Herrnstein, 1985). In broad personality domains, men score higher on traits such as dominance, activity, and competitiveness; women score higher on traits reflecting emotionality and kindness (Spence & Helmreich, 1978). Men retreat to play poker in the evenings; women gather to discuss their families or the latest self-help book. True, all these statements can be seen as in part "stereotypical," because male and female trait distributions overlap. Nonetheless, one would not misidentify biological sex too often if one guessed that a reader of hard-core pornography was male; that a reader of romance novels was female; that a player of a high-stakes game of chance was male; and that a person attending to the needs of an infant was female.

Studies of Sex-Linked Personality Traits

The earlier chapters have documented a general lack of family environmental influence on development. This pattern holds across the "Big Five" personality trait dimensions; it also holds for IQ, at least in families from the working class to the professional class.

Although most twin studies focus on general traits, two small ones looked at sex-linked personality traits in particular. My study of MZ and DZ twins investigated Janet Spence's masculinity and femininity trait dimensions (Rowe, 1982). The first dimension consists of stereotypically masculine traits; the second is made up of stereotypically feminine ones. As would be expected from their construction, the male trait mean was greater for masculinity in the twin sample, whereas the female trait mean was greater for femininity. Because the sample size was small (31 MZ pairs and 28 DZ pairs), my study lacked enough statistical power to detect all variance components that might exist. Nonetheless, genetic influence was found in masculinity, and a possible influence of rearing was found in femininity; of course, this last result was unexpected.

In a study conceptually replicating my work, Mitchell, Baker, and Jacklin (1989) administered childhood scales for masculinity and femininity to twins. They found results very compatible with this book's thesis. In childhood, genetic variation explained 20–48% of the individual differences in these trait dimensions; unshared environment, about half to 80% of the variation; and shared environment, none at all. Mitchell and her colleagues failed to replicate any shared rearing influence on femininity. Their data, mine on masculinity, and other studies reviewed by Mitchell et al. suggest together that sex-linked personality traits do not behave any differently from other traits. Indeed, it is hard how to imagine how they could, given that masculinity and femininity overlap conceptually with standard Big Five trait dimensions such as extraversion and agreeableness, respectively.

I believe that family experiences shared by brothers and sisters may *not* influence the development of their sex-typed traits. After all, they live in the same households, as siblings. Parents model behaviors that both brothers and sisters can see, and brothers and sisters feel the same home emotional climate in many other ways. They attend the same neighborhood schools. They are both rich or poor, fawned over or ignored. True, the treatment of siblings is never exactly alike; however, opposite-sex siblings reared together receive more similar "treatment" than do boys and girls raised in different families. Now, from behavior genetic data, we have established that variation in shared rearing influences makes little difference for personality outcomes *within* sex. If a boy exposed to a more competitive, aggressive father is not, as a result, more competitive and aggressive than a boy exposed to a milquetoast father, how can rearing variations produce any *mean* sex difference at all?

Behavioral development is seamless; whatever the causes, they

should influence both within- and between-group variation, as apportioned in the analysis of variance (Turkheimer, 1991). In this case, personality variation can be apportioned to two sources—within-gender and between-gender. But in terms of development, socialization science posits the *same developmental processes* in both cases: That is, the boy (girl) who has been exposed to more of a sex-biased treatment should be more sex-stereotypical in behavior than the boy (girl) who has been exposed to less of a sex-biased treatment. This is the familiar *within-gender* hypothesis. From the accumulation of many within-gender effects, the *average* sex difference would be expected to emerge (because boys, on the whole, receive more or less of the parental treatments than girls). But insofar as personality development is concerned, variation in family environments is not influential. Therefore, this developmental process with which we are concerned—that of differences in family environments—can explain neither individual differences nor the average sex difference. That is, the sum of many "null" effects is not a mean sex difference.

We could take a different tack, and say that treatments for males and females were exactly alike—denying for a moment any differential treatments we might observe. Perhaps similar treatments would be experienced differently by males and females. But is this not just another way of saying that males and females are different? Could not the different perceptions of "similar" experiences be attributed to biological differences inherent in males and females? Could not biologically based sex differences evoke observably different treatments?

Studies of Differential Treatments

Are the genders treated differently? Do these treatments influence them? Differential treatments of boys and girls are sometimes readily seen. Most parents buy dolls and kitchens for their daughters, but trucks and trains for their sons. Haircuts and dress styles are selected to be culturally sex-appropriate. And in at least some treatments, differences start early: Boys are more likely to be swaddled in blue, girls in pink. Ask the parents of a newborn what their son or daughter will be like, and they will more likely than not answer in gender-typed adjectives: A boy will be strong and hardy, whereas a girl will be pretty and sweet.

As in the previous chapters, the fundamental issue is not one of association, but rather one of causation. As we just mentioned, parents

may treat children differently in response to different preferences already inside the children. Toy manufacturers, like all companies with products to sell, may want to tailor their products to potential consumers—in this case, to the different tastes of boys and girls. Parents may give gender-stereotypical responses about their infant's potential, not because those expectations causally shape the next generation, but because their knowledge of the current generation allows them to anticipate what the next one will become.

Although we tend to think that the sexes are treated differently, cultural beliefs about differential socialization may be misleading. For instance, a substantial sex difference has been found in the upper ranges of mathematical ability (Benbow, 1988). For many years, a research project at Johns Hopkins University has tested 12-year-old children in an effort to identify the mathematically gifted ones. Seventh- and eighth-graders take the SAT mathematics test normally reserved for high school students heading to college. Of the students in this project studied by Benbow, more boys than girls were mathematically gifted in their test performance: About 4 boys scored over 600 for every girl, and about 12 boys scored over 700 for every girl. Because all these precocious children did very well in mathematics, sex difference explanations based on environmental variation may fail. For instance, the girls took as many math courses as the boys; they had somewhat better grades; they were not math-anxious; they received no less parental encouragement of their talents than the boys; and in at least one such group, more girls than boys wanted to do college work in mathematics. So where was the treatment difference “causing” the sex difference?

More unexpectedly, such small average sex differences in socialization may hold in many populations for many dimensions of parenting. Lytton and Romney (1991) reviewed 172 different studies of the differential socialization of males and females. The studies varied in sample size, in the use of direct observations versus self-reports, in location (North America vs. other parts of the world), in scientific quality, and in year of publication. Lytton and Romney used these scorable qualities in their meta-analysis, a quantitative review of study outcomes. Their conclusion was that, for the most part, boys and girls are raised similarly—there was no great divide in the treatment of the two sexes.

To see the basis for their conclusion, consider the effects presented in Table 6.1. This table translates Lytton and Romney's (1991) differential treatment effects by major socialization areas (see their Table 4) into IQ-type units. Treatment of females has been set to a mean of 100 “treat-

TABLE 6.1. Gender “Treatment Quotients” by Major Socialization Area for North American Studies

Area	Boys' mean	Girls' mean	No. of studies
Interaction	99.6	100	74
Encouragement of achievement	100.3	100	22
Warmth	99.0	100	63
Encouragement of dependency	98.5	100	16
Restrictiveness	101.2	100	40
Discipline	101.2	100	53
Encouragement of sex-typed activities	106.5	100*	20
Clarity/reasoning	99.3	100	13

Note. Conversion from standard scores to IQ-type metric assumes a female mean of 100 and a standard deviation of 15. Data are from Lytton & Romney (1991).

*Difference statistically significant.

ment points”; the mean of males is higher or lower, depending on whether they received more or less of the same treatment than females. Amazingly, in only one area (parental encouragement of sex-typed activities in play and household chores) was the treatment of the genders differential at conventional levels of statistical significance: In the IQ-type units, the males' mean in this area was 106.5 to the females' 100. In most other treatment areas, the sexes' means were less than 1 “treatment quotient” point apart.

Lytton and Romney's (1991) statistical control variables left this conclusion unaltered. No tendency existed for studies published more recently to produce smaller treatment differences. Results for unpublished studies were not unlike those for published ones. Studies from outside North America added one possible gender difference: Males received harsher physical punishment than females. By a head count of studies, a trend existed for females to receive more encouragement of dependency, and males more disciplinary strictness. But Lytton and Romney's conclusions refute the widely accepted belief that treatment differences between males and females are large or pervasive. A possible explanation is that people generalize from sex-typed play preferences (where sex differences are most visible and treatment differences

the largest) to other patterns of child rearing (where real treatment differences are often absent or quite weak).

Occasional case histories have been cited to show extraordinary treatment effects; however, these effects often fade in clarity when examined more closely. In social science, many college textbooks tell a story about MZ twin boys. At birth, one twin boy's penis was severely damaged during circumcision, and his doctors and parents made a decision to reconstruct his genitals surgically to female form. Hormonal therapy was then provided to feminize his body. "Her" parents then raised this genetic boy consistently with her assigned sex as a girl. Textbooks declare this "experiment" a resounding success in showing that sex of rearing determines sex-typed behaviors.

A follow-up report when the twins reached early adolescence, though, was not so sanguine (Diamond, 1982). At the time of the follow-up, the "girl" was in therapy for psychiatric problems that included sex role uncertainty. Her career ambition was to be a mechanic. She refused to draw a picture of a female, saying that it was easier to draw a man. Her masculine traits produced some unkind words from peers, who had nicknamed her "cave woman." Given the confusion and emotional distress she experienced, little support can be proffered for the idea that arbitrary sex role reassignment—even when aided with powerful steroid hormones—can change biologically based gender dispositions.

The Biological Basis of Sex Differences

Is a biological explanation of gender differences in behavior more compelling than an environmental one? Scientifically, experimental manipulation gives the strongest proof of causation. Can the relative gender typing of boys and girls be manipulated through biological means? The answer to this question, for us and other species, is "yes."

In many mammals, biological differentiation requires two phases. The first phase takes place during fetal development in humans, or shortly after birth in laboratory mice and rats. In these periods, the sex hormones biologically organize the brain into female or male patterns. During this organizational phase, brain tissue is actually differentiated in different ways in human males and females (Lacoste-Utamsing & Holloway, 1982; Swaab & Fliers, 1985). For example, the corpus callosum and the cell nuclei within the preoptic area of the brain grow to different sizes; the hypothalamus (brain tissue that controls the pituitary

and the secretion of hormones) also develops a different inner organization in men and women. The second phase takes place at puberty. Brain organization has been completed, but increasing sex hormone levels now activate sexual dimorphism in physical development and can trigger sex-typed behaviors, especially in the sexual domain (Udry, 1988).

Animal Studies

In mammals such as rats, mice, and monkeys, no researcher has attempted to change sex role behavior through manipulation of rearing circumstances; the idea would be seen as ludicrous, because it is understood that in most mammals these behaviors possess a strongly biological basis. Biological manipulations, in contrast, have successfully altered physical and behavioral forms of sex-typed behaviors in nonhuman animals. In a classic series of experiments on rabbits, Jost removed male gonadal tissue from genetically male (XY) fetuses (see Jost, 1979, for a summary). Without the organizing influence of secreted male hormones, these rabbits developed into physically and behaviorally "female" rabbits. Thus, the basic developmental plan of both male (XY) and female (XX) mammals is female, unless genes on the Y chromosome cause gonadal tissue to form, followed by the secretion of male hormones. Jost found further that if genetically male (XY) rabbits that had been "feminized" as described above were exposed to externally administered female hormones at puberty, they displayed species-typical female social behaviors, including sexual interest in male partners and female-typical sexual positions.

The reverse experiment also worked. Jost found that if genetically female (XX) fetuses or newborns were exposed to male hormones at the proper time during fetal or early postfetal development, they were "masculinized." Furthermore, when exposed to externally administered male hormones at the time of puberty, these females displayed species-typical male behaviors, including fighting, sexual interest in females, and male-typical positions for sexual intercourse. Given the ability to manipulate the amount and duration of hormone injections during pregnancy, the kind of gender reversal produced can be finely tuned. Genetically female (XX) monkeys can be influenced to be aggressive in their play, but not to mount male playmates; or to mount monkeys about the same age, but not their mothers (Moir & Jessel, 1991).

Reviewing both the animal and human literature on hormone

effects, Ellis and Ashley (1987) concluded that hormone exposure during the second and third months of human pregnancy is responsible for the differentiation of sexual orientation, whereas other male- and female-typical behavior patterns may be differentiated later, from the fourth to sixth months. Neural differentiation is complex and has a long time course. Its duration may explain how hormones can produce gender reversals in some behavior patterns, but not in others: A hormonal effect is not "all or none," but rather allows for gradations and subtleties.

Human Studies

On rats, mice, and monkeys, those animals that bear the major experimental burden for the biological and behavioral sciences, hormone effects have been dramatic; however, caution is called for in generalizing from other animals to humans. In humans, of course, these classic animal experiments cannot be replicated without flagrantly violating our ethical codes. But nature, in the form of rare genetic disorders, and medicine, in the form of misapplied drugs, have provided experiment-like contexts for the evaluation of hormone effects in humans. On the whole, people display the same susceptibility to having sex-typed behaviors reorganized through hormones as do other animals; therefore, gender differences may have a pervasive biological basis in humans as well as in other animals (Ellis & Ashley, 1987; Moir & Jessel, 1991; Reinisch, Rosenblum, & Sanders, 1987).

Consider the one child-rearing area in which males and females are clearly treated differently: the encouragement of sex-typed behaviors. Do these treatments cause these gender differences? Or do the gender differences result from biologically based tastes and preferences of young boys and girls? The latter view can be tested if behavior is changed through hormonal manipulations, when genetic sex remains unchanged.

For this purpose, nature's manipulation is a rare genetic disorder, adrenal hyperplasia, which leads the kidney's adrenal glands to secrete excessive androgens. The syndrome prenatally masculinizes the developing brain of a female (XX) fetus, whereas the excessive adrenal androgens do not clearly change the development of a male (XY) fetus. Newborn girls may also suffer some degree of abnormality in their genitals as a result of exposure, but its severity differs greatly among them. Usually these genital abnormalities can be surgically corrected shortly after birth, and prescribed drugs can block any further masculinization.

Berenbaum and Hines (1992) studied a series of girls affected with this disorder. Except for one girl raised for the first month as a boy, the girls ($n = 25$) had been diagnosed early (mostly in the neonatal period) and raised as girls. To learn about their "tastes," the researchers gave them choices in a short play session in which male-typed toys (a helicopter, two cars, a fire engine, blocks, and Lincoln Logs), female-typed toys (three dolls, kitchen supplies, a toy telephone, and crayons and paper), and gender-neutral toys (books, board games) were equally available. They scored the amount of time the girls played with each type of toy. The girls with adrenal hyperplasia were compared with a control group consisting of their sisters and female cousins.

As expected, affected girls played more with the male-typed toys and less with the female-typed toys; play with gender-neutral toys was about equal in the two "experimental" groups. Because play with one type of toy excludes play with another, I reproduce in Figure 6.1 only playing time with male-typed toys. As shown in Figure 6.1, the mean playing time for the affected (CAH) girls was about twice (about 6 minutes) that of the unaffected sisters and cousins (about 3 minutes). In terms of IQ-type units, the mean playing time would be 100 in the control group and about 113 in the affected group. In these units, this difference was greater than that between girls and boys for sex-typed socialization (as given earlier, 100 vs. 106.5). Neither the degree of abnormality in the genitals at birth, nor the age at diagnosis, influenced toy choice. Of course, these results do not prove that a unitary brain mechanism for toy preference exists (although it may), because the hormone exposures might have changed activity level, motor skills, or temperamental traits in gender-linked areas.

In another rare genetic disorder, a hormonal abnormality changed the genital area at birth, instead of influencing brain organization (Imperato-McGinley, Guerrero, Gautier, & Peterson, 1975; Imperato-McGinley, Peterson, Gautier, & Sturla, 1979). Born in rural villages in the Dominican Republic, the affected male (XY) babies lacked external testes, which were still undescended inside their bodies, and had clitoral-like penises hidden in labial-like folds. To uninformed observers, they looked like newborn girls; so convincing were the external genitalia that they were raised as such, although genetically they were male.

The cause of the disorder was later discovered to be an absence of one form of testosterone, which is responsible for the growth of male genitalia. A chemically different form of testosterone, though, still masculinized the affected boys' brains before birth. During puberty, more

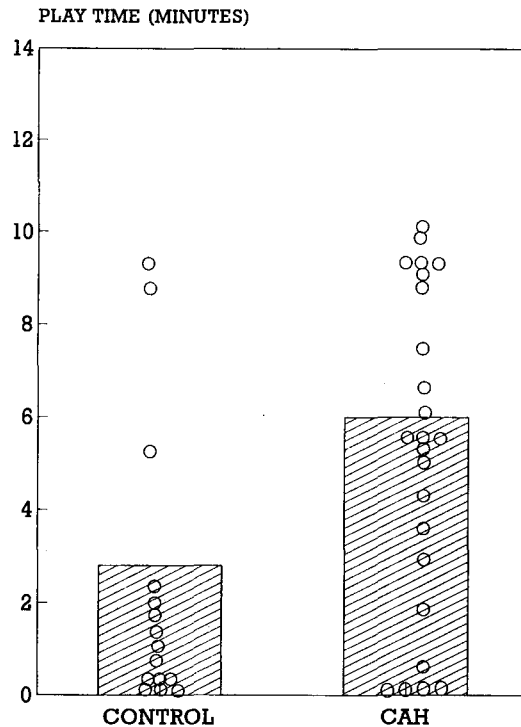


FIGURE 6.1. Play time with male-typed toys in control girls and hormone-exposed congenital androgenital syndrome (CAH) girls. Adapted from Berenbaum & Hines (1992). Copyright 1992 by the American Psychological Society. Adapted by permission.

hormone was secreted; each boy's body reacted by growing a penis and allowing the testes to descend. This sudden and shocking completion of reproductive development led to a local nickname for the disorder, translatable as "penis at 12 years."

What were the results of 12–14 years of raising boys with neuronally male brains as females? Although the scientific reports were less complete than social scientists would desire—the field work was done by medical doctors intent on solving the puzzle of the inherited metabolic errors—it was clear that once the affected boys reached puberty, almost all of them rapidly and easily shifted from female to male identities, adopting male clothing, marrying, and working as farmers, miners, or woodsmen in rural villages.¹ Although the affected men thus were successful "normal" males, their hormonal abnormality had some persistent physical effects (scanty or absent beard and a lack of balding).

A recessive gene was found to cause the "penis at 12 years" syndrome. Suppose it were common, rather than rare. Then we could raise all children as girls—and still have them turn out all right in adolescence, with boys adopting male gender roles. So much for the power of socialization. Therefore, let us look in the brain for the basis of sex differences. Unlike behavior, the brain's composition is invisible to outside inspection, and only a few studies have used dissection to compare male and female brains. One important finding—undoubtedly, one of many that will emerge as sex differences in the brain are further explored—is related to sexual orientation (LeVay, 1991).

LeVay looked within human brains for structural differentiation in areas sensitive to sex hormones in other animals. He tested particular cell groups called nuclei (clusters of nerve cell bodies) that were reported to be larger in men than in women, and that were located in the hypothalamus, a brain structure associated with male-typical sexual behavior in primates. His brain samples, acquired from routine autopsies, included the brains of 19 homosexual men, 16 heterosexual men, and 6 heterosexual women. One hypothalamic cell nucleus was larger in the heterosexual men than in either the women or the homosexual men; thus, this group of cells no larger than a pinprick was sexually dimorphic, and in males it could be used to distinguish sexual orientation.

The studies just described belong to a larger literature showing consistent hormonal influences on sex-typed behaviors in humans (Becker, Breedlove, & Crews, 1992; Moir & Jessel, 1991; Reinisch et al., 1987). No one study is as perfect in its experimental controls as are the studies of nonhuman primates, rats, and mice; together, however, they place the cause of behavioral sex differences in the biology of the brain. In the socialization studies summarized earlier in this chapter, differential treatments were far weaker than folklore commonly supposes, and where they were strong, the evidence of the directionality of the influence was itself the weakest. Perhaps the socialization effects have been underestimated by poor questionnaires, or by wrongly constructed observational measures. Nonetheless, the burden of proof now falls on environmentally oriented socialization scientists to show that treatments can causally induce sex differences.

The Evolutionary Perspective

Primarily, this book is about individual differences rather than about group differences. But the case of sex differences must be simultaneously

viewed from both perspectives: Males and females are self-evident groups, but within each biologically defined sex, people differ in the degree of “masculinity” and “femininity” they show in the behaviors relevant to average sex differences. Thus, it is useful to ask about the origins of sex differences. For this purpose, the chapter now takes a brief foray into evolutionary theory—a picture on the broad canvas of evolutionary millennia, rather than the historical time of a few generations. As I indicate in Chapter 7, an evolutionary understanding is integral to answering fundamental questions about the transmission of behavioral variation from one generation to the next.

Sexual Selection Theory

Sexual selection theory is an evolutionary explanation for the origin of biologically based gender differences. According to Darwin, two struggles have shaped the evolution of a species: that of natural selection, as adaptations have evolved in response to forces in the natural environment and to the inevitable competition of other species, including predators; and that of sexual selection, as adaptations have evolved from within-species competition to find mates and to protect and succor the young. In this latter arena of selection in most species, the sexes have entered into the selective process with asymmetries of biological function that dispose them toward different evolutionary solutions.

Females can be severely limited in the number of offspring they can bear and care for, and they must carry the biological burdens of pregnancy and giving milk. In contrast, males produce vast numbers of sperm, and in many species they contribute far less than females do to the care and protection of the young. The strength of this asymmetry varies among mammalian species. In some species, almost no parental care is provided by the male parent. In such species, rates of male reproduction are limited mainly by the access to mating opportunities; it pays males (in the evolutionary currency of increased reproductive success) to seek as many such opportunities as possible. Although the male-versus-male competition need not always involve aggression (e.g., a male may find more mates by reaching them faster than by fighting more against other males), his genetic traits will persist by whichever means he succeeds in securing mates, whereas the genetic traits of other males will die out. The number of successful matings is thus, to borrow Richard Dawkins's (1987) metaphor of evolution, like a “sieve”—selecting

some traits for survival and increase, and straining out others for extinction. In many species, females hurt their reproductive chances if they seek additional mates once they are fertilized successfully by one. This thesis is true even if males contribute little or nothing to rearing, because females' pursuit of mating opportunities may distract them from nurturing offspring. Thus competitive pressures that apply to males do not always apply to females, and vice versa.

One result of intramale competition for a greater number of mates, and of intrafemale competition for the best mate, is an evolution of sexually dimorphic traits. In species in which males and females have such different life histories, greater muscular strength and body size often (but not always) aid males in the competition for mating opportunities. A stronger, larger male will sire more offspring than a smaller, weaker one. For example, an antelope carrying a larger head of antlers wins more fights than do weakly armed opponents.

Physical and behavioral dimorphisms coevolve. That is, when weapons for sexual competition against other males grow larger, so must the willingness to use them—the desire to be aggressive and to maintain a dominant status, even at the risk of one's own death. Or, if the competition is a “scramble” search for mates rather than a physical fight, better location abilities and a desire to run in open areas (where the risk of predation is greater) must increase along with fleetness of foot. So strong sexual selection pressures appear in the skeleton, which shows the adaptive specializations for gaining mates in males, and the adaptive specializations for pregnancy and lactation in females; they also appear in the brain, which must guide the use of these specializations. This logical connection seems neglected in many theories of human gender differences that ignore physical differences but trumpet psychological ones.

The intensity of sexual selection varies among species. The crucial variable in determining this intensity is the degree of “parental investment”—the total time, energy, and effort devoted to caring for offspring. In species such as deer or elephant seals, a strong asymmetry in parental investment exists, because males invest virtually nothing in parenting the young. On the other hand, competition can be more relaxed in species in which males make heavy parental investments. If offspring cannot survive without a biparental investment in their care and protection, then no reproductive advantage accrues to a male to seek additional mates during a breeding season; rather, it pays to bond stably with a female partner in a sharing of parenting. Many bird species seem to

approach this ideal (or at least come more closely to it than deer or elephant seals), because chicks cannot survive without the provision of food and shelter by both adults.

Humans probably lie somewhere in the middle of the range of sexual selection intensities. A human skeleton exhibits its past history of sexual selection. For instance, a randomly chosen man has about a 92% chance of being taller than a randomly chosen female—in statistical jargon, a large “effect size” (McGraw & Wong, 1992). Presumably, greater strength, size, and weight at one time helped men in intrasexual competition—either by helping them in direct combat with other men, or by improving some other outcome that led indirectly to superior competition. But the absolute physical height difference between men and women is only about 8%, far less than the enormous weight and size gaps separating males and females in some primates that have been under stronger sexual selection pressure. Among baboons, for example, adult males weigh twice what females do. An evolutionary interpretation is that human males, who must offer some investment in offspring, are constrained in the time and energy they can devote to mating competition. Gender dimorphisms have evolved in humans, but not as ruthlessly as they might have if males had not been selected to nurture.

Although socialization science can offer environmental explanations of behavioral dimorphisms, it is strangely silent concerning these gender differences in height, weight, strength, and other visible traits. For most students of animal behavior, the presence of such purely physical differences is a reliable guide to the existence of related behavioral differences. As the husband-and-wife team of Martin Daly and Margo Wilson (1988) has noted, “Armed with the theory of sexual selection . . . and with no more knowledge of *Homo sapiens* than that provided by a few skeletons, a biologist from outer space would guess right about every aspect of male–female relations” (p. 155).

Examples of Gender-Dimorphic Traits

Behavioral sex differences fit well into the expectations of evolutionary biology. Daly and Wilson (1988) have identified one powerful example: murder. Murder is the ultimate solution to intrasexual competition—removing one’s competition entirely by taking another person’s life. But it is costly, because of the risk of retribution either by the victim’s relatives or by the state. It is also costly because in direct confrontations,

who is the victim and who is the victor may partly depend on chance. But the psychological disposition to murder can persist evolutionarily if males who murder, or threaten murder, obtain more mates than those who do not. Note the emphasis on male intrasexual competition. If one female were to kill another, her victory would do little to enhance her reproductive chances; even if she were to gain the affection of her victim’s mate, the availability of two males would not raise her birth rate (which is physically limited) nearly as much as one male’s marriage to two females would raise his reproductive rate.

According to this argument, adult males should kill one another with some frequency, but the murder of one adult female by another should be extremely rare. From a variety of the world’s societies, Daly and Wilson (1988) examined differences in murder rates of (1) adult males killing other adult males and (2) adult females killing other adult females. Because murder statistics were not collected with this exact comparison in mind, the numbers of female perpetrator–female victim murders were biased against the main hypothesis, as women killing female children were sometimes counted. Nonetheless, as shown in Table 6.2, nearly all same-sex murders involved one man killing another. Among the LaLuyia of Kenya, 95% of same-sex murders were male against male; among Chicagoans, 96%; among the Munda of India, 100%; and so on.

Other strong gender dimorphisms appear in the area of sexual behavior, dating, and marriage. To pick an illustrative example, Kenrick and Keefe (1992) investigated preferences for the age of a potential spouse. According to a sociobiological perspective, men should prefer younger mates (who are still capable of reproduction), whereas females should prefer older mates (who are in a stronger position to provide for them economically). Although these general expectations do not translate into precise age range predictions, they suggest that a male preference for younger mates should exist unless a man is himself young. In the latter case, a slightly older spouse should have about the same reproductive potential as one slightly younger. In contrast, women gain little reproductively from preferring younger mates.

Kenrick and Keefe (1992) used one unalloyed source to compare mate preferences: advertisements in urban “singles” newspapers. Because such ads are not placed to advance science, they permit a “naturalistic observation” of mating preferences, and Figures 6.2 and 6.3 show the oldest and youngest ages of preferred partners plotted against the advertisers’ own ages. For instance, in Figure 6.2, a 40-year-old “single white male” advertising for a 30-year-old “single white female” would be plot-

TABLE 6.2. Same-Sex Homicides in Various Societies

Location	Proportion of total killings where males killed males
Canada	94%
Miami	96%
Chicago	96%
Detroit	96%
Tzeltal Mayans (Mexico)	100%
Belo Horizonte (Brazil)	97%
New South Wales (Australia)	94%
Oxford (England, 1296–1398)	99%
Iceland	100%
Munda (India)	100%
!Kung San (Botswana)	100%
Tiv (Nigeria)	97%
BaSoga (Uganda)	98%
LaLuyia (Kenya)	95%

Note. Adapted from Daly & Wilson (1988). Copyright 1988 by Aldine de Gruyter. Adapted by permission. (For additional examples, see original table.)

ted midway between the two lines—as 40 years on the x axis and -10 on the y axis. That is, she is 10 years younger than he.

The plots conform closely to sociobiological expectations. Men in their 20s advertised for mates from 5 years younger to 5 years older than themselves; they did not prefer only younger women. As men aged, their preferences became increasingly discrepant from their own ages, with men in their 30s preferring 25-year-old partners, men in their 40s preferring 33-year-old partners, and men in their 50s preferring 40-year-old partners. Marriages embody these preferences in the United States and elsewhere, as men of a given age typically marry women younger than themselves in years about midway between the preference curves shown in Figure 6.2. Women's preferences remained relatively constant over the lifespan (see Figure 6.3): They preferred men from a few years younger than themselves to about 10 years older. The idea that women are constrained by their economic limitations to prefer older men was unsupported, because even well-to-do women placed singles advertisements for older men. Fantasy and mundane prospects are blended in unknown proportions in singles advertisements. Yet they capture a certain reality about marriage markets: A worldwide marriage pattern is one

of older men marrying younger women, and in many societies in which polygyny is legal, one older man may marry *several* younger women.

Not all sexual dimorphisms are as overt as murder or spousal age (Buss, 1989). In social meetings, for instance, males may interpret females' friendliness as promiscuous and seductive, but women do not make similar attributions about men (Abbey, 1982). Differently disposed, men and women have vast differences in rates of some behaviors; they also must suffer from the frequent sexual miscommunications of everyday life.

Gender Dimorphisms and Individual Differences

The consideration of sociobiology has added to this book's main theme of individual variability. As shown in the last several examples, the great-

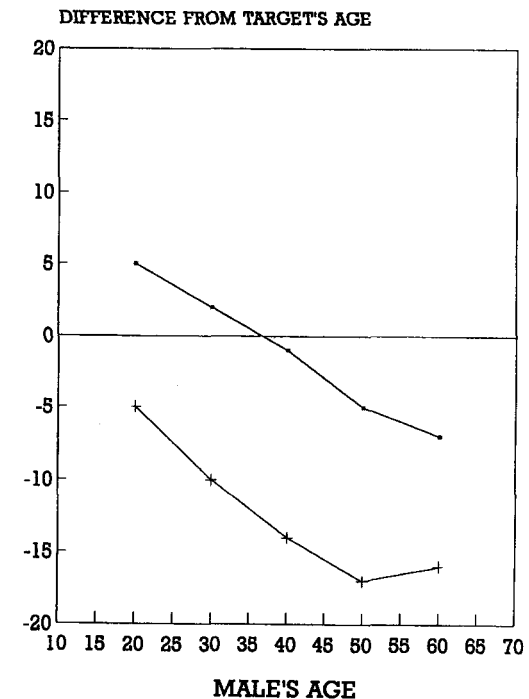


FIGURE 6.2. Males' preference for partners' age in singles advertisements. Upper curve, oldest age preferred; lower curve, youngest age preferred. Adapted from Kendrick & Keefe (1992). Copyright 1992 by Cambridge University Press. Adapted by permission.

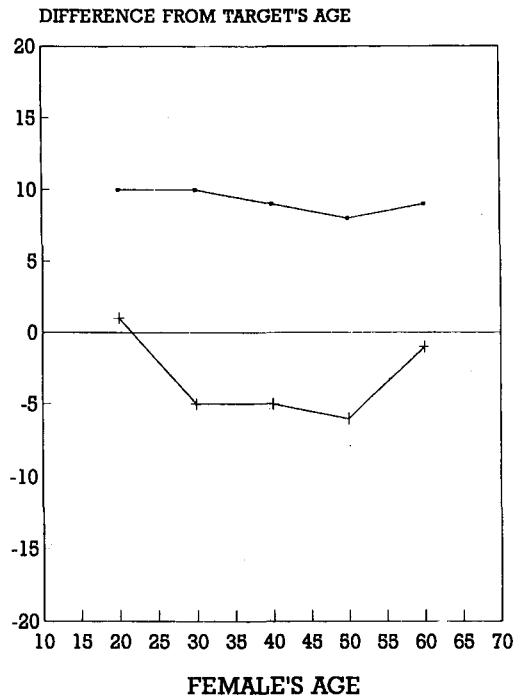


FIGURE 6.3. Females' preference for partners' age in singles advertisements. Upper curve, oldest age preferred; lower curve, youngest age preferred. Adapted from Kendrick & Keefe (1992). Copyright 1992 by Cambridge University Press. Adapted by permission.

est insights are produced whenever gender differences are most magnified. The gender gap can be so great as to suggest qualitative rather than quantitative differences between the sexes, as in the case of murder. And to some extent, the two sexes can be viewed as qualitatively different biological adaptations: A genetic "switch" (in humans, the sex-determining X or Y chromosome) puts a fetus onto one of these two developmental pathways.

On the other hand, personality trait distributions may overlap in men and women. A well-known law of normally distributed traits is that moderate mean differences may translate into huge differences at the extremes. Suppose that just the top 16% of males are overtly violent. If one standard deviation separated the male and female dispositional means, only 2.3% of females would score as high as these males (i.e.,

just 1 female for every 7 males). If only the top 2.3% of males are overtly violent, then just 0.13% of females would score as high (i.e., 1 female for every 18 males). Thus, in populations of limited size, few females may possess enough "aggressiveness" disposition to commit overtly violent acts. For sex differences in other traits, the size of the male-female mean difference may be a smaller one (e.g., spatial rotation, ideational fluency; Kimura, 1992), but this principle will still apply: Gender differences will grow greater at trait extremes.

Thus, rather than viewing sex differences as "all or none," we may conclude that biology may just shift the distributional means for men and women. Consider one kinship group especially suited for evaluating sex differences: brother-sister sibling pairs.

Opposite-sex siblings can show whether the *same* genes influence variation in male and female phenotypes. That is, the sibling correlation indicates the degree to which different or identical genetic loci affect trait expression in both sexes. When different genes produce similar phenotypes in males and females, they will obey Mendel's genetic law of independent assortment. This law is that traits of different genetic determination must be unassociated within individuals or across family members. Interracial marriages provide a visual proof of this law: For instance, in a child of a Caucasian man and a Japanese woman, light brown hair may be delightfully combined with dark Asian eyes. Because different physical features are determined by different genetic loci, any combination of them can occur in an interracial child. Given a heritability of .70 for some trait, but different sets of genetic influences in males and females, then brothers may correlate .35; sisters may also correlate .35; but a brother and sister may not correlate at all ($r = 0$). However, if the genes are the *same* in males and females, then the mixed-sex pairs should correlate .35 as well.

A pattern of separate genetic influences is not what is usually seen, though. Sibling correlations, rather than being lower in mixed-sex siblings, are usually about equal to those in same-sex pairs. Eaves, Eysenck, and Martin (1989) have tested broad personality traits for "sex limitation." Their study included the "Big Three" traits of psychoticism, neuroticism, and extraversion, and also a "lie scale" trait dimension. Using English data from same-sex and mixed-sex twin pairs, they conclude:

The data provide no evidence that the four aspects of personality [including the lie scale] are better explained by a model in which different genes and environmental effects contribute to variation in males and females. The

values of r_{AMF} [the genetic correlation across the genders] are instructive. They all exceed 0.70, confirming a high degree of commonality between genetic effects on the two sexes. (p. 99)

Their larger Swedish and Australian samples necessitated one qualification to this conclusion. For neuroticism, the genetic correlation across genders was significantly less than unity ($r_g = .58$). In criminality, in which sex differences are especially large, some genes may also be sex-specific (shared-genetic-causes $r = .61$; Cloninger, Christiansen, Reich, & Gottesman, 1978).² Nonetheless, even with these exceptions, most loci affecting trait variation appear to be the same in males and females.

If, in general, many identical genes influence traits in males and females, their expression may remain unequal because average phenotypes do differ in mixed-sex siblings. Thus I would argue that the same set of genes receive a somewhat different level of expression in men and women. Consider as a concrete example that steroid hormones, when injected externally, build up women's muscle tissue less than men's. As a chemical messenger, steroid hormones activate DNA synthesis, but this chemical message is not as well received in a female's muscle cells as in a male's. In these same genetic pathways, allelic variation may also contribute to individual differences in strength. Genes that act earlier in development may be especially important, because it is at this time that the sensitivity of the nervous system to later, sex-specific environmental and biological influences is set. Thus, different biological influences can explain mean and individual differences in a unitary system: The former may arise from sex-linked, hormonal modulation of gene expression, and the latter from allelic variation in these same biological pathways.

Biological Sex Differences and Cultural Transmission

The view proposed here is that sex differences should be little influenced by variations in family environments. But I certainly believe that cultural systems and biological sex differences interact. Moir and Jessel (1991), in discussing this interaction, choose to focus on how biological sex differences may limit the malleability of behavioral sex differences. Consider that men and women may differ in the drive to succeed in toughly competitive, hierarchical professions. Some women, in fact, may

prefer to stay at home with their children rather than to scale a career ladder. Some feminists decry these women's lack of drive and initiative; die-hard environmentalists attribute it entirely to limitations imposed by social constructions. But from a biological view, the choice of family versus career may reflect inherent biological sex differences that are stronger in some women and weaker (if not absent) in others. Those women who have a strong desire to succeed in careers may not understand or sympathize with women who lack this desire (and vice versa). Women who do not want to compete, though, do not see themselves as handicapped by their choice. Consider that people who do not want to be athletes cannot be said to be handicapped by their own indifference to winning (Moir & Jessel, 1991).

But the existence of different distributional curves can be viewed from a slightly different angle. The women who want to compete *are* handicapped by societies that do not permit them to be educated, or to enter worlds of business and commerce. Not long ago in Saudi Arabia, women spontaneously revolted against patriarchal authority by driving their husbands' cars. Because women were not permitted to drive in Saudi society, what women in the industrialized countries of the West may take for granted was for them real defiance. The response of Saudi authorities was unfriendly to the women's revolt: A restriction of women's driving was reaffirmed. Any woman near the masculine tail of the "masculinity" distribution will find her biological proclivities thwarted in a society that so restricts her social roles.

Societies have dealt with the unequal distributions of male and female "preferences" in different ways. Some have treated sex differences categorically—ignoring any distributional overlap of men and women, and restricting sharply the social alternatives available to both sexes. In other societies, legal restrictions on men and women have been fewer; women with the relevant inclinations have had the possibility of exploring predominantly male roles, and vice versa. Ironically, biological determination may be greater under the latter arrangement than under the former. When men and women are allowed to explore social roles over a wide social range, they may pick ones better suited to their *individual* biological dispositions; that is, only when there is freedom of choice can men and women make choices truly diagnostic of their biological proclivities. If people can find greater happiness in "niche picking" (Scarr & McCartney, 1983)—a position that is intuitively plausible, but for which empirical support is lacking—then permitting "biological deter-

minism" to flourish may be evaluated more positively than social engineering programs of either the radical left or the radical right.

Notes

¹One of 18 affected XY males raised as girls failed to shift to a male gender identity. She was reported to live alone and to work as a domestic. She was not sexually involved with other men at the time of the latest report, but she had "married" a man who had left her after 1 year (Imperato-McGinley et al., 1979).

²A sex difference in the expression of traits may support a threshold model. For criminality and antisocial personality, women may need a greater number of genetic factors contributing to risk than men before they express criminality or antisocial personality traits outwardly. Thus, the biological relatives of such affected women (high dose) would be at greater risk of developing criminality or antisocial personality traits than those of affected men (moderate dose). The data presented by Cloninger et al. (1978) were generally consistent with this threshold idea.

References

- Abbey, A. (1982). Sex differences in attributions for friendly behavior: Do males misperceive females' friendliness? *Journal of Personality and Social Psychology*, 42, 830-838.
- Becker, J. B., Breedlove, S. M., & Crews, D. (1992). *Behavioral endocrinology*. Cambridge, MA: MIT Press/Bradford Books.
- Benbow, C. P. (1988). Sex differences in mathematical reasoning ability in intellectually talented preadolescents: Their nature, effects, and possible causes. *Behavioral and Brain Sciences*, 11, 169-232.
- Berenbaum, S. A., & Hines, M. (1992). Early androgens are related to childhood sex-typed toy preferences. *Psychological Science*, 3, 203-206.
- Buss, D. M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses tested in 37 cultures. *Behavioral and Brain Sciences*, 12, 1-49.
- Churchman, D. (1984, January 15). Mother's attempts come to naught in the end. *Norman (Oklahoma) Transcript*, p. 9A.
- Cloninger, C. R., Christiansen, K. O., Reich, T., & Gottesman, I. I. (1978). Implications of sex differences in the prevalences of antisocial personality, alcoholism, and criminality for familial transmission. *Archives of General Psychiatry*, 35, 941-951.
- Daly, M., & Wilson, M. (1988). *Homicide*. New York: Aldine de Gruyter.

- Dawkins, R. (1987). *The blind watchmaker: Why the evidence of evolution reveals a universe without design*. New York: Norton.
- Diamond, M. (1982). Sexual identity: Monozygotic twins reared in discordant sex roles and a BBC followup. *Archives of Sexual Behavior*, 11, 181-186.
- Eaves, L. J., Eysenck, H. J., & Martin, N. G. (1989). *Genes, culture and personality: An empirical approach*. London: Academic Press.
- Ellis, L., & Ashley, A. M. (1987). Neurohormonal functioning and sexual orientation: A theory of homosexuality-heterosexuality. *Psychological Bulletin*, 101, 233-250.
- Imperato-McGinley, J., Guerrero, L., Gautier, T., & Peterson, R. E. (1974). Steroid 5 alpha-reductase deficiency in man: An inherited form of male pseudohermaphroditism. *Science*, 186, 1213-1215.
- Imperato-McGinley, J., Peterson, R. E., Gautier, T., & Sturla, E. (1979). Androgens and the evolution of male gender identity among male pseudohermaphrodites with 5 alpha-reductase deficiency. *New England Journal of Medicine*, 300(22), 1233-1237.
- Jost, A. (1979). Basic sexual trends in the development of vertebrates. In *Sex, hormones, and behavior* (Ciba Foundation Symposium No. 62, pp. 5-18). Amsterdam: Excerpta Medica.
- Kenrick, D. T., & Keefe, R. C. (1992). Age preferences in mates reflect sex differences in human reproductive strategies. *Behavioral and Brain Sciences*, 15, 75-133.
- Kimura, D. (1992). Sex differences in the brain. *Scientific American*, 119-125.
- Lacoste-Utamsing, C. de, & Holloway, R. L. (1982). Sexual dimorphism in the human corpus callosum. *Science*, 216, 1431-1432.
- LeVay, S. (1991). A difference in hypothalamic structure between heterosexual and homosexual men. *Science*, 253, 1034-1037.
- Lytton, H., & Romney, D. M. (1991). Parents' differential socialization of boys and girls: A meta-analysis. *Psychological Bulletin*, 109, 267-296.
- McGraw, K. O., & Wong, S. P. (1992). A common language effect size statistic. *Psychological Bulletin*, 111, 361-365.
- Mitchell, J. E., Baker, L. A., & Jacklin, C. N. (1989). Masculinity and femininity in twin children: Genetic and environmental factors. *Child Development*, 60, 1475-1485.
- Moir, A., & Jessel, D. (1991). *Brain sex: The real difference between men and women*. New York: Carol.
- Rowe, D. C. (1982). Sources of variability in sex-linked personality attributes: A twin study. *Developmental Psychology*, 18, 431-434.
- Reinisch, J. M., Rosenblum, L. A., & Sanders, S. A. (1987). *Masculinity/femininity*. Oxford: Oxford University Press.
- Scarr, S., & McCartney, K. (1983). How people make their own environments: A theory of genotype → environment effects. *Child Development*, 54, 424-435.

- Spence, J. T., & Helmreich, R. L. (1978). *Masculinity and femininity: Correlates and antecedents*. Austin: University of Texas Press.
- Swaab, D. F., & Fliers, E. (1985). A sexually dimorphic nucleus in the human brain. *Science*, 228, 1112–1115.
- Turkheimer, E. (1991). Individual and group differences in adoption studies of IQ. *Psychological Bulletin*, 110, 392–405.
- Udry, J. (1988). Biological predispositions and social control in adolescent sexual behavior. *American Sociological Review*, 53, 709–722.
- Wilson, J. Q., & Herrnstein, R. J. (1985). *Crime and human nature*. New York: Simon and Schuster.

WHY FAMILIES HAVE LITTLE INFLUENCE

Imo spat out the sand clinging to her sweet potato, put it into the sea, and rubbed it vigorously with her free hand. She ate the cleaned potato, enjoying its salty taste. Nearby, Nimby watched—and thrust her potato into the sea. She didn't get all the sand off, but it still tasted better than ever before. The two young playmates' example taught others; soon their age-mates, both male and female, had caught on to the potato-washing routine. Imo's mother also learned, and soon was teaching potato washing to Imo's younger siblings. Imo's father, though he enjoyed a reputation for toughness and leadership, was too stubborn to try the new trick.

The potato-washing clan members were not humans, of course. They were rhesus monkeys inhabiting the unpopulated Japanese island of Koshima, where curious researchers had provisioned the band with fresh sweet potatoes by leaving them on a beach. Although my rendition has taken some literary license, it holds true to the basic events (Kummer, 1971). Imo was the name assigned to the brilliant monkey who first came up with the idea of washing the potatoes, and later discovered that sand and grain could be separated by throwing them onto water. Her potato-washing innovation was copied first by other juvenile males and females, and then by older females (about 18% initially), who passed it on to their offspring. Adult males failed to pick it up, partly because they had less contact with feeding juveniles, but perhaps also because they resisted novelty in general. After a few years, potato washing was an established tradition among the Koshima monkeys, and the episode had moved into the lore of the social sciences.

But one lesson of the Koshima monkeys has been all but ignored in socialization science: Cultural transmission occurs *outside* the family