

Reading 3: ARE YOU A "NATURAL?"

Bouchard, T., Lykken, D., McGue, M., Segal, N., & Tellegen, A. (1990). Sources of human psychological differences: The Minnesota study of twins reared apart. *Science*, 250, 223-229.

This study represents a relatively recent and ongoing fundamental change in the way many psychologists view human nature in its broadest sense. You can relate to this change in a personal way by first taking a moment to answer in your mind the following question: "Who are you?" Think for a moment about some of your individual characteristics: your "personality traits." Are you high strung or laid-back? Are you shy or outgoing? Are you adventurous, or do you seek out comfort and safety? Are you easy to get along with, or do you tend toward the disagreeable? Are you usually optimistic or more pessimistic about the outcome of future events? Think about yourself in terms of these or any other questions you feel are relevant. Take your time . . . Finished? Now, answer this next, and, for this reading, more important question: "Why are you who you are?" In other words, what factors contributed to "creating" this person you are today?

If you are like most people, you will point to the child-rearing practices of your parents and the values, goals, and priorities they instilled in you. You might also credit the influences of brothers, sisters, grandparents, aunts, uncles, peers, teachers, and other mentors who played key roles in molding you. Still others of you will focus on key life-changing events, such as an illness, the loss of a loved one, or the decision to attend a specific college, choose a major, or take a particular life course that seemed to lead you toward becoming your current self. All these influences share one characteristic: they are all *environmental* phenomena. Hardly anyone ever replies to the question "Why are you who you are?" with "I was born to be who I am; it's all in my genes."

Everyone acknowledges that physical attributes, such as height, hair color, eye color, and body type, are genetic. More and more people are realizing that tendencies toward many illnesses, such as cancer, heart disease, and high blood pressure, have significant genetic components. However, almost no one thinks of genes as the main force behind who they are *psychologically*. This may strike you as odd when you stop to think about it, but in reality very understandable reasons explain our "environmental bias."

First of all, psychology during the second half of the 20th century was dominated by the *behaviorism* theory of human nature. Basically, that theory states that all human behavior is controlled by environmental factors, including the stimuli that provoke behaviors and the consequences that follow response choices. Strict behaviorists believed that the internal psychological workings of the human mind were not only impossible to study scientifically but, also, that such study was unnecessary and irrelevant to a complete explanation for human behavior. Whether the wider culture accepted or even understood formal theories of behaviorism is not as important as the reality of

their influence on today's firmly entrenched popular belief that *experience* is the primary or exclusive architect of human nature.

Another understandable reason for the pervasive acceptance of environmental explanations of behavior is that genetic and biological factors do not provide visible evidence of their influence. It's easy for someone to say "I became a writer because I was deeply inspired and encouraged by my seventh-grade composition teacher." You remember those sorts of influences; you see them; they are part of your past and present conscious experiences. You would find it much more difficult to recognize biological influences and say "I became a writer because my DNA contains a gene that has been expressed in me that predisposes me to write well." You can't see, touch, or remember the influence of your genes, and you don't even know where in your body they might be located!

In addition, many people are uncomfortable with the idea that they might be the product of their genes rather than the choices they have made in their lives. Such ideas smack of determinism and a lack of free will. Most people have a strong dislike for any theory that might in some way limit their conscious ability to determine the outcomes in their lives. Consequently, genetic causes of behavior and personality tend to be avoided or rejected. In reality, genetic influences interact with experience to mold a complete human, and the only question is this: Which is more dominant? Or, to phrase the question as it frequently appears in the media, "*Is it nature or nurture?*"

The article by Thomas Bouchard, David Lykken, and their associates at the University of Minnesota in Minneapolis that is referenced in this chapter is a review of research that began in 1979 to examine the question of how much influence your genes have in determining your personal psychological qualities. This research grew out of a need for a scientific method to separate genetic influences (nature) from environmental forces (nurture) on people's behavior and personality. This is no simple task when you consider that nearly every one of you, assuming you were not adopted, grew and developed under the direct environmental influence of your genetic donors (your parents). You might, for example, have the same sense of humor as your father (no offense!) because you learned it from him (nurture) or because you inherited his "sense-of-humor" gene (nature). No systematic approach can tease those two influences apart, right?

Well, Bouchard and Lykken would say "wrong." They have found a way to determine with a reasonable degree of confidence which psychological characteristics appear to be determined primarily by genetic factors and which are molded more by your environment.

THEORETICAL PROPOSITIONS

It's simple, really. All you have to do is take two humans who have exactly the same genes, separate them at birth, and raise them in significantly different environments. Then you can assume that those behavioral and personality characteristics they have in common as adults must be genetic. But how on

earth can researchers possibly find pairs of *identical people* (don't say "cloning"; we're not there yet!)? And even if they could, it would be unethical to force them into diverse environments, wouldn't it? As you've already guessed, the researchers didn't have to do that. Society had already done it for them. Identical twins have virtually the same genetic structure. They are called *monozygotic twins* because they start as one fertilized egg, called a *zygote*, and then split into two identical embryos. Fraternal twins are the result of two separate eggs fertilized by two separate sperm cells and are referred to as *dizygotic twins*. Fraternal twins are only as genetically similar as any two non-twin siblings. As unfortunate as it sounds, twin infants are sometimes given up for adoption and placed in separate homes. Adoption agencies will try to keep siblings, especially twins, together, but the more important goal is to find good homes for them even if it means separation. Over time, thousands of identical and fraternal twins have been adopted into separate homes and raised, frequently without the knowledge that they were a twin, in different and often contrasting environmental settings.

In 1983 Bouchard and Lykken began to identify, locate, and bring together pairs of these twins. This 1990 article reports on results from 56 pairs of monozygotic reared-apart (MZA) twins from the United States and seven other countries who agreed to participate in weeklong sessions of intensive psychological and physiological tests and measurements (that this research is located in Minneapolis, one half of "the Twin Cities" is an irony that has not, by any means, gone unnoticed). These twins were compared with monozygotic twins reared together (MZT). The surprising findings continue to reverberate throughout the biological and behavioral sciences.

METHOD

Participants

The first challenge for this project was to find sets of monozygotic twins who were separated early in life, reared apart for all or most of their lives, and reunited as adults. Most of the participants were found through word of mouth as news of the study began to spread. The twins themselves or their friends or family members would contact the research institute, the Minnesota Center for Twin and Adoption Research (MICTAR), various social-services professionals in the adoption arena would serve as contacts, or, in some cases one member of a twin-pair would contact the center for assistance in locating and reuniting with his or her sibling. All twins were tested to ensure that they were indeed monozygotic before beginning their participation in the study.

Procedure

The researchers wanted to be sure they obtained as much data as possible during the twins' one-week visit. Each twin completed approximately 50 hours of testing on nearly every human dimension you might imagine. They completed four personality trait scales, three aptitude and occupational interest

inventories, and two intelligence tests. In addition, the participants filled in checklists of household belongings (such as power tools, telescope, original artwork, unabridged dictionary), to assess the similarity of their family resources, and a family environment scale that measured how they felt about the parenting they received from their adoptive parents. They were also administered a life history interview, a psychiatric interview, and a sexual history interview. All these assessments were carried out individually so that it was not possible for one twin to inadvertently influence the answers and responses of the other.

As you might imagine, the hours of testing created a huge database of information. The most important and surprising results are discussed here.

RESULTS

Table 3-1 summarizes the similarities for some of the characteristics measured in the monozygotic twins reared apart (MZA) and includes the same data for monozygotic twins reared together (MZT). The degree of similarity is expressed in the table as correlations or *r* values. The larger the correlation, the greater the similarity. The logic here is that if environment is responsible for individual differences, the MZT twins who shared the same environment as they grew up *should be* significantly more similar than the MZA twins. As you can see, this is not what the researchers found.

TABLE 3-1 Comparison of Correlations (*r*) of Selected Characteristics for Identical Twins Reared Apart (MZA) and Identical Twins Reared Together (MZT)*

CHARACTERISTIC	<i>r</i> (MZA)	<i>r</i> (MZT)	SIMILARITY <i>r</i> (MZA) ÷ <i>r</i> (MZT)**
Physiological	—	—	—
Brain wave activity	.80	.81	.987
Blood pressure	.64	.70	.914
Heart rate	.49	.54	.907
Intelligence	—	—	—
WAIS IQ	.69	.88	.784
Raven Intelligence Test	.78	.76	1.03
Personality	—	—	—
Multidimensional Personality Questionnaire (MPQ)	.50	.49	1.02
California Personality Inventory	.48	.49	.979
Psychological interests	—	—	—
Strong Campbell Interest Inventory	.39	.48	.813
Minnesota Occupational Interest Scale	.40	.49	.816
Social attitudes	—	—	—
Religiosity	.49	.51	.961
Nonreligious social attitudes	.34	.28	1.21

*Adapted from Table 4, p. 226.

**1.00 would imply that MZA twin pairs were found to be exactly as similar as MZT twin pairs.

The last column in Table 3-1 expresses the difference in similarity by dividing the MZA correlation on each characteristic by the MZT correlation. If both correlations were the same, the result would be 1.00; if they were entirely dissimilar, the result could be as low as 0.00. Examining column 4 in the table carefully, you'll find that the correlations for characteristics were remarkably similar—that is, close to 1.00 and no lower than .700 for MZA and MZT twin pairs.

DISCUSSION AND IMPLICATIONS OF FINDINGS

These findings indicate that genetic factors (or the *genome*) appear to account for most of the variations in a remarkable variety of human characteristics. This finding was demonstrated by the data in two important ways. One is that genetically identical humans (monozygotic twins), who were raised in separate and often very different settings, grew into adults who were extraordinarily similar, not only in appearance but also in basic psychology and personality. The second demonstration in this study of the dominance of genes is the fact that there appeared to be *little* effect of the environment on identical twins who *were* raised in the same setting. Here's Bouchard and Lykken's take on these discoveries:

For almost every behavioral trait so far investigated, from reaction time to religiosity, an important fraction of the variation among people turns out to be associated with genetic variation. This fact need no longer be subject to debate; rather, it is time to consider its implications.

Of course, some will argue with Bouchard and Lykken's notion that the time to debate these issues is over. Some varying views are discussed in the next section. However, a discussion of the implications of this and other similar studies by these same researchers is clearly warranted. In what ways do the genetic findings reported in this study change psychologists' and, for that matter, all of our views of human nature? As mentioned previously, psychology and Western culture have been dominated for over 50 years by environmental thinking. Many of our basic beliefs about parenting, education, crime and punishment, psychotherapy, skills and abilities, interests, occupational goals, and social behavior, just to name a few, have been interpreted from the perspective that people's experience molds their personalities, not their genes. Very few of us look at someone's behavior and think, "That person was *born* to behave like that!" We *want* to believe that people *learned* their behavior patterns because that allows us to feel some measure of confidence that parenting makes a difference, that positive life experiences can win out over negative ones, and that unhealthy, ineffective behaviors can be *unlearned*. The notion that personality is a done deal the moment we are born leaves us with the temptation to say "Why bother?" Why bother working hard to be good parents? Why bother trying to help those who are down and out? Why bother trying to offer quality education? And so on. Bouchard and Lykken would want to be the first to disagree with such an interpretation of their findings. In

this article, they offer three of their own implications of their provocative conclusions:

1. Clearly, intelligence is primarily determined by genetic factors (70% of the variation in intelligence appears to be due to genetic influence). However, as the authors state very clearly,

[T]hese findings do not imply that traits like IQ cannot be enhanced A survey covering 14 countries has shown that the average IQ test score has increased in recent years. The present findings, therefore, do not define or limit what might be conceivably achieved in an optimal environment, (p. 227)

Basically, what the authors are saying is that although 70% of the variation in IQ is due to naturally occurring genetic variation, 30% of the variation remains subject to increases or decreases due to environmental influences. These influences include many that are well known, such as education, family setting, toxic substances, and socioeconomic status.

2. The basic underlying assumption in Bouchard and Lykken's research is that human characteristics are determined by some combination of genetic and environmental influences. When the environment exerts less influence, differences must be attributed more to genes. The converse is also true: as environmental forces create a stronger influence on differences in a particular characteristic, genetic influences will be weaker. For example, most children in the United States have the opportunity to learn to ride a bicycle. This implies that the environment's effect on bicycle riding is somewhat similar for all children, so differences in riding ability will be more affected by genetic forces. On the other hand, variation in, say, food preferences in the United States are more likely to be explained by environmental factors because food and taste experiences in childhood and throughout life are very diverse and will, therefore, leave less room for genetic forces to function. Here's the interesting part of the researchers' point: they maintain that personality is more like bicycle riding than food preferences.

The authors are saying, in essence, that family environments exert *less* influence over who the kids grow up to be than do the genes they inherit from birth. Understandably, most parents do not want to hear or believe this. They are working hard to be good parents and to raise their children to be happy individuals and good citizens. The only parents who might take some comfort from these findings are those who are nearing their wits' end with out-of-control or incorrigible sons or daughters and would appreciate being able to take less of the blame! However, Bouchard and Lykken are quick to point out that genes are not necessarily destiny and that devoted parents can still influence their children in positive ways, even if they are only working on a small percentage of the total variation.

3. The most intriguing implication that Bouchard and Lykken suggest is that it's not the environment influencing people's characteristics, but vice versa. That is, people's genetic tendencies actually mold their environments! The following is an example of the idea behind this theory.

The fact that some people are more affectionate than others is usually seen as evidence that some parents were more affectionate with their children than were other parents. In other words, affectionate kids come from affectionate environments. When this kind of assumption has been studied, it is usually found to be true. Affectionate people have, indeed, received more affection from their parents. Bouchard and Lykken are proposing, however, that variation in "affectionateness" may be, in reality, genetically determined so that some children are just born more affectionate than others. Their inborn tendency toward affectionate behavior causes them to *respond* to affection from their parents in ways that reinforce the parents' behavior much more than genetically nonaffectionate children. This, in turn *produces* the affectionate behavior in the parents, not the other way around. The researchers contend that genes function in this way for many, if not most, human characteristics. They state it this way:

The proximal [most immediate] cause of most psychological variance probably involves learning through experience, just as radical environmentalists have always believed. The effective experiences, however, to an important extent are self-selected, and that selection is guided by the steady pressure of the genome, (p. 228)

CRITICISMS AND RELATED RESEARCH

As you might imagine, a great many related studies have been carried out using the database of twins developed by Bouchard and Lykken. In general, the findings continue to indicate that many human personality characteristics and behaviors are strongly influenced by genes. Many attributes that have been seen as stemming largely or completely from environmental sources are being reevaluated as twin studies reveal that heredity contributes either the majority of the variation or a significantly larger proportion than was previously contemplated.

For example, studies from the University of Minnesota team found not only that the vocation you choose is largely determined by your genes but also that about 30% of the variation in your overall job satisfaction and work ethic appears due to genetic factors (Arvey et al., 1989; Arvey et al., 1994) even when the physical requirements of various professions were held constant. Other studies comparing identical (monozygotic) twins with fraternal (dizygotic) twins, both reared together and reared apart, have focused more directly on specific personality traits that are thought to be influential and stable in humans (Bouchard, 1994; Loehlin, 1992). These and other studies' findings determined that the people's variation on the characteristics of extraversion-introversion (outgoing versus shy), neuroticism (tendency to

suffer from high anxiety and extreme emotional reactions), and conscientiousness (degree to which a person is competent, responsible, and thorough) is explained more (65%) by genetic differences than by environmental factors.

Of course, not everyone in the scientific community is willing to accept these findings at face value. The criticisms of Bouchard and Lykken's work take several directions (see Billings et al., 1992). Some studies claim that the researchers are not publishing their data as fully and completely as they should, and, therefore, their findings cannot be independently evaluated. These same critics also claim that many articles are reporting on case studies demonstrating strong environmental influences on twins that Bouchard and Lykken fail to consider.

In addition, some researchers have voiced a major criticism of one aspect of twin research in general, referred to as the "equal environment assumption" (e.g., Joseph, 2002). This argument maintains that many of the conclusions drawn by Bouchard and Lykken about genetic influence assume that monozygotic and dizygotic twins raised together develop in identical environments. These critics maintain that such an assumption is not valid and that fraternal twins are treated far more differently than are identical twins. This, they contend, draws the entire method of twin research as a determinant of genetic influences into question. However, several other articles have refuted this criticism and supported the "equal environment assumption" (e.g., Kendler et al., 1993).

RECENT APPLICATIONS

In 1999, Bouchard reviewed the nature-nurture evidence from the Minnesota twin registries (Bouchard, 1999). He concluded that, overall, 40% of the variability in personality and 50% of the variability in intelligence appears to be genetically based. He also reiterated his position, discussed previously, that your genes drive your selection of environments and your selection or avoidance of specific personality-molding environments and behaviors.

Research at the Minnesota Center for Twin and Adoption Research continues to be very active. Some fascinating research has examined very complex human characteristics and behaviors that few would have even guessed to be genetically driven, such as love, divorce, and even death (see Minnesota Twin Family Study, 2007). They have studied people's selection of a mate to see if "falling in love" with Mr. or Ms. Right is genetically predisposed. It turns out that it is not. However, the researchers have found a genetic link to the likelihood of divorce, eating disorders, and age at the time of death.

Bouchard and Lykken's research has been applied to the larger philosophical discussion of human cloning (see Agar, 2003). If a human being is ever successfully cloned, the question is, as you are probably thinking, to what extent will a person's essence, an individual's *personality*, be transferred to his or her clone? The fear that human identity might be changed, degraded, or lost has been a common argument of those opposed to cloning. On the other

hand, results of twin studies, such as those of Bouchard and Lykken suggest that "the cloned person may, under certain circumstances, be seen as surviving, to some degree, in the clone.... However... rather than warranting concern, the potential for survival by cloning ought to help protect against the misuse of the technology" (Agar, 2003, p. 9). In a separate study examining the issue of identical twins and cloning (Prainsack & Spector, 2006), researchers found that identical twins rarely consider the genetic aspects of their real-life experience of being identical twins. In addition, from a personal perspective, they did not view the idea of human cloning as unnatural or immoral but were more concerned about the ethics underlying the reasons for human cloning. Of course, this is philosophical discussion so far, but as the prospect of human cloning looms ever closer, it becomes increasingly important and interesting food for thought.

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Reading 4: WATCH OUT FOR THE VISUAL CLIFF!

Gibson, E. J., & Walk, R. D. (1960). The "visual cliff." *Scientific American*, 202(A), 67-71.

One of the most often told anecdotes in psychology concerns a man called S. B. (initials used to protect his privacy). S. B. had been blind his entire life until the age of 52, when he underwent a newly developed operation (the now-common corneal transplant) and his sight was restored. However, S. B.'s new ability to see did not mean that he automatically perceived what he saw the way the rest of us do. One important example of this became evident soon after the operation, before his vision had cleared completely. S. B. looked out his hospital window and was curious about the small objects he could see moving on the ground below. He began to crawl out on his window ledge, thinking he would