Chapter 12. Nature versus Nurture

The most difficult developmental question was saved for last: the nature-nurture issue. I first examine this question in a more general way, by discussing the genetic basis of creative genius. Modern behavior genetics is shown to provide a reasonable solution to the genes-versus-environment debate. I then scrutinize a more specific case of the nature-nurture issue: the relation between gender and genius. In particular, I evaluate whether the relative dearth of women in the annals of psychology has a biological or cultural foundation.

"Genius must be born, and never can be taught," said John Dryden (1693/1885, p. 60), the English dramatist.

In the classic *Lives of the Painters, Sculptors, and Architects*, Vasari's (ca. 1550/1968) began his biography of Michelangelo by saying how "the great Ruler of Heaven looked down" and decided "to send to earth a genius universal in each art" who would be endowed with such special qualities that his works would seem "rather divine than earthly" (p. 347).

This conception of the origins of genius harks all the way back to the ancient Greeks, who saw human creativity as something special, inspired by the Muses. There was a Muse for all major creative activities of classical times, including heroic or epic poetry, lyric and love poetry, sacred poetry, tragedy, comedy, music, dance, and even astronomy and history.

Even so, the picture presented in the preceding chapters seem to portray genius as being made rather than born.

In particular, chapter 9 presented the family background most likely to encourage the development of great psychologists,

and chapter 10 described the impact of education and other facets of career training.

The implicit assumption was always that there exists a characteristic environment that shapes personal growth into the kind of individual who will leave some mark in the annals of the discipline.

Actually, on occasion this environmentalist position was made explicit, as was the case when we treated birth order and childhood trauma.

But whether implicitly or explicitly, the empirical findings seem to suggest that disciplinary achievement can be predicted by such external circumstances as socioeconomic class, religion and ethnicity, geographical origins, birth order, childhood trauma, various facets of formal education, and relationships with distinguished mentors.

So, what is the truth of the matter? Are great psychologists born or made? This question will be addressed in two ways.

First, the chapter begins with the general problem of the genetic basis of genius.

Second, the chapter closes with a specific manifestation of that broad issue, namely the relation between gender and greatness as a psychologist.

GENERAL PROBLEM: GENES AND GENIUS

Chapter 8 treated the connection between an eminent psychologist's worldview and his or her long-term impact on the field, as gauged by the citations he or she continues to receive in the professional literature (Simonton, 2000b).

At that time it was noted that psychologists were most likely to enjoy such long-term influence if they adopted extremist positions on the various critical dimensions that distinguish psychological theory and methodology.

Among those dimensions was the contrast between the endogenists who emphasize biological determinants and heredity and the exogenists who stress environmental determinants and social influences (Coan, 1968, 1979).

An outstanding example of an extreme endogenist is Francis Galton, whereas John B. Watson and many other behaviorists count as a conspicuous proponents of the extreme exogenist position.

The first tells us that genius is born, whereas the second says that genius is made.

Let us first examine these two opposed views, and then turn to what modern behavioral genetics has contributed to the debate.

Genetic Determinism

The title of Galton's (1869) *Hereditary Genius* means exactly what it says: Genius is born. Indeed, the whole book is devoted to propounding this thesis. In a nutshell, Galton's argument went as follows:

1. Human beings display tremendous individual differences in what he called "natural ability." According to Galton, this term meant something a bit more complex than just intelligence. Specifically, he said that "by natural ability, I mean those qualities of intellect and disposition, which urge and qualify a man to perform acts that lead to reputation. I do not mean capacity without zeal, nor zeal without capacity, nor even a combination of both of them, without an adequate power of doing a great deal of very laborious work" (Galton, 1892/1972, p. 77). In any large human population, natural ability would be distributed according to the normal, or bell-shaped curve. In this Galton was following the ideas of Adolphe Quételet, the Belgian pioneer in social statistics.
2. Those individuals whose natural ability place them in the upper right-hand tail of the distribution would then have what it takes to be called true geniuses. Such geniuses "will, urged by an inherent stimulus, climb the path that leads to eminence, and has strength to reach the summit – one which, if hindered or thwarted, will fret and strive until the hindrance is overcome, and it is again free to follow its labour-loving instinct" (Galton, 1892/1972, p. 77). Galton seems to have made a big assumption here, namely that the possession of a purely psychological attribute (high natural ability) would automatically manifest itself as a social attribute (eminence or reputation). But he believed that the personal and social facets of genius were practically equivalent. With respect to those with high natural ability, "it is almost a contradiction in terms, to doubt that such men will generally become eminent" (p. 77). At the same time, "few have won high reputations without possessing these peculiar gifts," and therefore "it follows that the men who achieve eminence, and those who are naturally capable, are, to a large extent, identical" (p. 78).
3. Individual differences in natural ability are subject almost entirely to inheritance. That is, "the concrete triple event, of ability combined with zeal and with capacity for hard labour, is inherited" (Galton, 1892/1972, p. 78). So strong was Galton's belief in the genetic determination of genius that the environment had virtually no role to play.

   > I believe, and shall do my best to show, that, if the "eminent" men of any period, had been changelings when babies, a very fair proportion of those who survived and retained their health up to fifty years of age, would, notwithstanding their altered circumstances, have equally risen to eminence. (p. 78)

   "If a man is gifted with vast intellectual ability, eagerness to work, and power of working," Galton (p. 79) explained, "I cannot comprehend how such man should be repressed." After all, he added, "the world is always tormented with difficulties waiting to be solved – struggling with ideas and feelings, to which it can give no adequate expression. If, then, there exists a man capable of solving those difficulties, or of giving a voice to those pent-up feelings, he is sure to be welcomed with universal acclamation" (Galton, 1892/1972, p. 79). In a sense, Galton was arguing that certain individuals at the upper end of the distribution are born as great problem solvers, an exceptional ability that will necessarily be directed to some useful purpose, and thereby receive acknowledgment from contemporaries and posterity.
4. If the foregoing three statements are granted, then a fourth follows automatically: Eminence should run in families. In fact, the bulk of *Hereditary Genius* is devoted to listing major geniuses and their biological relatives. The geniuses themselves were taken from a recently published biographical dictionary of eminent personalities. The luminaries were grouped into several chapters, including Statesmen, Commanders, Literary Men, Men of Science, Poets, Musicians, and Painters. The chapter containing the scientists is most relevant here, because several of those listed have also carved out a name for themselves in psychology's history. These include Aristotle, Francis Bacon, Comte de Buffon, Charles Darwin, Benjamin Franklin, William Harvey, Gottfried Wilhelm Leibniz, and Sir Issac Newton. All told, the number of distinguished scientists who had distinguished relatives was far greater than would be expected according to the base rate of genius in the general population.

The results for the Darwin family are perhaps most typical. Charles Darwin was the grandson of Erasmus Darwin, an early evolutionist. Moreover, Charles Darwin himself had sons sufficiently distinguished to have become knighted, an honor that Darwin himself never received (albeit Galton only mentions one by name, Sir Francis). Galton ends his listing the various notables of the lineage by adding that "I could add the names of others of the family who, in a lesser but yet decided degree, have shown a taste for subjects of natural history" (Galton, 1892/1972, p. 261). This statement could be an indication of Victorian modesty, for no doubt Galton could have included himself in this anonymous group. Galton, like Charles Darwin, was the grandson of Erasmus Darwin, although from a different grandmother.

To be sure, not every great scientist could be embedded within a notable family line. Galton specifically identified 18 who seemed to stand alone, including Roger Bacon, Tycho Brahe, Copernicus, Galen, Galvani, Kepler, and Thomas Young. Yet these exceptions are too rare to overthrow the general principle. Eminence in science tends to emerge from eminent pedigrees. This conclusion was strengthened by Galton's apparent demonstration that the same linkage also held for all other areas of human achievement. These results, Galton concluded, endorsed the argument that natural ability was inherited and that superior natural ability led to high distinction.

A large number of later inquiries have essentially replicated Galton's (1869) results, some looking at inclusive groups of geniuses (e.g., Bowerman, 1947; Bramwell, 1948; Ellis, 1926; Post, 1994), others concentrating on a particular domain of achievement (e.g., Simonton, 1983c, 1984a), including the sciences (e.g., Eiduson, 1962; Simonton, 1992c).

Of these latter studies, probably the most relevant was an extensive three-part examination of family resemblances among those of sufficient eminence to receive entries in J. M. Cattell's *American Men of Science* (Brimhall, 1922, 1923a, 1923b).

- At least one quarter of those in the "starred" group – whom Cattell identified as especially distinguished – had at least one eminent relative (Brimhall, 1923a).
- These incidence rates were appreciably higher than in the general population.
- For example, the brothers of illustrious scientists are 70 times more likely to become eminent than the population baseline.
- Furthermore, the greater the degree of genetic proximity to the eminent scientist, the higher the odds that a relative will also be eminent (Brimhall, 1923b).
- Interestingly, the published genealogies include a section on 16 eminent psychologists, including James Rowland Angell, Frank Angell, James McKeen Cattell, John Dewey, G. Stanley Hall, Joseph Jastrow, Edward Lee Thorndike, and Robert Session Woodworth.
- Indeed, two of these, the two Angell's, were related to each other, as cousins.

Although eminence in science thus appears to cluster into family lineages, it is not clear what is exactly being inherited.

Sometimes Galton (1869) held that the pedigrees merely reflect the genetic transmission of natural ability, a rather generic combination of both intellect and disposition.

> Havelock Ellis (1926) drew a similar conclusion on the basis of his examination of British genius, holding that it was general intellectual ability that was being transferred across generations (also see Bowerman, 1947).

Yet other times Galton appears to suggest that the inheritance is more domain specific. For example, on the basis of his survey of members of the Royal Society of London, Galton (1874, p. 195) concluded about 60% were "gifted by nature with a strong taste" for science.

One problem with the notion of domain-specific inheritance, however, is that many of the distinguished family lines fail to confine themselves to a single field, nor even to a closely related set of fields (Galton, 1869).

> According to one study of eminent scientists, for instance, eminent relatives were almost evenly divided between those who attained distinction in science and those who became famous in some other domain (Post, 1994).

If the domain is defined even more narrowly, the degree of concordance becomes even smaller (Brimhall, 1922).

Thus, although great psychologists may come disproportionately from distinguished pedigrees, it is relatively rare for those pedigrees to produce more than one great psychologist.

> The eponymous founder of Weber's law (Ernst Heinrich) had a younger brother of note (Wilhelm Eduard), but the latter was a famous physicist. Likewise, the eminent Neo-Behaviorist Edward Chace Tolman had an eminent older brother, Richard Chace, who was also a physicist. Besides the Angell cousins, the only really conspicuous examples in psychology's history are: the Allport brothers, Floyd and Gordon; the father-daughter pair Sigmund and Anna Freud; and the father-son pair James and John Stewart Mill. Somewhat less eminent instances include the siblings Magdalen and Philip Vernon and the father-son pairing of Edward Lee and Robert Ladd Thorndike.

Hence, it is very unlikely becoming a great psychologist is contingent upon inheriting a domain-specific set of traits.

Environmental Determinism

Needless to say, all of this speculation about some genetic endowment that leads to greatness as a psychologist – whether that endowment be generic or domain-specific – is premature anyway.
The pedigrees may instead result from a developmental process having nothing to do with biological inheritance.
Galton said that if a person with superlative natural ability became a changeling, and were thus raised in a totally alien environment, he or she would still become a renowned genius.
The behaviorist John B. Watson (1970/1924) turned Galton's curious Gedanken experiment upside down:

> Give me a dozen healthy infants, well formed, and my own specified world to bring them up in, and I'll guarantee to take any one at random and train him to become any type of specialist I might select – a doctor, lawyer, artist, merchant chief, and yes, even a beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations and race of his ancestors. (p. 104)

Other behaviorists have taken a similarly strong stance in favor of environmental determinism.
An especially relevant example is B. F. Skinner (1961), who has interpreted the creative process in terms of the reinforcement contingencies to which the creator was exposed.

- The creative individual is merely the developmental product of a supportive cumulative record.
- Indeed, as was noted in chapter 6, this basic Skinnerian position has been elaborated into a behavioristic theory of insight (Epstein, 1990, 1991).

Moreover, one investigator even showed that the output of publications – in this case by writer Isaac Asimov – could be described in terms of the typical "learning curve" (Ohlsson, 1992).

Naturally, no behaviorist has actually carried out the experiment Watson suggested, nor has anyone ever carefully tracked the reinforcement schedules of creative individuals throughout their life span.
Even so, there is certainly an abundance of evidence that suggests that environmental factors must play a major role in the emergence of creative genius (Simonton, 1987a).
Alphonse de Candolle (1873), the notable French botanist, offered the first empirical demonstration.

> Surprisingly, Candolle enjoyed a genuinely distinguished pedigree, so much so that Galton (1869) had listed him and his eminent father in his chapter on "Men of Science."
> Furthermore, at the time *Hereditary Genius* was published, Candolle's own son was well on his way to become a notable scientist in his own right.
> That prominent genetic background notwithstanding, Candolle believed that Galton had grossly underestimated the impact of the environment.
> To establish the importance if not primacy of environmental forces, Candolle gathered a tremendous amount of data on the political, economic, social, cultural, and religious circumstances that were most supportive of the emergence of eminent scientists in various nations of Western civilization.

Because these conditions are best regarded as features of the sociocultural context, I can save discussion for Part V, especially for chapter 15.
Nonetheless, Galton was perfectly willing to accept the weight of Candolle's evidence, at least enough to moderate his extreme genetic determinism.
In fact, it was Candolle's (1873) that inspired Galton (1874) to undertake his pioneering survey of eminent British scientists.
The outcome of that survey was reported in *English Men of Science: Their Nature and Nurture*.
The book's subtitle clearly reveals Galton's recognition that scientific genius is in all likelihood both born and made.
The use of words "nature" and "nurture" to indicate these two developmental forces harks back to William Shakespeare, who, in *The Tempest*, has Prospero say of Caliban:

> A devil, a born devil, in whose nature
> Nurture can never stick; on whom my pains
> Humanely taken, all, all lost, quite lost.

(quoted in Evans, 1974, p. 1631)

Nevertheless, it was Galton who used these terms explicitly to describe the nature-nurture controversy as it is currently recognized in psychology.

As Galton (1874) defined the contrast,

> the phrase "nature and nurture" is a convenient jingle of words, for it separates under two distinct heads the innumerable elements of which personality is composed. Nature is all that a man brings with himself into the world; nurture is every influence from without that affects him after his birth. (p. 12)

Expertise acquisition: Pro.

Galton's own approach to addressing this question was to inquire into the family and education backgrounds of his notable survey respondents.

However, more recently the nature-nurture debate has been rekindled from cognitive psychology.

> Despite all the disagreements between the behaviorists and the cognitive psychologists, they have tended to concur that genetic inheritance has little if any causal influence.
>
> This position emerged from the work of Herbert Simon and his colleagues on the acquisition of expertise (e.g., Ericsson, Krampe, & Tesch-Römer, 1993; H. A. Simon & Chase, 1973).
>
> According to this view, world-class experts must acquire approximately 50,000 "chunks" of domain-relevant information (H. A. Simon, 1986).
>
> As might be expected, this acquisition takes considerable effort and time in study and practice (Ericsson & Charness, 1994).
>
> Most commonly it requires approximately a decade of intense work as an apprentice and novice before attaining expert status (Hayes, 1989).
>
> This commitment is often referred to the "10-year rule" (e.g., Ericsson, 1996a).

For the most part, this principle was based on studies of expertise acquisition in domains like chess, sports, and music performance (Ericsson, 1996b).

Still, the same principle has been said to apply to world-class creativity as well (Ericsson, 1996a).

In support of this idea, researchers have shown that about a decade transpires between the time when creative individuals first begins acquiring the necessary expertise and the time when their first genuine masterpieces appear (Hayes, 1989b).

> For instance, one study of 120 classical composers found that music lessons first began around 9 years old, composition around 17 years, and the first successful composition around 26 (Simonton, 1991b).
>
> Hence, by the time the typical composer had the first hit, he or she was composing for 9 years and studying music for around 17.

Although no investigator has explicitly tested the 10-year rule using a sample of eminent psychologists, there has been indirect evidence respecting its descriptive accuracy.

- An inquiry into the career development of 69 eminent American psychologists found that the average age for producing their first high-impact publication was around 30, whereas the average age for obtaining their highest degree was around 28 (Simonton, 1992b).
    - When allowance is made for the amount of specialized training that likely preceded the latter figure – certainly graduate school and for most an undergraduate major in psychology besides – it would seem that something close to a decade was usually required.
- Another study scrutinized the typical career age that researchers publish articles in leading psychology journals, where career age was defined as the years accumulated since receiving the doctoral degree (Lyons, 1976).
    - The journals examined were *Psychological Review*, *Psychological Bulletin*, the *Journal of Abnormal and Social Psychology*, and the *Journal of Experimental Psychology*.
    - Although the median professional age ranged between 8 and 11 years, the bottom quartile fell between 4 and 6 years.
    - These figures were for all articles, without respect to whether they are frequently cited or not.
    - Highly cited articles would probably occur somewhat later in the career (Simonton, 1997b).

In any case, it is apparent that it is uncommon for psychologists to produce a high-impact publication immediately after completing their graduate training, suggesting that their apprenticeship may continue a bit after the career officially begins.

Expertise acquisition: Con.

Like all other nomothetic principles in psychology, there certainly exist numerous exceptions to the 10-year rule.

At one extreme, some great psychologists had to wait longer before their first hit.

> Hermann Ebbinghaus was 12 years post-PhD before publishing his first great contribution *On Memory*, while Sigmund Freud was 14 years post-MD before he collaborated with Josef Breuer on the landmark *Studies in Hysteria*.

At the other extreme are those who get their careers off to a great start almost at once.

> Edward L. Thorndike's dissertation, as I already noted in chapter 4, was almost immediately published in *Psychological Review*, and went on to become one of the classics in the psychology of learning.

Yet the existence of such individual differences would seem to cast some doubt on the expertise-acquisition model.

In fact, research has shown that the amount of time usually required to acquire the necessary expertise tends to vary as a function of the degree of creative genius eventually displayed (Simonton, 1991a, 1991b).

- For both artistic and scientific creativity, those with the greatest lifetime productivity and highest levels of achieved eminence mastered the necessary information and skills in a shorter time than did their less prolific and less well-known colleagues (Simonton, 1997b, 1999d).
- For 69 eminent American psychologists, in particular, eminence in the field correlates -.23 with the amount of time that elapsed between receiving the highest degree and the first highly-cited publication (Simonton, 1992b).

Nor is this the only empirical association that does not seem compatible with this environmental factor.

- Research has also shown that expertise-acquisition can operate to stifle creative development rather than enhance it (Simonton, in press).
- This evidently happens because individuals can become overly specialized and thus narrow and inflexible in their thinking (Frensch & Sternberg, 1989).
- Indeed, this very possibility was implied by some of effects discussed in earlier chapters, such as the repercussions of formal education, professional marginality, and career aging (i.e., Planck's principle).
- Sometimes, in fact, the detrimental effects of "over-training" must be treated by a suitable amount of "cross-training," or the acquisition of expertise in another domain (Simonton, 2000a).

These empirical issues aside, the expertise-acquisition model must come up against another critical reality: Modern behavioral genetics suggests that genius may have indeed some foundation in biological inheritance (Simonton, 1999d).

Modern Behavior Genetics

Galton's (1869) *Hereditary Genius*, by introducing the pedigree method, became one of the pioneering works in the development of what was eventually to become known as behavior genetics.

Nor was this his last contribution to the emerging discipline. His work on bivariate regression was developed by his star pupil Karl Pearson into the correlational statistics that play an essential role in establishing the degree of inheritance (i.e., heritability coefficients).

Furthermore, Galton pioneered the use of twins as a vehicle for helping to resolve the nature-nurture problem, a method that has a very important part to play in behavior genetics (Bouchard et al., 1990).

Naturally, behavior genetics has acquired a conception of this issue that is far more complex and sophisticated than anything Galton ever imagined.

Sometimes the behavior geneticists have lent considerable support to Galton's position, but other times their results have cast doubt on many of his key ideas.

Let us begin with the most supportive findings.

The heritability of ability and character.

Perhaps the single most significant message to come out of recent research is how many individual-difference variables have appreciable heritability coefficients (Bouchard, Lykken, McGue, Segal, & Tellegen, 1990; Loehlin, 1992a; Plomin, Owen, & McGuffin, 1994).

Even rather complex characteristics have genetic underpinnings, including political attitudes and musical tastes (Tesser, 1993), the amount of time devoted to watching television (Plomin, Corley, DeFries, & Fulker, 1990), job satisfaction and values (Arvey, Bouchard, Segal, & Abraham, 1989; Keller et al. 1992), dispositional empathy (Davis, Luce, & Kraus, 1994), and religious interests and attitudes (Waller, Kojetin, Bouchard, Lykken, & Tellegen, 1990).

To be sure, not all traits feature the same high degree of genetic inheritance.

Some traits, like intelligence, can be mostly attributed to nature, whereas other traits, like religiosity, can be mostly attributed to nurture.

Yet the inventory of characteristics with non-trivial heritability coefficients is sufficiently large and diverse that a large part of a person's personality profile will necessarily have a genetic foundation.

This inventory of genetic influences may even help historians of our discipline fathom some of the personal idiosyncrasies of various notables in its history.

For instance, one history of psychology textbook contained the following observation: "Despite the intellectually stimulating atmosphere in which Wundt grew up (or perhaps because of it), he remained a shy, reserved person who was fearful of new situations" (Hergenhahn, 1992, p. 237).

Well, it just so happens that about half of Wundt's inclination toward a fearful and reserved shyness might be ascribed to the genes he inherited at the moment of his conception. According to behavior genetic research, about 50% of the variance in shyness, or "anxious introversion," can be ascribed to the genes, a degree of heritability noticeably higher than found for most other personality traits, which tend to feature heritabilities more around 30-40% (Sulloway, 1996).

Shared versus unshared environment.
Just as crucial is the fact that behavior geneticists have clarified the nature of nurture (Plomin & Bergeman, 1991).
That is, the impact of environmental factors has been partitioned into two independent influences: shared and nonshared.

- The former concerns those aspects of the child's environment that are shared with siblings, such as their socioeconomic class.
- The latter concerns those that aspects that are distinct to each child, such as their respective ordinal positions in the family.

Surprisingly, behavior geneticists have discovered that for most personal attributes, the shared environment is far less influential than is the nonshared environment (Plomin & Rende, 1990; cf. Waller & Shaver, 1994).

> As a result, siblings coming from the same family are actually rather more different from each other than might be expected from the fact that they grew up in the same home and neighborhood.

How does this relative impotency of the shared environment square with what was reviewed about the family background of great psychologists?
Doesn't chapter 9 contain a long list of familial influences that concern the shared rather than nonshared environment?
The solution comes from another critical finding of behavior genetics, namely that many so-called environmental effects are actually genetic effects (Plomin & Bergeman, 1991).
Nurture is often mistaken for nature (Harris, 1998).

- To illustrate, although great psychologists are more likely to come from the homes of parents who are professionals – ministers, physicians, lawyers, professors, and teachers – that does not necessarily mean that the these homes provide a stimulating environment for the nurture of scientific talent.
- The children raised in these homes also inherited a superior set of genes.
- The same genes that enabled their parents to become professionals will enable these children to accomplish the same.
- That the parents provided homes well-stocked with books and other reading materials, that the family often took trips to museums, art galleries, and other stimulating locales – all this is the effect rather than the cause of the high-power intellects that all inherited, parent and child alike.
- In genetic terms, the apparent association between the parental phenotype (behaviorally intelligent and inquisitive) and the offspring phenotype (also behaviorally intelligent and inquisitive) is the spurious result of the shared parent-child genotype (innate inclination toward intelligent and inquisitive behavior) rather than being a direct consequence of the parental phenotype shaping their offspring's phenotype.

This notion may even be applied to environmental factors that would seem to have their environmental status totally secure, such as immigrant status, scholastic performance, distinguished mentors, and professional marginality (Simonton, 1994a).

Take the supposed developmental impact of parental loss as a case in point.

> It would seem that whether one or both parents died during a person's childhood or adolescence would constitute an unambiguous instance of nurture rather than nature.
>
> Yet it is very easy to recast this event as the consequence of genetic influences (Simonton, 1994a).
>
> Parents who have the attributes that Galton (1869) would consider "natural ability" should tend to marry later in life and begin parenthood later still.
>
> Accordingly, those who become eminent should be born to parents who are much older than the norms, and that is demonstrably the case, as has been shown by Galton (1874), Havelock Ellis (1926) and many others (e.g., Bowerman, 1947; Raskin, 1936; Visher, 1947).
>
> Typically, the fathers of famous persons are in their late 30s or early 40s, the mothers in their late 20s or early 30s.
>
> For instance, the survey respondents in Galton's (1874) *English Men of Science* were born to fathers who were around 36 years old and mothers who were around 30.

In general, then, it must be manifest that individuals who have older parents will be more likely to lose one or both parents while still in their minority.

This delay can also account for the tendency for the rates of parental loss to be higher among literary than scientific creators (Berry, 1981).

> If scientists are more likely to firstborns and writers laterborns, then this contrast necessarily follows (Bliss, 1970; Galton, 1874).
>
> In line with this interpretation, the fathers of eminent scientists tend to be younger at the time the luminaries were born than the fathers of eminent literary figures (Raskin, 1936).

Psychopathological pedigrees.
The foregoing interpretation assumes that increased rates of parental loss among the eminent is a mere by-product of the parents' higher "natural ability," which manifests itself as a tendency to delay reproduction and thereby place their children at increased risk.
But it could also be argued that the parents of eminent personalities carry genes that predispose them to die young or to exhibit some other form of parental absence.
In line with this alternative genetic interpretation, research has shown that parents of the eminent who were themselves eminent
(a) are more likely to have experienced early parental loss and
(b) are more prone to shorter life expectancies (Eisenstadt, 1978).
What might this genetic disposition be? Back in chapter 7 I discussed the literature on the "mad genius" syndrome.
If creative genius is associated with a moderate infusion of madness, and if various psychopathological symptoms have high heritability coefficients, then the distinguished pedigrees that Galton (1869) may overlap the family lines that carry an above-average amount of genes for psychopathology.
This argument has considerable empirical support (Juda, 1949; Myerson & Boyle, 1941; Richards, Kinney, Lunde, Benet & Merzel, 1988).

- For instance, one comprehensive study in Iceland – where genealogical and medical records are exceptionally complete – found that those families that produced a disproportionate number of Icelanders suffering from mental illness also produced a disproportionate number of family members who ended up in *Who's Who in Iceland* (Karlson, 1970).
- In another study of 291 eminent figures of history, 56% were found to have come from family lines with conspicuous rates of psychopathology (Post, 1994).

Because psychopathology is often associated with suicide, alcoholism, and other life-shortening behaviors, these pedigrees would also exhibit higher rates of early parental loss as well.
In agreement with this chain of reasoning, many notables of psychology's history emerged from family lines that exhibited some evidence of psychopathology.

- Friedrich Nietzsche's father succumbed to mental illness, and the mothers of both Ivan Pavlov and Jean Piaget suffered from nervous disorders or emotional instability.
- Sigmund Freud had two cousins who went insane, and Wilhelm Reich's parents both committed suicide.
- Not only did William James suffer from many emotional difficulties, but his father seemed to display a borderline personality disorder, while his sister Alice exhibited exceptional hypochondriasis and an incapacitating pathological dependency.
- Probably the most conspicuous mad-genius pedigree is that of "Darwin's bulldog," T. H. Huxley.

I am not arguing that early parental loss represents exclusively a genetic factor.
I am only stating that according to modern behavior genetics, things are not always what they seem. Many so-called environmental influences may actually be the consequence of underlying genetic factors.
Sometimes the genetic etiology will be fairly straightforward, as in the tendency for eminent individuals to come from the homes of professionals.
Other times the genes may operate by rather more roundabout routes, as in the tendency for famous persons to have experienced early parental loss.
Furthermore, when nurture does exert some impact on early development, that influence may involve the nonshared environment – such as birth order – far more than the shared environment.

Nurture as nature.

There is one final finding of modern behavior genetics that puts one of Galton's seemingly outlandish claims in a more favorable light.

Galton (1869) believed that genetic endowment was so potent that if a highly gifted person were to become a changeling, and thus raised in a totally different environment, genius would still win out, and emerge all the obstacles notwithstanding.

Although behavior geneticists would not defend so strong a position, the accumulated evidence does support a weakened form of the same proposition (e.g., Beer, Arnold, & Loehlin, 1998; Plomin, Fulker, Corley, & DeFries, 1997).

- In the first place, even when children are raised from infancy in a foster home, with biologically unrelated parents, their phenotype will resemble more that of their true parents than that of their foster parents (Scarr & McCartney, 1983).
- Furthermore, identical (monozygotic) twins reared in separate homes, not only retain their genetic similarities on most individual-difference variables, but also those similarities tend to increase over time (Bouchard, 1995).

In other words, the influence of genetic endowment becomes stronger as the offspring get older – precisely the opposite of what would be predicted if individual development became progressively dominated by environmental factors.

> Evidently, as offspring mature, they acquire the enhanced ability to shape the environment in a manner more consistent with their genotypic leanings (Scarr & McCartney, 1983).
>
> Toddlers are pretty much at the mercy of their parents when it comes to choosing activities and recreation.

Yet by the time offspring reach adolescence, they take an active role in making the environment fit better their natural inclinations.

> They may decide to take up this specific instrument or participate in that particular sport or read some specialized genre of books, their parents' preferences be what they may.

Hence, Galton's hypothetical changelings will do whatever possible to secure the opportunities necessary to realize their full potential.

Even if those changelings were raised by a John B. Watson trying to convert them into a "beggar-man and thief," their born genius may still emerge in some form – though perhaps as a big-time drug lord rather than a great psychologist.

Emergenesis.
Although it appears that Galton's views have more empirical justification than Watson's, behavior geneticists have pointed to one significant complication: Genetic inheritance may not always operate according to a simple additive process.
This is apparent in the fact that for certain personal traits, identical (monozygotic) twins are far more similar than are fraternal (dizygotic) twins, who may on those traits no more similar than any randomly selected pair from the larger population (Lykken, 1982).
This is what would be expected if inheritance were multiplicative rather than additive.
David Lykken (1982) has styled this complex form of inheritance emergenesis, and has suggested that emergenic endowment underlies creative genius (Lykken, 1998).
This suggestion has received some empirical endorsement (Waller et al., 1993).
One peculiar implication of emergenic inheritance is that exceptional genius should generally *not* run in family lines (Lykken, McGue, Tellegen, & Bouchard, 1992).
Instead, great geniuses should most often emerge out of nowhere.
This happens because it is difficult to inherit the full configuration of genes required for the manifestation of the multiplicative composite necessary for genius (Simonton, 1999d).
Lykken (1998) provided some specific examples of emergenic genius, including Carl Friedrich Gauss and Michael Faraday.
For some reason, Galton did not even consider these two notables in his pedigree study.
Gauss's mathematical work – the Gaussian curve – even had made a contribution to Galton's own thinking about individual differences.
Curiously, Galton (1869) offered a conception that appears to be more multiplicative than additive.
He said that natural ability required the combination of intelligence, energy, and persistence.
If to this list are added certain other ingredients – such as the imagination and independence expected of those who hail from psychopathological pedigrees – then the odds are all the greater that genius is emergenic in nature.
If so, then this process could help account for the highly skewed distribution of lifetime productivity and eminence discussed at length in chapter 3.
The reason is that multiplicative inheritance implies that the emergenic trait would have a lognormal cross-sectional distribution even if the component of those traits were normally distributed.
This consequence was first suggested by Cyril Burt (1943) and was more recently given considerable mathematical elaboration and empirical documentation (Simonton, 1999d).
But if genius is emergenic, what does this imply about the distinguished pedigrees that Galton (1869) so assiduously assembled in *Hereditary Genius*?
One possibility is that Galton may have overstated his case, so that the lineages are not so conspicuous.
Take Isaac Newton, as an example.
Other inquiries that have implemented much more strict criteria regarding what counts as a notable lineage arrive at a much lower proportion of cases (e.g., Simonton, 1984a, 1992c).
Admittedly, there do exist many conspicuous examples – the Darwin family to which Galton belonged conspicuous among them.
Even so, these might have a totally different causal basis.
Indeed, the true foundation of these lineages may be more environmental than genetic. This possibility will be picked up again in Part V.
So, may it suffice to say that if Galton were still alive today, would could not consider himself to have been completely vindicated by modern behavior genetics.

SPECIFIC MANIFESTATION: GENDER AND GENIUS

Anyone who reads Galton's (1869) cannot avoid noting one distinctive fact:

Women are immensely underrepresented.

The only notable case is that of the Brontë sisters, who receive their due attention in Galton's chapter on "Literary Men."

Given that women represent slightly more than half of human adults, far more instances would be expected.

It would seem, moreover, that this dearth should cause a problem for Galton's genetic determinism.

Except for a few odd "sex-linked" genes, like those for color blindness and hemophilia, women and men inherit more or less the same genes from their parents.

Galton seemed not to be sufficiently aware of this potential problem, perhaps because he had some rather curious pre-Mendelian conceptions about how inheritance worked.

For instance, at one point in the book Galton stated that certain statistics "prove that the female influence is inferior to the male in conveying ability" (Galton, 1892/1972p. 103).

Yet the problem remains.

Why are women so rare in *Hereditary Genius*?

Is it because a sexist bias permeated his data?

Or is the differential real?

If the later, what is the developmental cause?

Are women by nature not equipped to attain greatness, or is it a matter of nurture?

To address these questions, let us first look at the raw empirical facts and then turn to their theoretical interpretations.

The Facts

In 1903, James McKeen Cattell strove to identify the most "eminent men" of history.

- In order to avoid ethnocentric biases as much as possible, he attempted to gather an international collection of biographical dictionaries, although he was only able to procure appropriate reference works in English, French, and German.
- Based on the amount of space allotted in these sources, he produced a list of the top 1000.
- Of those listed, only 32, or a bit more than 3%, were women.
- Moreover, many of these women were female monarchs, such as Mary Stuart of Scotland, Elizabeth I of England, Catherine the Great of Russia, Isabella of Castille, and Christina of Sweden.

In fact, when Catharine Cox (1926) used Cattell's (1903) listing to obtain her sample of eminent achievers, she deleted all those women who she believed were born to fame, and obtained a more truncated sample of eminent females.

- Of her final 301 geniuses, only 8 were women, namely, Madame de Stael, Georges Sand, Madame de Sévigné, Marquise de Maintenon, Elizabeth Gaskell, George Eliot (Marian Evans), Charlotte Brontë, and Harriet Martineau.
- That amounts to less than 3%, or a proportional loss of about 2 women.

Women are a little better represented among those included in Havelock Ellis' (1926) *A Study of British Genius*.

- Of the 1030 eminent individuals, 55 are female, yielding a percentage in excess of 5%.

Other heterogeneous samples of famous creators, leaders, and miscellaneous celebrities obtain percentages that fall far short of the 51% that women represent of the larger population (e.g., Eisenstadt, 1978; Goertzel & Goertzel, 1962; Goertzel, Goertzel, & Goertzel, 1978; Hayes, 1989b).

The proportion is usually so low that small samples of notable individuals may not contain any women at all.

- For instance, when Edward L. Thorndike (1950) assessed the personality traits of just 94 luminaries, not one was a woman.
- Women did only a little better in the subsample of geniuses that Cox (1926) similarly assessed on 67 character traits: out of the 100, just 2, Stael and Sand, were women.

Naturally, the proportion of women varies according to the specific domain of achievement.

On the one hand, women have always received more ample representation among the giants of literature.

- According to Cattell (1903), about 12% of all great writers are female, a substantial increase in their usual ratio.
- Indeed, in the subsample of 301 geniuses that Cox (1926) drew from Cattell's 1000, every woman but one – Maintenon, the wife of King Louis the Great of France – was a creative writer.
- In a few parts of the world, female writers have attained the greatest possible heights.
- Japanese literature is rich in female names, among them Murasaki Shikibu, who authored the world's first novel, *The Tale of Genji*, thereby obtaining a status that compares favorably with that of William Shakespeare (Simonton, 1992a).

On the other hand, women have been rather more rare in classical music.

- The proportion is so small, in fact, that they appear not at all among the 120 most eminent composers (Simonton, 1991b) and are just barely represented in a sample of nearly 700 (Simonton, 1977c).
- Given these statistics, it comes as no surprise that not a single female composer was included among the 11 composers in Cox's (1926) historiometric inquiry.
- Given these statistics, it is perhaps no wonder that George Trumball Ladd, the early American psychologist, could publish in 1917 a book with the silly title *Why Women Cannot Compose Music* (Sheehy, Chapman, & Conroy, 1997).

In science, women do a little better, but still fall far short of the overall percentage.

- In a sample of illustrious scientists extracted from standard biographical dictionaries and encyclopedias, less than 1% were women (Simonton, 1991a). Names like Hypatia, Caroline Herschel, Marie Curie, and Barbara McClintock are mere drops in an ocean of male scientists.
- Although more contemporary samples of scientists have obtained a better representation, the figures are still pretty low, especially among the truly eminent (J. R. Cole, 1987).
- For instance, the number of women who were members of the National Academy of Sciences in 1991 was about 5% (Feist, 1997).
- Furthermore, women have received around 2% of the major scientific awards, such as the Nobel Prize, the National Medal of Science, and the various awards bestowed by the National Academy of Sciences (Hayes, 1989b).

Yet the female representation varies even within distinct scientific disciplines.

- This is immediately apparent from the results that J. M. Cattell (1933) reported for a large sample of 9,785 notable American scientists.
- Although the overall percentage of women in this group stood at the respectable figure of 7%, the percentage remained only around 2% for physics and 4% for geology.
- In contrast, about 10% of the botanists and physiologists were women, and psychologists especially welcomed female participation, obtaining an impressive figure of 22%, more than twice the representation of any other scientific discipline.

Nonetheless, this percentage is based on a fairly inclusive sample of 656 living psychologists. More select samples obtain lower percentages.

- Among 538 luminaries who obtained a place in the annals of psychology between 1600 and 1967, only 11, or about 2%, were women (R. I. Watson & Merrifield, 1973).
- More recently, of those deceased psychologists of sufficient prominence to earn obituaries in American Psychologist between 1979 and 1990, the percentage reaches 13% (Kinnier et al., 1974).
- According to a tabulation executed by one of my research assistants, women made up only 11% of those listed in a recent biographical dictionary distinguished psychologists (Sheehy, Chapman, & Conroy, 1997).
- Furthermore, of 69 psychologists who influenced American psychology between 1879 and 1967, the proportion declines to 4% (Simonton, 1992b).

Although psychology is highly receptive to female achievement, outstanding women psychologists are not evenly distributed across the field's subdisciplines.

- According ` eminent female psychologists (O'Connell & Russo, 1990). Out of all the eminent women covered in this reference book, less than one quarter made contributions to one of psychology's "hard" or "tough-minded" subdisciplines, such as experimental, physiological, and comparative.

According to an analysis of the membership of the National Academy of Sciences, experimental psychologists have a much greater likelihood of receiving that honor than do personality and social psychologists (Over, 1981). This alone could account for the poor representation of women psychologists in that distinguished body – a much smaller percentage than their place among great psychologists in general.

Although women may be among the highly respected researchers in certain subdisciplines of psychology, the fact persists that men dominate the annals of psychology's history.

Moreover, with only one minor qualification, the hegemony of men holds no matter what the specialty may be.

That one exception may be the psychology of women and gender, where women seem to predominate. Yet by its very nature this exception is itself so exceptional that it cannot seriously threaten the generalization.

The overwhelming majority of great psychologists are still men. Why?

The Interpretations

As emphatically demonstrated in chapter 3, the single most critical predictor of an individual's lasting fame is his or her total lifetime output.

Thus, the most direct explanation of the low female representation in creative domains may be their low total productivity.

In line with this interpretation, many notable women psychologists seem to have based their reputations on somewhat thin publication records.

June Downey could claim only 76 lifetime publications, and Else Frenkel-Brunswik a mere 16.

Yet it is also easy to cite counterexamples.

Anna Freud's bibliography contains over 100 items, and Margaret Washburn's more than 200.

So, is there any genuine evidence that women tend to publish less than men, and thereby compromise their short- and long-term impact on the field?

There exists an abundant literature showing that women scientists tend to be less productive than men (J. R. Cole, 1987).

- According to one study of university faculty, the likelihood of publishing 5 or more articles in a 2-year period was 3 times greater for men than for women (Blackburn, Behymer, & Hall, 1978).
- Another investigation showed that men out-produced women in both articles and books by a ratio of about 2 to 1 (Clemente, 1973).

Gender-based output differentials have been found in psychology as well.

- One study looked at the factors that predict the number of publications in the first 6 years after receiving the PhD for a sample 485 APA members who had received their doctorates between 1966 and 1976 (Rodgers & Maranto, 1989).Whether the survey respondent was male or female was a more powerful predictor than any other factor, including the quality of the first job, the pre-doctoral publication record, and general scholastic ability.
- Another investigation that focused on experimental social psychologists found that gender accounted for more variance in publications than did the quality of the graduate department, the quality of the current department, and such personality traits as competitiveness (Helmreich et al., 1980). On the whole, male psychologists appear to out-publish their female colleagues by a ratio of almost 3 to 1 (Guyter & Fidell, 1973; Helmreich et al., 1980).

The lowered quantity of output should not be equated with a lowered quality of output.

- In the study of 485 APA members, gender did not directly predict the number of citations received, but rather any contrasts in professional visibility was entirely mediated by the differences in publication rates (Rodgers & Maranto, 1989; cf. Helmreich et al., 1980). In concrete terms, males averaged 1.9 citations per article, women 1.8, a negligible difference.
- Another inquiry compared 564 high-impact articles with low-impact articles that appeared in the same journals (Over, 1990). The articles came from leading psychology journals, such as *Psychological Review*, *Psychological Bulletin*, *Journal of Experimental Psychology*, *Journal of Personality and Social Psychology*, *Journal of Abnormal Psychology*, *Journal of Applied Psychology*, *Journal of Consulting and Clinical Psychology*, and *American Psychologist*. Although 78% of the former had male first-authors, 83% of the latter had first-authors of the same gender. In other words, men publish more highly-cited articles only because they publish more ignored articles.
- Finally, I should mention a study of the impact of dissertation research that was published as articles in 14 top psychology journals (Over, 1982d). In the 6 years following publication, there were no gender differences in the number of citations. Although men soon pulled ahead of women in cumulative output, the number of citations received per paper remained the same.

In sum, gender differences in citation rates can be ascribed almost exclusively to corresponding differences in output rates.

This is exactly what would be predicted according to the equal-odds rule introduced in chapter 3.
Although the productivity gap between men and women psychologists is rather substantial, it tends to be reduced when other extraneous factors are taken into consideration (Helmreich & Spence, 1982; also see Boice, Shaughnessy, & Pecker, 1985).
This reduction was best demonstrated by a study that sampled 122 women and 122 men from the 1968 APA Directory (Guyter & Fidell, 1973).

- The men were almost 3 times more productive than the women, according to the publications listed in *Psychological Abstracts*.
- Yet most of this disparity disappeared when adjustments were made for age, area of interest (theoretical or applied), prestige of institution, and academic position (full professor, associate professor, assistant professor, lecturer-instructor, and nonacademic).
- The most important predictor was not gender, but rather whether the psychologist's interests were theoretical or applied.
- Moreover, the main effect of gender essentially vanished, to be replaced by two interaction effects (Gender × Academic Position and Gender × Prestige of Institution).

Hence, any raw gap in total output may be moderated by other factors besides gender per se.
As far as I can determine, this result has not been replicated on more recent samples, nor elaborated with the incorporation of additional variables.
Nonetheless, it suggests the possibility that women may be less likely to become great psychologists for other reasons besides their productivity.
In addition, even if the productivity gap is accepted, the differential output remains to be explained.
Thus, in either case, it becomes necessary to scrutinize the deeper causes of the phenomenon.
Among the most prominent possibilities are these five: sexual dimorphism, gender socialization, gender roles, gender bias, and the gender milieu.
The first of these concerns nature, whereas the last four concern nurture.
This contrast is reflected in the terminology.
Where the term "sexual" denotes the natural differences between men and women, "gender" signifies the nurtured differences.

Sexual dimorphism.

During the course of evolution, natural and sexual selection have created some very obvious morphological differences between men and women.

> Although the existence of contrasts in muscle mass, body fat, skeletal structure, and other secondary sexual features are uncontroversial, it is much more contentious whether men and women innately differ on anything that may account for the relative paucity of female genius.

Nevertheless, for more than a century there have appeared psychologists willing to speculate that this gender disparity is born rather than made.

Among the more recent examples is Hans Eysenck (1995), the eminent personality psychologist.

In his *Genius: The Natural History of Creativity*, he offered the following three biological explanations:

1. Women may be naturally less intelligent than men. Eysenck's (1995) assertion was based largely on the well-established observation that women's brains are noticeably smaller than men's. More controversial, however, is the claim that this difference cannot be totally attributed to contrasts in body size, a conspicuous correlate of brain size. Eysenck maintained that recent research suggests that a residual gap remains (e.g., Ankney, 1992). Moreover, Eysenck argued that this gap is reflected in observable differences in performance on IQ tests (citing Lynn, 1994). Men are reputed to enjoy an IQ at least one quarter of a standard deviation higher.
2. Women display appreciably less variation in intelligence than do men. This implies that the upper tail of the intelligence distribution will extend out farther for men than women, yielding a higher proportion of men with extremely high IQ scores. According to Eysenck's (1995) estimate, out of 10,000 randomly selected individuals, there would be 55 males with IQs of 160 or higher, but only 5 females. In other words, men at these superlative intellectual grade would outnumber women 11 to 1. Of course, men would also be disproportionately represented among those with subnormal IQs, but that tail has no consequence of the attainment of greatness anyway. Oddly, Eysenck (1995) made no attempt to explain why the person with the highest recorded IQ according to the *Guinness Book of Records* – Marilyn Vos Savant, with a score of 228 – is a woman rather than a man (McFarlan, 1989).
3. Women are constitutionally disposed toward certain personality traits that make them less likely to become creative geniuses. Eysenck (1995) put special stress on gender differences in Psychoticism, a key dimension of the Eysenck Personality Questionnaire. As noted in chapter 7, high scores on this dimension have been associated with enhanced creativity. Yet because men tend to score twice as high as women on this factor, the former should exceed the latter in creativity as well. The consolation prize the women would be that they would have a less tendency toward the kinds of psychopathology associated with excessive scores on Psychoticism.

Although Eysenck's (1995) assertions are documented with contemporary research, the arguments themselves date back into psychology's early history (Shields, 1975).

- Organologist Franz Joseph Gall and phrenologist Johann Spurzheim both believed that women's brains were strikingly different from, and inferior to, men's.
- Pioneer neuroanatomists Paul Broca and Theodore Meynert were able to demonstrate to their satisfaction the inferior organization of female brains.
- The negative implications of the women's smaller brains were drawn by the psychologists Alexander Bain and George Romanes.

The variability hypothesis had its early beginnings in Darwin's *The Descent of Man*, and was explicitly linked with intellectual ability by Havelock Ellis, notwithstanding the latter's positive attitudes toward the liberation of women.

> This link received endorsement and development by Edward Thorndike (Shields, 1982), and J. M. Cattell (1903) explicitly used this hypothesis to account for the very poor showing of women among his elite 1000. "Women depart less from the normal than man," he said, "a fact that usually holds for the female throughout the animal series" (p. 375).

Finally, the debilitating constitution of the female personality goes back to ancient Greece, and found many more modern advocates, including the Spanish physician Juan Huarte and the British scientist Francis Galton (Shields, 1975).
Admittedly, dissenters from the prevailing view would appear from time to time.
Philosopher John Stuart Mill attacked the notion that women were inherently less intelligent, and the variability hypothesis was attacked by statistician Karl Pearson and psychologist Leta Hollingworth.
Yet the fact remains that the idea that women are biologically inferior to men can continue to be entertained by serious and illustrious psychologists at the turn of the century.
It is hard to decide why the debate has continued so long without resolution.

- Part of the problem is that the issue has become highly political in nature, the stand taken seeming to reflect more general attitudes toward the place of women in society.
- Just as crucial may be deficiencies in the empirical evidence that make it impossible for any one side to deliver a knockout punch. Underlying Eysenck's (1995) arguments, for example, are a host of tenuous measurement assumptions. Tests are not provided a priori, but rather emerge a posteriori, through various psychometric procedures that are implemented by fallible human beings (most of whom happen to be men).
- Lastly, it is not completely clear how evolution would account for the conjectured innate differences, as Karl Pearson was among the first to recognize (Shields, 1975). Indeed, it is perfectly possible to conceive evolutionary scenarios in which men and women would have to be equal on virtually all individual-difference variables (G. F. Miller, 1998; Simonton, 1999b).

Perhaps only gender contrasts in physical aggressiveness can boast an empirically and theoretically secure basis, as Eleanor Maccoby and others have demonstrated (e.g., Maccoby & Jacklin, 1980; Hyde, 1986).
At present, the safest scientific strategy may be to adopt an agnostic attitude, at least until psychologists can devise more rigorous techniques to resolve the debate.
Besides, there already exist an ample inventory of environmental factors that have a proven connection to the gender gap in creative achievement.

Gender socialization.

Parents clearly raise their children differently depending on their gender.

In most literate societies across the globe, boys are socialized toward independence and achievement, whereas girls are trained to center their lives around family and relationships (Barry, Bacon & Child, 1957).

Accordingly, throughout the course of history, many women of enormous talent probably never even considered the prospect of having life goals outside the home.

At best, a gifted woman might hope to become the "woman behind the man," a choice made by many of the brilliant women who participated in Terman's classical longitudinal study (Tomlinson-Keasey, 1990).

Furthermore, when a family has both boys and girls, the parents have traditionally invested limited resources in their sons.

After all, the sons were expected to obtain occupations sufficiently well-paying that they could support a wife and children.

The unfortunate ramifications of this pro-son bias has been empirically demonstrated by Ravenna Helson, the notable female psychologist (O'Connell & Russo, 1990).

- In a longitudinal study of Mills College graduates, Helson (1990) found that those women "who were successful in careers at age 43 were, with few exceptions, those who did not have brothers" (p. 49).
- Because Helson (1980) obtained similar results for eminent female mathematicians, she may have identified an important – and clearly environmental – inhibitor of talent development in women.

Something of this pro-son orientation can certainly be seen in the history of psychology.

Sigmund Freud, his mother's firstborn and favorite, was given special treatment that his younger siblings could only envy. He was the only one in the family who had his own room, a room lit with an oil lamp while the others had to use candles. Because Freud had 5 sisters and only one brother, who was the lastborn in the family, it was obviously his female siblings who bore most of this burden. When one of his sisters took up the piano, her older brother complained that it disrupted his studies, and so it was she, not he, who did all the compromising.

Beyond mere anecdote, Table 9.1 presented the birth orders of several eminent women in the field.

- Anne Anastasi, Josephine Hilgard, Bärbel Inhelder, Clara Mayo, Brenda Milner, Maria Montessori, Margaret Rioch, Elizabeth Spelke, Shelley Taylor, and Margaret Washburn were only children. These women had no brothers to contend with at all.
- Furthermore, Sandra Bem, Ellen Bersheid, Charlotte Bühler, Barbara Stoddard Burks, Mary Calkins, Mamie Phipps Clark, Dorothea Dix, Eleanor Gibson, Lillian Gilbreth, Leta Hollingworth, Molly Harrower, Christina Ladd-Franklin, Lillien Martin, Margaret Mead, Bernice Neugarten, Janet Spence, Bonnie Strickland, Thelma Thurstone, Anne Treisman, Leona Tyler, and Beth Wellman were all firstborns – as was Ravenna Helson herself.
    - Of these, Bem, Benedict, Burks, Gibson, Hollingworth, Spence, Treisman, and Wellman had sisters only, Gilbreth 3 brothers and 5 sisters, Ladd-Franklin 2 brothers and 2 sisters (one each being half siblings), and both Berscheid and Calkins 2 brothers and 1 sister each.
    - Although Clark, Dix, Harrower, Helson, Martin, Neugarten, Strickland, Thurstone and Tyler had younger brothers only, they at least enjoyed the advantage of primogeniture.
    - Helson's two brothers (twins) were also 4 years younger.
- The middle children in the table are Nancy Bayley, Martha Bernal, Else Frenkel-Brunswick, Hélène Deutsch, Jacqueline Goodnow, Edna Heidbreder, Eleanor Maccoby, Sandra Scarr, and Pauline Sears.
    - Bernal, Frenkel-Brunswick, and Maccoby only had sisters.
    - Sears had 3 sisters and 1 older brother, Scarr an older brother and a younger sister, while Heidbreder and Bayley each had 3 sisters and 1 younger brother.
- Finally, the lastborns listed are Florence Denmark, Hélène Deutsch, Anna Freud, Florence Goodenough, Mary Henle, Karen Horney, Francis Degen Horowitz, Melanie Klein, Carolyn Payton, Carolyn Sheriff, and Virginia Sexton.
    - Denmark, Horowitz, and Payton only had sisters, Sexton had only her older sister survive beyond childhood, Goodenough had 5 sisters and 2 brothers, and Deutsch and Klein 2 sisters and 1 brother each.
    - Henle had an older brother, but also a twin sister (who became an archeologist).
    - Horney had no sisters and one older full brother, who was 4 years her senior.
    - Although Anna Freud had to deal with her three older brothers – Jean Martin, Ernst, and Cromwell – she also developed an extremely intimate relationship with her father that put her in a rather distinctive position.

Taken altogether, these data suggest that the Helson Effect may constitute more than a chance observation.

With only a few exceptions, most of these women came from homes where (a) there are no brothers, (b) no older brothers, or (c) sisters predominate.

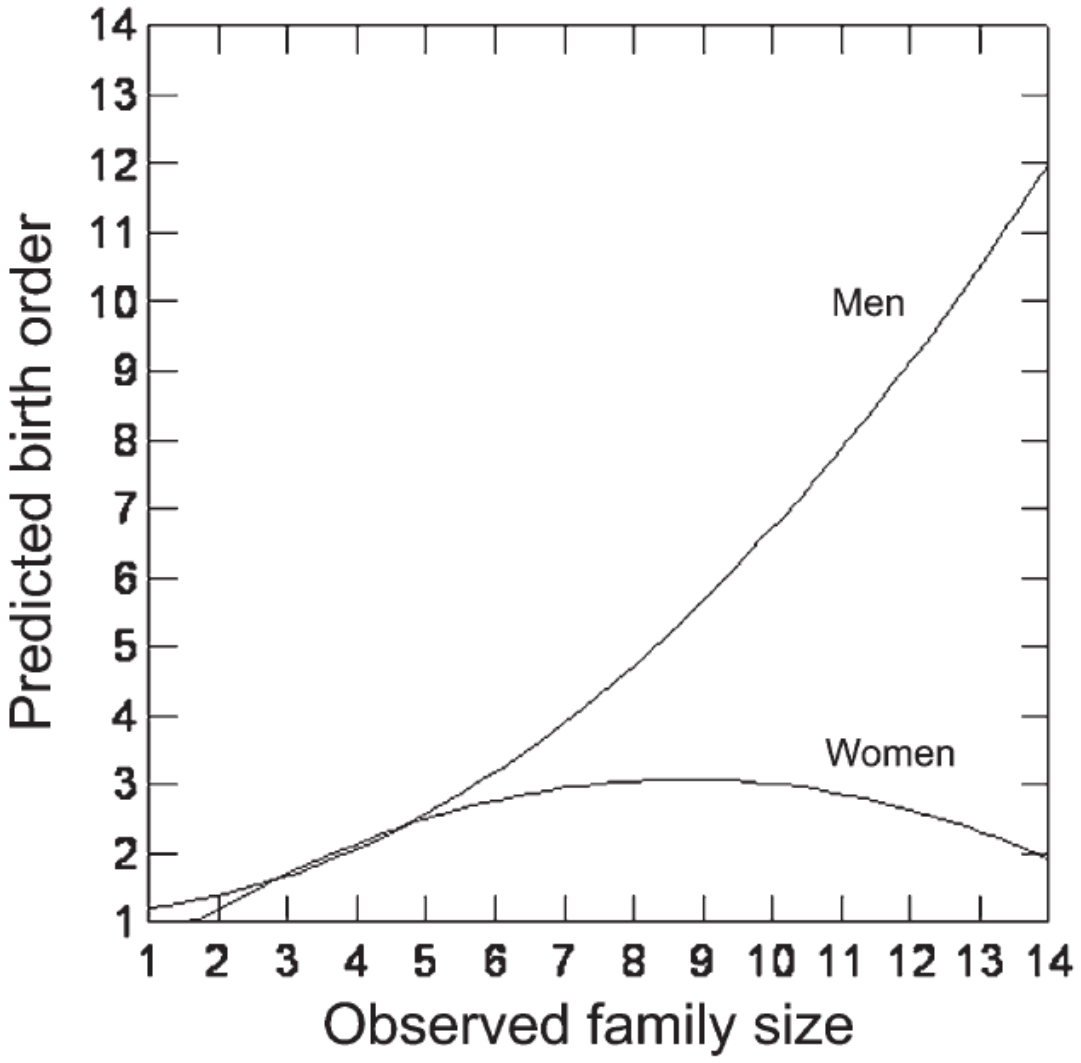
Therefore, it would be immensely valuable to investigate this question more systematically and in greater detail.

- It would be especially interesting to determine whether the developmental detriment of having brothers, especially older ones, has diminished.
- Presumably, societies have become more egalitarian in the way they raise their children. In fact, something precisely like this has been found for women who have managed to become presidents or prime ministers of their nations (Steinberg, 2001).
- Those who came to power in 1960-1989 were quite unlikely to have an older brother, but this tendency vanished for those who gained office since 1990.

Follow-up Study:

Simonton, D. K. (2008f). Gender differences in birth order and family size among 186 eminent psychologists. *Journal of Psychology of Science and Technology*, *1*, 15-22.

Ever since Galton (1874) research has indicated that earlier born children are overrepresented among distinguished scientists, even after controlling for family size. Other studies imply that the developmental asset of an early ordinal position could be even stronger for eminent women. This hypothesis was tested using a sample of illustrious psychologists born between 1802 and 1952 (112 women and 74 men). Not only did women tend to have earlier birth orders, but also the relation between family size and birth order was far weaker for women than for men. In fact, where for men birth order was a positive monotonic function of family size, for women it was a nonmonotonic single-peaked function. These gender differences were stable across historical time and survived control for differences in eminence and year of birth.



The Helson Effect must operate as a nonshared environmental influence.

- One consequence of this developmental factor would be a woman who grows up with a disposition that departs from society's feminine stereotype.
- Either the gender typical socialization pressures would be less pronounced or the young talented woman would be better equipped to resist them.

In support of this conjecture is the persistent finding that high-achieving women tend to be much more similar to high-achieving men than they are to women in general.

- Even in the case of women who became the First Ladies of US Presidents success is not at all dependent upon being "the hostess with the mostest" in the White House (Simonton, 1996c).
- Instead, her performance rating is contingent on her establishing an independent identity and reputation as a political leader.

This broad pattern holds in psychology as well.

- For example, one study of 212 male and 79 female psychologists found that scores on a femininity scale were negatively correlated with the citations they received in the professional literature (Helmreich et al., 1980).
- Another survey of 124 female psychologists concluded, on the basis of their scores on R. B. Cattell's 16 PF Questionnaire, that

  > successful academic women in psychology differ from adult women in general and from women college students in many of the same personality characteristics in which they resemble successful academic men. As a group, they tend to be more intelligent, socially aloof, dominant, serious, adventuresome, sensitive, flexible, imaginative, insightful, unconventional, secure, and self-sufficient than adult women in the general population and women in college, and less anxiety prone. (Bachtold & Werner, 1970, p. 242)

  Critically, "the significant contributors among the women psychologists were more socially aloof and exacting" (p. 242), and thus departed even more distant from the other-directed and communal female stereotype. Furthermore, when these women did differ from comparable men, it was often in a direction away from traditional femininity. In particular, "the women psychologists score, as a group, higher than the successful academic men on intelligence, super-ego strength, and unconventionality (radicalism) and lower than the academic men on self-sentiment" (p. 242).

These remarks should not be interpreted as saying that great psychologists are completely equivalent.

> As mentioned earlier, women are more prone to make major contributions to the "soft" or "tender-minded" subdisciplines of the field.

This emphasis may reflect a residual effect of gender-differentiated socialization.

> For instance, a survey of 510 male and 356 female psychologists revealed that the genders tend to differ on some of the methodological and theoretical dimensions that were discussed in chapter 8 (Coan, 1979).
>
> Specifically, women were much less likely than men to favor the quantitative, atomistic, objective, materialistic, deterministic, and impersonal approaches to human psychology.

Hence, female psychologists may not differ from their male counterparts in having the intellect and disposition required to attain greatness, but their gender may shape the particular nature of their contributions.

Gender roles.

I have assumed the gender differences that underlie the attainment of greatness as a psychologist can be partly ascribed to gender-based differentials in socialization practices.

Men are raised one way, women in another, with corresponding consequences for the level and type of female achievement.

Yet an advocate of a nature rather than nurture account might argue that the gender differences in socialization just reflects the biological contrasts between the sexes.

This argument would seem to fit what was said earlier about many so-called environmental effects actually being the spurious repercussion of deeper genetic differences.

However, there are good reasons why socialization should be considered a cause rather than an effect.

Not only do parents have to work so hard to make sure their children acquire what they consider to be gender-appropriate behaviors and attitudes, but also distinct cultures may have different expectations about what is gender appropriate, and adjust the socialization practices accordingly (Eagly & Wood, 1999).

> This point was made most obvious in Margaret Mead's (1935) classic book on *Sex and Temperament*.
>
> Looking at three tribes of British New Guinea, she concluded that "many, if not all, of the personality traits which we have called masculine or feminine are as lightly linked to sex as are the clothing, the manners, and the form of head-dress that a society at a given period assigns to either sex" (p. 190).
>
> Among the Arapesh, both male and female have what Westerners would consider feminine traits; among the Mundugumor, both men and women feature masculine personalities; and among the Tchambuli, the males were feminine while the females were masculine in character.
>
> To be sure, Mead may have overstated her case.
>
> Just as men hold a monopoly on physical aggressiveness, so do they monopolize war.
>
> Occasional cases like Joan of Arc notwithstanding, men constitute the principal combatants in all the world's wars throughout human history.
>
> Even so, with this lone exception, Mead's main generalization holds, namely that "human nature is almost unbelievably malleable, responding accurately and contrastingly to contrasting cultural conditions" (p. 191).

Ultimately, the socialization practices favored by any given society have one essential function: to help each child become a mature adult.

> This function specifically means that boys and girls must be prepared to assume the gender roles defined for men and women in their native culture.
>
> Moreover, those gender roles may exert their own independent influence on the connection between gender and genius.
>
> That is, even if a woman has the temperament necessary to achieve distinction, she may find that societal norms and expectations interfere with her realizing that potential.
>
> This obstacle is nowhere more apparent than in the repercussions of marriage and family. In chapter 11 I quoted Francis Bacon's admonition that ambitious men avoid wife and children.
>
> If Bacon could recommend that gifted men shy away from domestic commitments, how much more should this recommendation apply to women who are trained to assume far more responsibility when it comes to such family matters.

As a result, many eminent women have simply avoided altogether the constraints imposed on the role of wife and mother.

> Prominent instances include Jane Austen, Emily Brontë, Emily Dickinson, George Eliot, Barbara McClintock, Georgia O'Keeffe, and Virginia Woolf.

In more general terms, women who win an entry in *Who's Who* are four times more likely than similarly illustrious men to be unmarried (Hayes, 1989b).

- Moreover, according to the statistics calculated by Havelock Ellis (1926), those who do get married tend to do at a later age than is the norm for their social class. Charlotte Brontë did not marry until she was 38, Elizabeth Browning until 40.
- In addition, those successful women who somehow fit marriage in their lives are three times more likely to be childless in comparison to equally successful married men (Hayes, 1989b).
- In fact, between 1948 and 1976 in the United States, the proportion of doctorates that were granted to women correlated -.94 with the average cohort fertility, a very remarkable aggregate-level correlation (McDowell, 1982).
- Finally, with or without children, the marriages of high-achieving women are more prone to fail. Among the women in a sample of 20th-century luminaries, only 9% could be considered happily married (Goertzel, Goertzel & Goertzel 1978). Hélène Deutsch's husband, Felix, was one of those rare men who shared child-rearing responsibilities and who provided her with continual support and encouragement in her pursuit of career as a distinguished psychiatrist.
- In contrast, 40% of these women were divorced and another 6% remained married but were separated from their husbands (Goertzel, Goertzel & Goertzel 1978). The dissolution of a marriage did not always improve matters, for that often meant that many had to coordinate career and childcare as single mothers, something Margaret Mead, among many others, had to endure.

The foregoing statistics were based on samples that were heterogeneous with respect to the domain of achievement.

Several studies have focused on specific domains, and have, for the most part, obtained compatible results.

> For instance, in a sample of 99 male and 109 female artists examined 18 years after they had completed art school, the women exhibited much more career discontinuity in comparison to the men, the greatest degree of discontinuity being found among those with more children (Stohs, 1992). It is difficult to maintain a continuous career while engaged in childcare.

Sometimes the cost of such career interruptions can severely threaten the prospects of resuming the career once family responsibilities sufficiently diminish.

> In certain domains of achievement, the knowledge and techniques requisite for making creative contributions experience rapid obsolescence.
>
> In physics, a woman who interrupts her career for 4 years will see her domain-relevant expertise reduced by half, whereas to lose the same amount would require a social scientist or biologist to interrupt her career 7 years (McDowell, 1982).
>
> Better yet, an English professor can take 20 years off and still expect to sacrifice only 50% of the knowledge required to restart her career!

Thus, the effort required for a woman to bring herself back up to speed after a career interruption appears to be the most severe in the physical sciences, a bit less arduous in the social and biological sciences, and negligible in the humanities.

Despite these results, research on scientific achievement has yielded somewhat more complex results (Zuckerman, J. R. Cole, & Bruer, 1991).

> Neither marriage nor motherhood has to be a disadvantage with respect to scientific performance, as gauged by productivity in professional journals (J. R. Cole & Zuckerman, 1987; Kyvik, 1990).
>
> In fact, both male and female scientists appear to be more productive if they are married rather than unmarried.
>
> In addition, although the responsibilities of parenthood can depress output, the costs are about the same for men as for women (Hargens, McCann, & Reskin, 1978).
>
> Furthermore, the negative consequences are only long-term if the number of children is large, a situation that also has a differential impact on men and women, the latter tending to suffer more from an exceptional increase in family responsibilities (Kyvik, 1990).
>
> Because scientists tend to have few children and to rely heavily on collaborators and students in their research, the repercussions of marriage and family are likely minimized for women.

Unfortunately, there has been very little research addressing this question within the specific domain of psychology.

> One investigation of American psychologists found that the women were almost 5 times more likely to be unmarried as the men, and among the currently or previously married the women were almost 3 times more likely to be childless (Helmreich et al., 1980).

Yet the consequences for productivity was not reported.

Clearly more research needs to be carried out to determine how the gender role that women are expected to fulfill affects the likelihood of their becoming great psychologists.

> Besides looking at how marital and parental responsibilities impact on creative output, other potentially detrimental aspects of the traditional female role should be investigated.
>
> For instance, woman may feel more obliged to contribute to a variety of interpersonal relationships beyond just husband and children. One thinks immediately of the awesome task Anna Freud took on in caring for her father during the 16 years in which he fought his losing battle with cancer.

But perhaps the most interesting empirical question is whether gender roles have converged sufficiently to lessen substantially the obstacles to female eminence in the discipline.

To the extent that societal expectations have become much less strongly differentiated according to gender, then women would be expected to achieve far more now than they could in the past.

Certainly there is suggestive anecdotal evidence of substantial gains within the 20th century alone.

> A concrete illustration can be found in Sandra Bem's (1998) autobiographical *An Unconventional Family*. Her marriage to the eminent psychologist Daryl Bem was totally egalitarian at both personal and professional levels. At home, they co-parented their three children in a truly equal fashion, as well as doing their utmost to raise them in an androgynous, non-gender stereotypic manner. Irrevocably committed to a genuinely dual career marriage, when Sandra was denied tenure at Stanford, Daryl joined the search for a new position, giving up his own position at the same distinguished institution.

Although the marriage did not survive in the long term, Bem's experience shows how dramatically the gender roles could change.

Only 50 years earlier many talented women were far more inclined to withdraw from a career in psychology once they faced the demands of being wife and mother.

> This alternative outcome is well illustrated in the life of Lucy May Day, whose truncated career secured her a unique place in psychology's history (Furumoto, 1998). It is a tempting "what if" to contemplate what would have happened if Lucy May Day and E. G. Boring had assumed the same egalitarian gender roles as did Sandra and Daryl Bem half of a century later. The history of psychology, and even the history of psychology's history, would probably have been rewritten.

Gender bias.

The counterfactual speculation that closed the preceding section may have seen a little exorbitant. Why should anyone infer that Lucy May Boring might have become a great psychologist had she not become a wife and mother instead?

One cue comes from something discussed in chapter 10, namely that eminent scientists tend to earn their PhDs at relatively precocious ages.

By this criterion, Miss Day had received her doctoral degree at an age fairly typical of great psychologists – age 26.

To put this achievement in context, her husband E. G. Boring and her collaborator M. Bentley, who worked under the same mentor, were 28 and 29, respectively.

What makes Lucy Day's doctoral performance even more impressive is that women tend to earn their doctorates at older ages than men anyway.

For instance, in a sample of nearly 300 experimental social psychologists, the men were around 28 and the women 30 when they earned their PhDs (Helmreich et al., 1980).

For a more eminent sample of 69 American psychologists, the differences between the means were even greater, 28 versus 34, or a gap of 6 years (Simonton, 1992b).

Thus, if anything, Day should have been older, not younger, than her husband was when she attained her highest degree.

To some extent, the environmental factors already discussed probably contribute to the woman's decelerated progression through programs that lead to the higher degree.

Women are socialized to have certain priorities – and are obliged to occupy certain roles – that might compel them to assign lowered priority to the completion of degree requirements.

Besides women taking longer to complete the requirements, this may also induce women not to finish at all, converting them into graduate school dropouts.

This difference was demonstrated in a study of graduate students who entered the psychology graduate program at the U of Illinois at Urbana-Champaign between 1965 and 1970 (Hirshberg & Itkin, 1978).

- Only 35% of the women had earned their degree by 1975, whereas the rate for the men was 68%, almost double that.
- Even fellow graduate students were less like to see their female peers as finishing the program in 4 years.

As distressing as these influences can be, it could be worse: until recent times, women had to overcome an even more severe obstacle to greatness – outright prejudice and discrimination.

Christine Ladd-Franklin obtained her bachelors degree from Vassar, a woman's college, and later obtained a fellowship to attend Johns Hopkins for advanced study in mathematics and logic. By 1882, when she was 35, she had completed the requirements for a PhD, but found that the school was not willing to award her the degree. It seems that the university did not officially recognize female candidates, and so her graduate work was discounted. She had to wait until 1926 for the injustice to be rectified.

Although Ladd-Franklin was then 78, at least she finally got what she deserved. As is well known, Mary Calkins was not nearly so lucky. Working under William James, she had fulfilled all the requirements for a PhD in 1895, at age 32. Despite the enthusiastic recommendation of her professors, Harvard would not give her the degree, because of her gender. It is astonishing how long Harvard's authorities remained adamant on this issue. By 1903 non-Dr. Calkins was rated among the top American psychologists, a reputation endorsed in 1905 when she became president of the American Psychological Association, the first woman to be so recognized. In 1918 she also became the first woman elected president of the American Philosophical Association, and a decade later she became the first woman elected as an honorary member of the British Psychological Association. She obtained honorary degrees from both Columbia University and Smith College (her alma mater) in 1909 and 1910, respectively. Yet Harvard resisted repeated attempts to reverse its decision, even as late as 1927, just 3 years before she

died. The sole concession was an institutional willingness to grant her a degree of Radcliff, which did not have a graduate program. Rightly, Calkins refused.

The Johns Hopkins and Harvard episodes were blatant.

Both institutions made it clear that they were not in the business of bestowing doctoral degrees on women.

Although such institutionalized sexism is history in most of the industrial world, more subtle forms of anti-female prejudice and discrimination are not.

One guise of gender bias occurs when a woman seeks her first position at a research university. Women with identical qualifications as men are nonetheless perceived as less adequate candidates (Fidell, 1970; Glick, Zion & Nelson 1988).

One consequence is that they tend to be appointed at inferior levels or else hired by less prestigious institutions (Helmreich et al., 1980; Simonton, 1992b).

This puts women at a definite disadvantage in comparison to equally competent men who manage to obtain positions that are more supportive of independent research.

One long-term consequence of this differential placement may be that talented women who enter the most prestigious universities will not find the female professors they need to serve as their mentors (see, e.g., Goldstein, 1979).

Woman more than men may need guidance from same-gender mentors in order to succeed in a male-dominated world.

As if this where not a sufficient handicap, the ideas of female psychologists may not receive due recognition from male psychologists.

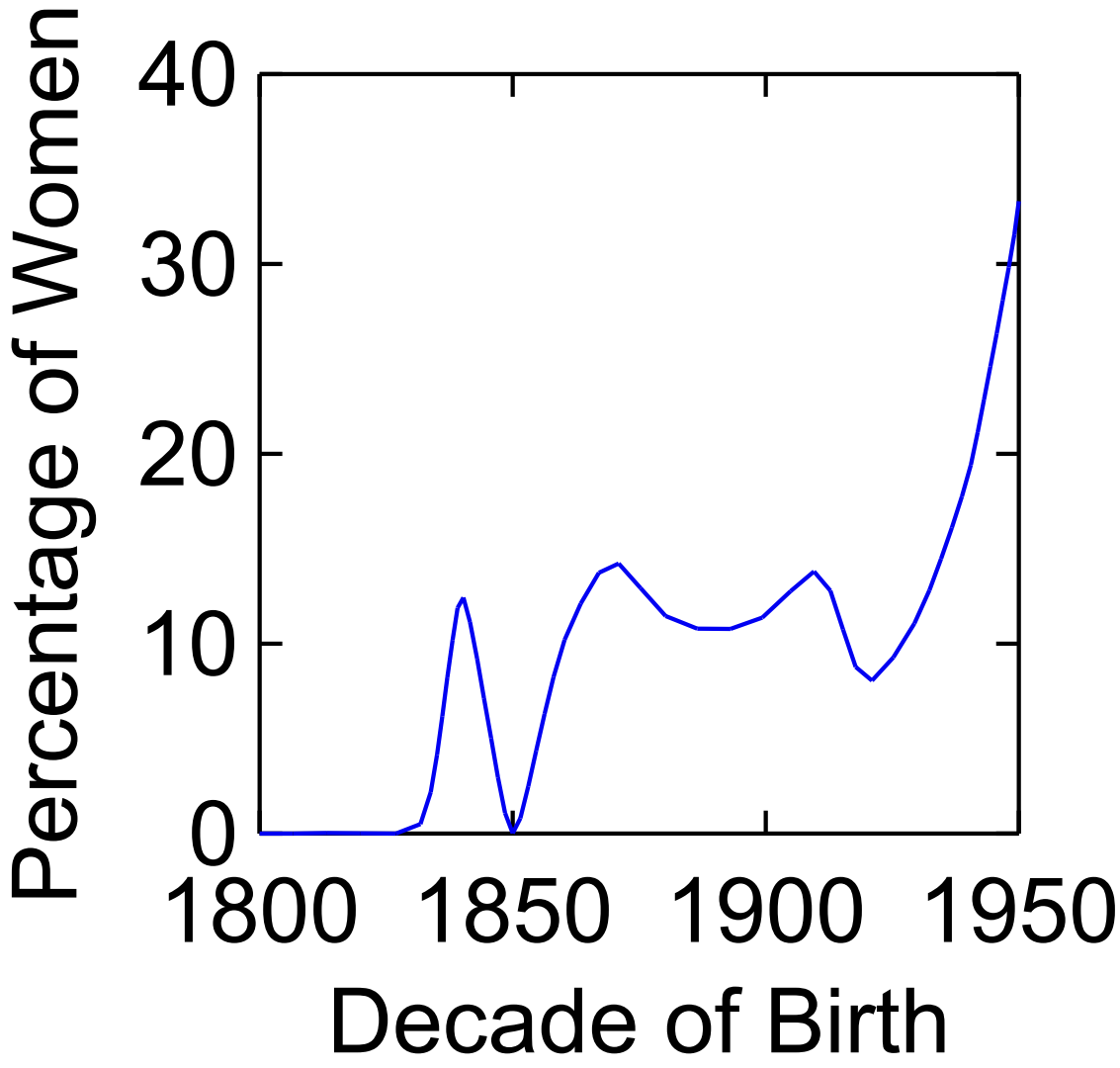
- There appears to be a gender bias in citation practices, so that men are more likely to cite the work of men while women are more likely to cite the work of women, a pattern that cannot be attributed to the different topics that men and women discuss (Ferber, 1986).
- A similar own-gender favoritism appears in the literature that is cited in psychology textbooks (Roeckelein, 1996c) and in the praise that is bestowed by book reviewers (Moore, 1978).

Although the bias operates both ways, it probably harms women more than men, at least so long as men dominate the scientific enterprise.

A man who does receive the appreciation he deserves from women will suffer less than a woman whose work does not receive due attention from men.

Happily, the negative consequences of sexist prejudice and discrimination have been declining over the course of psychology's history.

This secular trend is apparent in the changes in the representation of women among great psychologists, as displayed in Figure 12.1



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- This graph is based on the entries in a recent biographical dictionary of psychology (Sheehy, Chapman, & Conroy, 1997).
- Each individual is assigned to that decade in which he or she was born, where the consecutive decades span from 1800-1809 to 1950-59.
- It is obvious that women were nonexistent in the days of Fechner and other German physiologists. Women did not start appearing until one third through the 19th century, and even then they could disappear once more in the mid-century.
- Although women recovered soon after that setback, their representation oscillated around a meager 10% until after World War II.
- Only in the last cohort did the percentage shoot up, and even then it maximized at 33%, still far short of the proportion of women in the general population.

Gender milieu.

Figure 12.1 provokes the question:

Why does the representation of women among great psychologists fluctuate so radically over time?

It is obvious that nature cannot provide the explanation, for it is difficult to imagine how the biology of being a woman could change so rapidly.

Instead, the explanation must reside with nurture.

The various environmental factors that enhance or inhibit female achievement must also change over the course of history.

Gender socialization, roles, and bias are all embedded in a larger sociocultural system.

This system includes economic, political, social, cultural, religious, and ideological components that provide the foundation of how women will be raised and treated at a particular time and place.

The operation of these systemic factors was demonstrated in a historiometric study of the course of Japanese civilization (Simonton, 1992a).

> The number of eminent women in consecutive generations was tabulated since 580 AD, and then compared to the ups and downs in the predominance of two contextual factors that were hypothesized to affect the emergence of feminine genius.
>
> The first factor was militarism, a measure of the society's emphasis on war, conquest, military leadership, machismo, and the code of the warrior, as exemplified by the samurai.
>
> The second factor was Confucianism, an index of the predominance of a Chinese ideology that stresses the intrinsic inferiority of women vis-à-vis men.
>
> According to the generational time-series analysis, both militarism and Confucianism were negatively associated with the presence of eminent Japanese women.
>
> Furthermore, this detrimental consequence even held for literary creativity, a domain in which women had made signal contributions to the civilization of Japan.

Empirical research has yet to determine whether comparable systemic factors are responsible for the fluctuations shown in Figure 12.1.

Even so, it appears likely that the connection between gender and genius in psychology's history has deep roots in the more comprehensive features of the sociocultural milieu.

This gender-based Zeitgeist may even shape the ideas produced at a particular point in psychology's history.

This assertion is nothing new, for historians of the discipline often evoke such systemic effects to explain some of the strange errors that permeate the annals of our discipline.

Needless to say, the very existence of these sociocultural influences should inspire some doubts about the scientific validity of attempts to prove that women are innately inferior to men.

> If the very ideas that psychologists promote reflect extraneous contextual factors, can those ideas be trusted to represent truth rather than opinion?
>
> Admittedly, those who still advocate the supremacy of nature over nurture might argue that an explicit connection between their theories and the larger Zeitgeist has not been scientifically proven.
>
> Yet so much research demonstrates the pervasive effects of the sociocultural milieu on the history of ideas that it strains credulity to claim that gender theories are somehow insulated from these effects.

In the meantime, I think this chapter can best close with this conclusion: Although nature probably plays a big part in determining who comes a great psychologist, nurture likely claims the largest role in deciding whether that psychologist will be male or female.