Module 62

The Dynamics of Intelligence

Module Learning Objectives

62-1 Describe the stability of intelligence scores over the life span.

62-2 Describe the traits of those at the low and high intelligence extremes.

We now can address some age-old questions about the dynamics of human intelligence—about its stability over the life span, and about the extremes of intelligence.

Stability or Change?

62-1 How stable are intelligence scores over the life span?

If we retested people periodically throughout their lives, would their intelligence scores be stable? Let's first explore the stability of mental abilities in later life.

Aging and Intelligence

What happens to our broader intellectual muscles as we age? Do they gradually decline, as does our body strength (even if relative intellectual and muscular strength in later life is predictable from childhood)? Or do they remain constant? The quest for answers to these questions illustrates psychology's self-correcting process. This research developed in phases.

PHASE I: CROSS-SECTIONAL EVIDENCE FOR INTELLECTUAL DECLINE

In *cross-sectional studies,* researchers at one point in time test and compare people of various ages. In such studies, researchers have consistently found that older adults give fewer correct answers on intelligence tests than do younger adults. WAIS-creator, David Wechsler (1972) therefore concluded that "the decline of mental ability with age is part of the general [aging] process of the organism as a whole." For a long time, this rather dismal view went unchallenged. Many corporations established mandatory retirement policies, assuming the companies would benefit by replacing aging workers with younger, presumably more capable, employees. As "everyone knows," you can't teach an old dog new tricks.

PHASE II: LONGITUDINAL EVIDENCE FOR INTELLECTUAL STABILITY

After colleges in the 1920s began giving intelligence tests to entering students, several psychologists saw their chance to study intelligence *longitudinally.* They retested the same **cohort**—the same group of people—over a period of years (Schaie & Geiwitz, 1982). What they found was a surprise: Until late in life, intelligence remained stable (**FIGURE 62.1** on the next page). On some tests, it even increased.

cohort a group of people from a given time period.

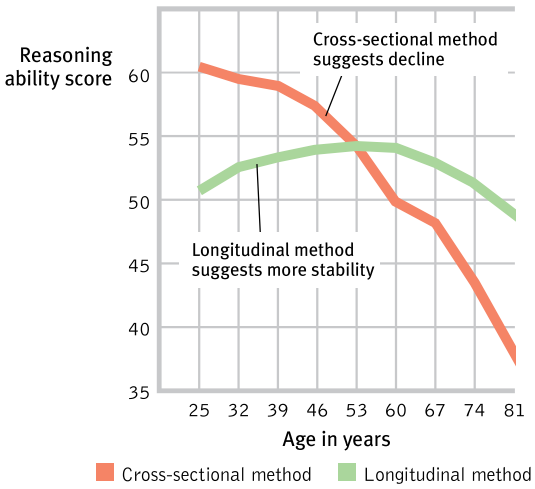


Figure 62.1

Cross-sectional versus longitudinal testing of intelligence at various ages In this test of one type of verbal intelligence (inductive reasoning), the cross-sectional method produced declining scores with age. The longitudinal method (in which the same people were retested over a period of years) produced a slight rise in scores well into adulthood. (Adapted from Schaie, 1994.)

How then are we to account for the cross-sectional findings? In retrospect, researchers saw the problem. When cross-sectional studies compared 70-year-olds and 30-year-olds, they compared people not only of two different ages but of two different eras. They compared generally less-educated people (born, say, in the early 1900s) with better-educated people (born after 1950), people raised in large families with people raised in smaller families, people growing up in less affluent families with people raised in more affluent families.

With this more optimistic view, the myth that intelligence sharply declines with age was laid to rest. At age 70, John Rock developed the birth control pill. At age 81—and 17 years from the end of his college football coaching career—Amos Alonzo Stagg was named coach of the year. At age 89, architect Frank Lloyd Wright designed New York City's Guggenheim Museum. As "everyone knows," given good health you're never too old to learn.

PHASE III: IT ALL DEPENDS

With "everyone knowing" two different and opposing facts about age and intelligence, something was clearly wrong. As it turns out, longitudinal studies have their own potential pitfalls. Those who survive to the end of longitudinal studies may be bright, healthy people whose intelligence is least likely to decline. (Perhaps people who died younger and were removed from the study had declining intelligence.) Adjusting for the loss of participants, as did a study following more than 2000 people over age 75 in Cambridge, England, reveals a steeper intelligence decline, especially after 85 (Brayne et al., 1999).

Research is further complicated by the finding that intelligence is not a single trait, but rather several distinct abilities. Intelligence tests that assess speed of thinking may place older adults at a disadvantage because of their slower neural processing. Meeting old friends on the street, names rise to the mind's surface more slowly—"like air bubbles in molasses," said David Lykken (1999). But slower processing need not mean less intelligence. In four studies in which players were given 15 minutes to complete *New York Times* crossword puzzles, the highest average performance was achieved by adults in their fifties, sixties, and seventies (Salthouse, 2004). "Wisdom" tests assessing "expert knowledge about life in general and good judgment and advice about how to conduct oneself in the face of complex, uncertain circumstances" also suggested that older adults more than hold their own on such tasks (Baltes et al., 1993, 1994, 1999).

So the answers to our age-and-intelligence questions depend on what we assess and how we assess it. **Crystallized intelligence**—our accumulated knowledge as reflected in vocabulary and analogies tests—*increases* up to old age. **Fluid intelligence**—our ability to reason speedily and abstractly, as when solving novel logic problems—*decreases* beginning in the twenties and thirties, slowly up to age 75 or so, then more rapidly, especially after age 85 (Cattell, 1963; Horn, 1982; Salthouse, 2009). With age we lose and we win. We lose recall memory and processing speed, but we gain vocabulary knowledge (**FIGURE 62.2**). Our decisions also become less distorted by negative emotions such as anxiety, depression, and anger (Blanchard-Fields, 2007; Carstensen & Mikels, 2005). And despite their lesser fluid intelligence, older adults also show increased social reasoning, such as by taking multiple perspectives, appreciating knowledge limits, and thus offering helpful wisdom in times of social conflict (Grossman et al., 2010).

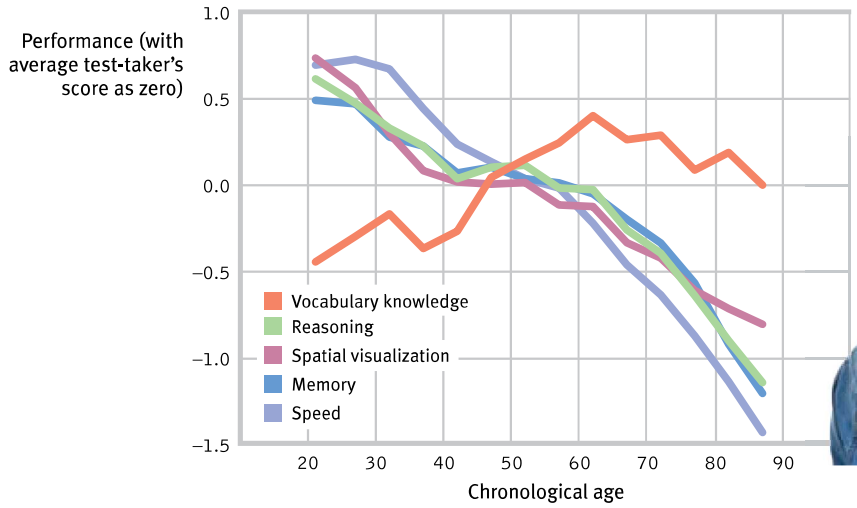
FYI

Like older people, older gorillas process information more slowly (Anderson et al., 2005).

"Knowledge is knowing a tomato is a fruit; wisdom is not putting it in a fruit salad." -Anonymous

crystallized intelligence our accumulated knowledge and verbal skills; tends to increase with age.

fluid intelligence our ability to reason speedily and abstractly; tends to decrease during late adulthood.



Ann Baldwin/Shutterstock

Figure 62.2
With age we lose and we win Research reveals that word power grows with age, while fluid intelligence dimensions decline (Salthouse, 2010b).

These cognitive differences help explain why older adults are less likely to embrace new technologies (Charness & Boot, 2009). In 2010, only 31 percent of Americans ages 65 and older had broadband Internet at home, compared with 80 percent of adults under 30 (Pew, 2010). The age-related cognitive differences also help explain some curious findings about creativity. Mathematicians and scientists produce much of their most creative work during their late twenties or early thirties. In literature, history, and philosophy, people tend to produce their best work in their forties, fifties, and beyond—after accumulating more knowledge (Simonton, 1988, 1990). Poets, for example, who depend on fluid intelligence, reach their peak output earlier than prose authors, who need a deeper knowledge reservoir. This finding holds in every major literary tradition, for both living and dead languages.

"In youth we learn, in age we understand." -Marie Von Ebner-Eschenbach, *Aphorisms*, 1883

Stability Over the Life Span

Now what about the stability of intelligence scores early in life? Except for extremely impaired or very precocious children, casual observation and intelligence tests before age 3 only modestly predict children's future aptitudes (Humphreys & Davey, 1988; Tasbihsazan et al., 2003). For example, children who are early talkers—speaking in sentences typical of 3-year-olds by age 20 months—are not especially likely to be reading by age 4½ (Crain-Thoreson & Dale, 1992). (A better predictor of early reading is having parents who have read lots of stories to their child.) Even Albert Einstein was slow in learning to talk (Quasha, 1980).

"My dear Adele, I am 4 years old and I can read any English book. I can say all the Latin substantives and adjectives and active verbs besides 52 lines of Latin poetry." -Francis Galton, letter to his sister, 1827

By age 4, however, children's performance on intelligence tests begins to predict their adolescent and adult scores. The consistency of scores over time increases with the age of the child. The remarkable stability of aptitude scores by late adolescence is seen in a U.S. Educational Testing Service® study of 23,000 students who took the SAT® exam and then later took the GRE® (Angoff, 1988). On either test, verbal scores correlated only modestly with math scores—revealing that these two aptitudes are distinct. Yet scores on the SAT® exam verbal test correlated +.86 with the scores on the GRE® verbal tests taken four to five years later. An equally astonishing +.86 correlation occurred between the two math tests. Given the time lapse and differing educational experiences of these 23,000 students, the stability of their aptitude scores is remarkable.

FYI

Ironically, SAT® exam and GRE® scores correlate better with each other than either does with its intended criterion, school achievement. Thus, their reliability far exceeds their predictive validity. If either test was much affected by coaching, luck, or how one feels on the test day (as so many people believe), such reliability would be impossible.

Ian Deary and his colleagues (2004, 2009) set a record for long-term follow-up. Their amazing longitudinal studies have been enabled by their country, Scotland, doing something that no nation has done before or since. On June 1, 1932, essentially every child in the country who had been born in 1921—87,498 children around age 11—was given an intelligence test. The aim was to identify working-class children who would benefit from

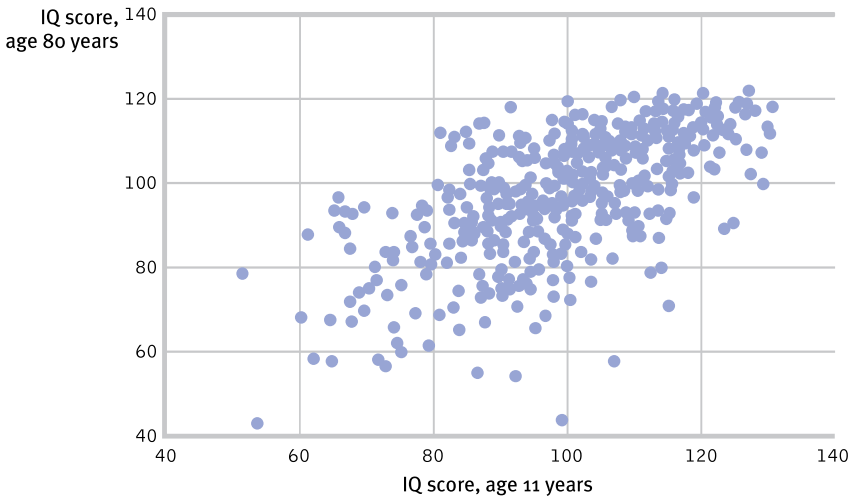


Figure 62.3

Intelligence endures When Ian Deary and his colleagues (2004) retested 80-year-old Scots, using an intelligence test they had taken as 11-year-olds, their scores across seven decades correlated +.66. (When 207 survivors were again retested at age 87, the correlation with their age 11 scores was +.51 [Gow et al., 2011].)

> "Whether you live to collect your old-age pension depends in part on your IQ at age 11."
> -Ian Deary, "Intelligence, Health, and Death," 2005

further education. Sixty-five years later to the day, Patricia Whalley, the wife of Deary's co-worker, Lawrence Whalley, discovered the test results on dusty storeroom shelves at the Scottish Council for Research in Education, not far from Deary's Edinburgh University office. "This will change our lives," Deary replied when Whalley told him the news.

And so it has, with dozens of studies of the stability and the predictive capacity of these early test results. For example, when the intelligence test administered to 11-year-old Scots in 1932 was readministered to 542 survivors as turn-of-the-millennium 80-year-olds, the correlation between the two sets of scores—after almost 70 years of varied life experiences—was striking (**FIGURE 62.3**). A later study that followed Scots born in 1936 from ages 11 to 70 confirmed the remarkable stability of intelligence, independent of life circumstance (Johnson et al., 2010).

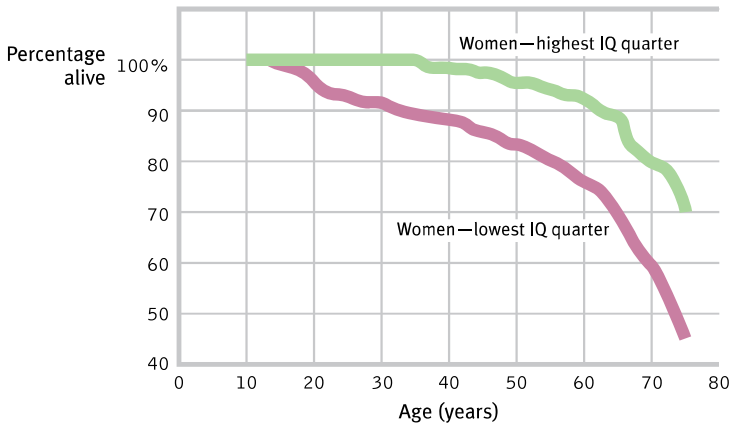
High-scoring 11-year-olds also were more likely to be living independently as 77-year-olds and were less likely to have suffered the cognitive erosion of Alzheimer's disease (Starr et al., 2000; Whalley et al., 2000). Among girls scoring in the highest 25 percent, 70 percent were still alive at age 76—as were only 45 percent of those scoring in the lowest 25 percent (**FIGURE 62.4**). (World War II prematurely ended the lives of many of the male test-takers.) Follow-up studies with other large samples confirm the phenomenon: More intelligent children and adults live healthier and longer (Deary et al., 2008, 2010; Der et al., 2009; Weiss et al., 2009). One study that followed 93 nuns found that those exhibiting less verbal ability in essays written when entering convents in their teens were more at risk for Alzheimer's disease after age 75 (Snowdon et al., 1996).

Pause a moment: Have you any ideas why more intelligent people might live longer? Deary (2008) reports four possible explanations:

1. Intelligence facilitates more education, better jobs, and a healthier environment.
2. Intelligence encourages healthy living: less smoking, better diet, more exercise.
3. Prenatal events or early childhood illnesses might have influenced both intelligence and health.
4. A "well-wired body," as evidenced by fast reaction speeds, perhaps fosters both intelligence and longevity.

Figure 62.4

Living smart Women scoring in the highest 25 percent on the Scottish national intelligence test at age 11 tended to live longer than those who scored in the lowest 25 percent. (From Whalley & Deary, 2001.)



Extremes of Intelligence

62-2 What are the traits of those at the low and high intelligence extremes?

One way to glimpse the validity and significance of any test is to compare people who score at the two extremes of the normal curve. The two groups should differ noticeably, and they do.

The Low Extreme

At one extreme of the normal curve are those with unusually low intelligence test scores. To be labeled as having an **intellectual disability** (formerly referred to as *mental retardation*), a person must have both a low test score and difficulty adapting to the normal demands of independent living. American Association on Intellectual and Developmental Disabilities guidelines specify performance that is approximately two standard deviations below average (Schalock et al., 2010). For an intelligence test with 100 as average and a standard deviation of 15, that means (allowing for some variation in one's test score) an IQ of approximately 70 or below. The second criterion is a comparable limitation in adaptive behavior as expressed in

- *conceptual skills,* such as language, literacy, and concepts of money, time, and number,
- *social skills,* such as interpersonal skills, social responsibility, and the ability to follow basic rules and laws and avoid being victimized, and
- *practical skills,* such as daily personal care, occupational skill, and travel and health care.

intellectual disability a condition of limited mental ability, indicated by an intelligence score of 70 or below and difficulty in adapting to the demands of life. (Formerly referred to as *mental retardation.*)

Down syndrome a condition of mild to severe intellectual disability and associated physical disorders caused by an extra copy of chromosome 21.

Intellectual disability is a developmental condition that is apparent before age 18, sometimes with a known physical cause. **Down syndrome,** for example, is a disorder of varying severity caused by an extra chromosome 21 in the person's genetic makeup.

Consider one reason why people diagnosed with a mild intellectual disability—those just below the 70 score—might be better able to live independently today than many decades ago, when they were institutionalized. Recall that, thanks to the Flynn effect, the tests have been periodically restandardized. As that happened, individuals who scored near 70 on earlier tests suddenly lost about 6 IQ points. Two people with the same ability level could thus be classified differently, depending on when they were tested (Kanaya et al., 2003; Reynolds et al., 2010). As the boundary shifts, more people become eligible for special education and for Social Security payments for those with an intellectual disability. And in the United States (one of only a few industrialized countries with the death penalty), fewer people are eligible for execution—the U.S. Supreme Court ruled in 2002 that the execution of people with an intellectual disability is "cruel and unusual punishment." For people near that score of 70, intelligence testing can be a high-stakes competition. And so it was for Teresa Lewis, a "dependant personality" with limited intellect, who was executed by the state of Virginia in 2010. Lewis, whose reported IQ score was 72, reportedly agreed to a plot in which two men killed her husband and stepson in exchange for a split of a life insurance payout (Eckholm, 2010). If only she had scored 69.

Reuters/Claudia Daut

Mainstreaming in Chile Most Chilean children with Down syndrome attend separate schools for children with special needs. However, this boy is a student at the Altamira School, where children with differing abilities share the classrooms.

The High Extreme

In one famous project begun in 1921, Lewis Terman studied more than 1500 California schoolchildren with IQ scores over 135. Contrary to the popular notion that intellectually gifted children are frequently maladjusted, Terman's high-scoring children, like those in later studies, were healthy, well-adjusted, and unusually successful academically (Koenen et al., 2009; Lubinski, 2009a; Stanley, 1997). When restudied over the next seven decades, most people in Terman's group (the "Termites") had attained high levels of education (Austin et al., 2002; Holahan & Sears, 1995). They included many doctors, lawyers, professors, scientists, and writers, but no Nobel Prize winners.

FYI

Terman did test two future Nobel laureates in physics but they failed to score above his gifted sample cutoff (Hulbert, 2005).

JOE KLAMAR/AFP/Getty Images

The extremes of intelligence
Moshe Kai Cavalin completed his third college degree by the time he was 14, when the math major graduated from UCLA. According to his mother, he first picked up a college textbook and started reading it at age 2.

"Joining Mensa means that you are a genius. . . . I worried about the arbitrary 132 cutoff point, until I met someone with an IQ of 131 and, honestly, he was a bit slow on the uptake." -Comedian Steve Martin, 1997

A more recent study of precocious youths who aced the math SAT® exam at age 13—by scoring in the top quarter of 1 percent of their age group—were at age 33 twice as likely to have patents as were those in the bottom quarter of the top 1 percent (Wai et al., 2005). Compared with the math aces, 13-year-olds scoring high on verbal aptitude were more likely to have become humanities professors or written a novel (Park et al., 2007). About 1 percent of Americans earn doctorates. But among those scoring in the top 1 in 10,000—on the mere two-hour SAT® at age 12 or 13—more than half have done so (Lubinski, 2009b).

These whiz kids remind me of Jean Piaget, who by age 15 was publishing scientific articles on mollusks and who went on to become the twentieth century's most famous developmental psychologist (Hunt, 1993). Children with extraordinary academic gifts are sometimes more isolated, introverted, and in their own worlds (Winner, 2000). But most thrive.

Is there a gifted education program at your school? There are critics who question many of the assumptions of currently popular "talented and gifted child" programs, such as the belief that only 3 to 5 percent of children are gifted and that it pays to identify and "track" these special few—segregating them in special classes and giving them academic enrichment not available to their peers. Critics note that tracking by aptitude sometimes creates a self-fulfilling prophecy: Those implicitly labeled "ungifted" may be influenced to become so (Lipsey & Wilson, 1993; Slavin & Braddock, 1993). Denying lower-ability students opportunities for enriched education can widen the achievement gap between ability groups and increase their social isolation from one another (Carnegie, 1989; Stevenson & Lee, 1990). Because minority and low-income youth are more often placed in lower academic groups, tracking can also promote segregation and prejudice—hardly, note critics, a healthy preparation for working and living in a multicultural society.

Critics and proponents of gifted education do, however, agree on this: Children have differing gifts, whether at math, verbal reasoning, art, or social leadership. Educating children as if all were alike is as naive as assuming that giftedness is something, like blue eyes, that you either have or do not have. One need not hang labels on children to affirm their special talents and to challenge them all at the frontiers of their own ability and understanding. By providing *appropriate developmental placement* suited to each child's talents, we can promote both equity and excellence for all (Colangelo et al., 2004; Lubinski & Benbow, 2000; Sternberg & Grigorenko, 2000).

Before You Move On

▶ ASK YOURSELF
How do you feel about mainstreaming children of all ability levels in the same classroom? What evidence are you using to support your view?

▶ TEST YOURSELF
The Smiths have enrolled their 2-year-old son in a special program that promises to assess his IQ and, if he places in the top 5 percent of test-takers, to create a plan that will guarantee his admission to a top university at age 18. Why is this endeavor of questionable value?

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

Module 62 Review

62-1 How stable are intelligence scores over the life span?

- Cross-sectional studies (comparing people of different ages) and longitudinal studies (retesting the same *cohort* over a period of years) have shown that *fluid intelligence* declines in older adults, in part because neural processing slows. *Crystallized intelligence* tends to increase.
- The stability of intelligence test scores increases with age.
  - At age 4, scores fluctuate somewhat but begin to predict adolescent and adult scores.
  - By early adolescence, scores are very stable and predictive.

62-2 What are the traits of those at the low and high intelligence extremes?

- An intelligence test score of or below 70 is one diagnostic criterion for the diagnosis of *intellectual disability* (others are limited conceptual, social, and practical skills). People with this diagnosis vary from near-normal to requiring constant aid and supervision.
- *Down syndrome* is a developmental disorder caused by an extra copy of chromosome 21.
- High-scoring people tend to be healthy and well-adjusted, as well as unusually successful academically.
  - Schools sometimes "track" such children, separating them from students with lower scores. Such programs can become self-fulfilling prophecies as both groups live up to—or down to—others' perceptions and expectations.

Multiple-Choice Questions

1. Which of the following is a longitudinal study?

a. Researchers test the intelligence of all the students in a high school.
b. Intelligence tests are given to the residents of a nursing home.
c. Researchers randomly select 50 students from a high school with 2000 students. The 50 students are given intelligence tests.
d. A group of college juniors is given an extensive battery of tests over a period of 2 days.
e. A group of kindergartners is given an intelligence test. They are retested every other year for 30 years.

2. Which of the following best represents crystallized intelligence?

a. Jake can solve math word problems quickly.
b. Grandpa Milt is good at crossword puzzles.
c. Aliyah has a knack for training dogs.
d. Anna writes creative computer programs.
e. Heng bakes excellent chocolate chip cookies.

3. Who conducted a famous study of high IQ children?

a. Lewis Terman
b. David Wechsler
c. Robert Sternberg
d. Howard Gardner
e. Alfred Binet

4. Intellectual disability is defined by both IQ and which of the following?

a. Chronological age
b. Mental age
c. Adaptive ability
d. Physical condition
e. Heritability

Practice FRQs

1. Name and describe the two main types of evidence used to determine whether there is an intellectual decline as people age.

Answer

2 points: Cross-sectional evidence, which comes from studies that examine several age groups at once.

2 points: Longitudinal evidence, which comes from studies that examine the same group of people over a long period of time.

2. Explain three reasons why more intelligent people might live longer.

(3 points)

Module 63

Studying Genetic and Environmental Influences on Intelligence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Module Learning Objectives

63-1 Discuss the evidence for a genetic influence on intelligence, and explain what is meant by heritability.

63-2 Discuss the evidence for environmental influences on intelligence.

"I told my parents that if grades were so important they should have paid for a smarter egg donor."

heritability the proportion of variation among individuals that we can attribute to genes. The heritability of a trait may vary, depending on the range of populations and environments studied.

63-1 What evidence points to a genetic influence on intelligence, and what is heritability?

Intelligence runs in families. But why? Are our intellectual abilities mostly inherited? Or are they molded by our environment?

Few issues arouse such passion or have such serious political implications. Consider: If we mainly inherit our differing mental abilities, and if success reflects those abilities, then people's socioeconomic standing will correspond to their inborn differences. This could lead to those on top believing their intellectual birthright justifies their social positions.

But if mental abilities are primarily nurtured by our environments, then children from disadvantaged environments can expect to lead disadvantaged lives. In this case, people's standing will result from their unequal opportunities.

For now, as best we can, let's set aside such political implications and examine the evidence.

Twin and Adoption Studies

Do people who share the same genes also share mental abilities? As you can see from **FIGURE 63.1**, which summarizes many studies, the answer is clearly *Yes.* Consider:

- The intelligence test scores of identical twins raised together are virtually as similar as those of the same person taking the same test twice (Lykken, 1999; Plomin, 2001). (The scores of fraternal twins, who share only about half their genes, are much less similar.) Estimates of the **heritability** of intelligence—the extent to which intelligence test score variation can be attributed to genetic variation—range from 50 to 80 percent (Johnson et al., 2009; Neisser et al., 1996; Plomin, 2003). Identical twins also exhibit substantial similarity (and heritability) in specific talents, such as music, math, and sports (Vinkhuyzen et al., 2009).
- Brain scans reveal that identical twins' brains are built and function similarly. They have similar gray and white matter volume (Deary et al., 2009). Their brains (unlike those of fraternal twins) are virtually the same in areas associated with verbal and spatial intelligence (Thompson et al., 2001). And their brains show similar activity while doing mental tasks (Koten et al., 2009).

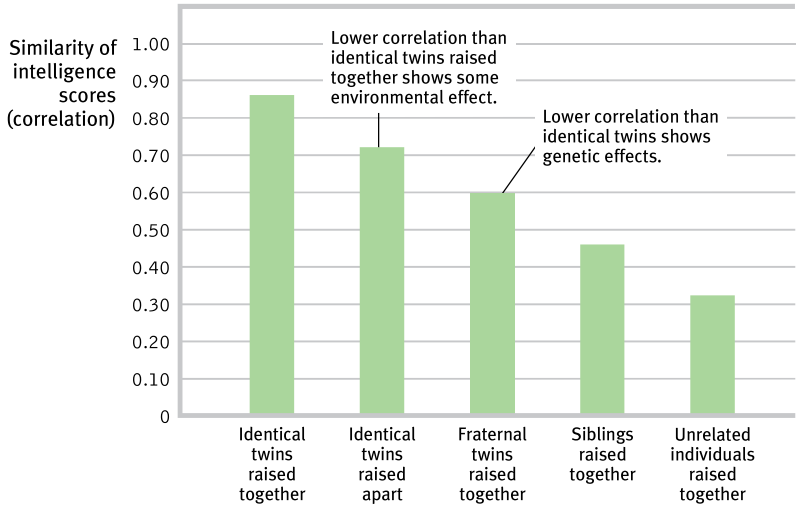


Figure 63.1

Intelligence: Nature and nurture The most genetically similar people have the most similar intelligence scores. Remember: 1.0 indicates a perfect correlation; zero indicates no correlation at all. (Data from McGue et al., 1993.)

AP® Exam Tip

Figure 63.1 is worth spending some time on. Try grabbing a study buddy and explaining whether each of the five conditions provides more support for nature or more for nurture. In most cases, it's some of each and you have to look at comparisons between categories to really be able to draw conclusions.

- Are there known genes for genius? Today's researchers have identified chromosomal regions important to intelligence, and they have pinpointed specific genes that seemingly influence variations in intelligence and learning disorders (Dick, 2007; Plomin & Kovas, 2005; Posthuma & de Geus, 2006). But intelligence appears to be *polygenetic,* involving many genes, with each gene accounting for much less than 1 percent of intelligence variations (Butcher et al., 2008). Intelligence is like height, suggests Wendy Johnson (2010): 54 specific gene variations together have accounted for 5 percent of our individual differences in height, leaving the rest yet to be discovered. Do we really need to discover them all—or is it enough to know that few individual genes have a big effect on height, or intelligence? What matters is the combination of many genes.

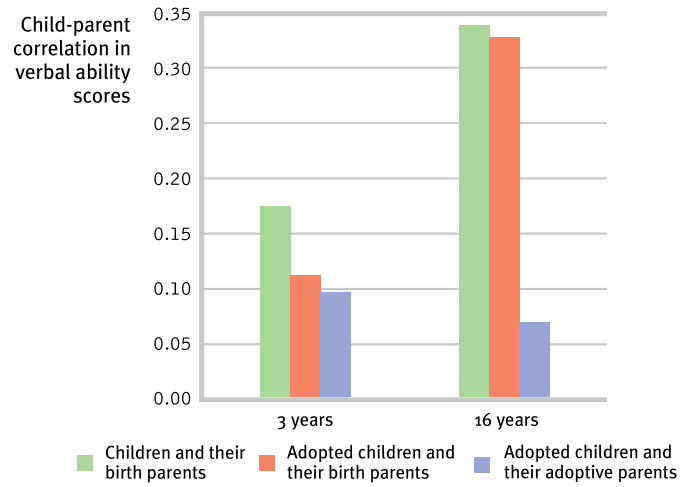
Other evidence points to the effects of environment. Twin studies show some environmental contribution to IQ score variation among top scorers (Brant et al., 2009; Kirkpatrick et al., 2009). Where environments vary widely, as they do among children of less-educated parents, environmental differences are more predictive of intelligence scores (Rowe et al., 1999; Tucker-Drob et al., 2011; Turkheimer et al., 2003). Studies also show that adoption enhances the intelligence scores of mistreated or neglected children (van IJzendoorn & Juffer, 2005, 2006).

Seeking to disentangle genes and environment, researchers have compared the intelligence test scores of adopted children with those of (a) their adoptive siblings, (b) their biological parents (the providers of their genes), and (c) their adoptive parents, the providers of their home environment. During childhood, the intelligence test scores of adoptive siblings correlate modestly. Over time, adopted children accumulate experience in their differing adoptive families. So would you expect the family-environment effect to grow with age and the genetic-legacy effect to shrink?

If you would, behavior geneticists have a stunning surprise for you. Mental similarities between adopted children and their adoptive families wane with age, until the correlation approaches zero by adulthood (McGue et al., 1993). Genetic influences—not environmental ones—become more apparent as we accumulate life experience. Identical twins' similarities, for example, continue or increase into their eighties. Thus, report Ian Deary and his colleagues (2009), the heritability of general intelligence increases from "about 30 percent" in early childhood to "well over 50 percent in adulthood." In one massive study of 11,000 twin pairs in four

"Selective breeding has given me an aptitude for the law, but I still love fetching a dead duck out of freezing water."

Figure 63.2
Who do adopted children resemble in verbal ability?
As the years went by in their adoptive families, children's verbal ability scores became modestly more like their *biological* parents' scores. (Adapted from Plomin & DeFries, 1998.)



"There are more studies addressing the genetics of *g* [general intelligence] than any other human characteristic."
-Robert Plomin (1999)

countries, the heritability of *g* increased from 41 percent in middle childhood to 55 percent in adolescence to 66 percent in young adulthood (Haworth et al., 2010). Similarly, adopted children's verbal ability scores over time become more like those of their biological parents (**FIGURE 63.2**). Who would have guessed?

Environmental Influences

63-2 What does evidence reveal about environmental influences on intelligence?

Genes make a difference. Even if we were all raised in the same intellectually stimulating environment, we would have differing aptitudes. But life experiences also matter. Human environments are rarely as impoverished as the dark and barren cages inhabited by deprived rats that develop thinner-than-normal brain cortexes (see Module 50). Yet severe deprivation also leaves footprints on the human brain.

Early Environmental Influences

Nowhere is the intertwining of biology and experience more apparent than in impoverished human environments such as J. McVicker Hunt (1982) observed in a destitute Iranian orphanage. The typical child Hunt observed there could not sit up unassisted at age 2 or walk at age 4. The little care the infants received was not in response to their crying, cooing, or other behaviors, so the children developed little sense of personal control over their environment. They were instead becoming passive "glum lumps." Extreme deprivation was bludgeoning native intelligence—a finding confirmed by other studies of children raised in poorly run orphanages in Romania and elsewhere (Nelson, et al., 2009; van IJzendoorn et al., 2008).


Josef Polleross/The Image Works

Devastating neglect
Some Romanian orphans, such as this child in the Leaganul Pentru Copii orphanage in 1990, had minimal interaction with caregivers, and suffered delayed development.

Aware of both the dramatic effects of early experiences and the impact of early intervention, Hunt began a program of *tutored human enrichment.* He trained caregivers to play language-fostering games with 11 infants, imitating the babies' babbling, then engaging them in vocal follow-the-leader, and finally teaching them sounds from the Persian language. The results were dramatic. By 22 months of age,

the infants could name more than 50 objects and body parts, and so charmed visitors that most were adopted—an unprecedented success for the orphanage.

Hunt's findings are an extreme case of a more general finding: Among those economically impoverished, environmental conditions can depress cognitive development. Schools with many poverty-level children often have less-qualified teachers, as one study of 1450 Virginia schools found. So these children may receive a less-enriched education. And even after controlling for poverty, having less-qualified teachers predicted lower achievement scores (Tuerk, 2005). Malnutrition also plays a role. Relieve infant malnutrition with nutritional supplements, and poverty's effect on physical and cognitive development lessens (Brown & Pollitt, 1996).

Do studies of such early interventions indicate that providing an "enriched" environment can "give your child a superior intellect," as some popular products claim? Most experts are doubtful (Bruer, 1999). Although malnutrition, sensory deprivation, and social isolation can retard normal brain development, there is no environmental recipe for fast-forwarding a normal infant into a genius. All babies should have normal exposure to sights, sounds, and speech. Beyond that, Sandra Scarr's (1984) verdict still is widely shared: "Parents who are very concerned about providing special educational lessons for their babies are wasting their time."

Still, explorations of intelligence promotion continue. Some parents, after exposing their 12- to 18-month-old babies to educational DVDs such as from the *Baby Einstein* series, have observed their baby's vocabulary growing. To see whether such cognitive growth is a result of the DVD exposure, or simply of infants' natural language explosion, two research teams assigned babies to DVD exposure or a control group (DeLoache et al., 2010; Reichert et al., 2010). Their common finding: The two groups' word-learning did not differ.

Schooling and Intelligence

Later in childhood, schooling is one intervention that pays intelligence score dividends. Schooling and intelligence interact, and both enhance later income (Ceci & Williams, 1997, 2009). Hunt was a strong believer in the ability of education to boost children's chances for success by developing their cognitive and social skills. Indeed, his 1961 book, *Intelligence and Experience,* helped launch Project Head Start in 1965, a U.S. government-funded preschool program that serves more than 900,000 children, most of whom come from families below the poverty level (Head Start, 2010). Does it succeed? Generally, the aptitude benefits dissipate over time (reminding us that life experience *after* Head Start matters, too). Psychologist Edward Zigler, the program's first director, nevertheless believed there are long-term benefits (Ripple & Zigler, 2003; Zigler & Styfco, 2001).

Genes and experience together weave the intelligence fabric. (Recall from Module 14 that *epigenetics* is one field that studies this nature–nurture meeting place.) But what we accomplish with our intelligence depends also on our own beliefs and motivation. One analysis of 72,431 collegians found that study motivation and study skills rivaled previous grades and aptitude as predictors of academic achievement (Credé & Kuncel, 2008). Motivation even affects intelligence test performance. Four dozen studies show that, when promised money for doing well, adolescents score higher (Duckworth et al., 2011).

Psychologist Carol Dweck (2006, 2007, 2008) reports that believing intelligence is biologically set and unchanging can lead to a "fixed mindset." Believing intelligence is changeable, a "growth mindset" results in a focus on learning and growing. As collegians, these believers also tend to happily flourish (Howell, 2009). Dweck has developed interventions that effectively teach young teens that the brain is like a muscle that grows stronger with use as neuron connections grow. Indeed, as we noted earlier, superior achievements in fields from sports to science to music arise from disciplined effort and sustained practice (Ericsson et al., 2007).

Before You Move On

▶ ASK YOURSELF

How have genetic and environmental influences shaped your intelligence?

▶ TEST YOURSELF

As society succeeds in creating equality of opportunity, it will also increase the heritability of ability. The heritability of intelligence scores will be greater in a society marked by equal opportunity than in a society of peasants and aristocrats. Why?

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

Module 63 Review

63-1 What evidence points to a genetic influence on intelligence, and what is heritability?

- Studies of twins, family members, and adoptees indicate a significant hereditary contribution to intelligence scores.
- Intelligence seems to be polygenetic, and researchers are searching for genes that exert an influence.
- *Heritability* is the proportion of variation among individuals that can be attributed to genes.

63-2 What does evidence reveal about environmental influences on intelligence?

- Studies of twins, family members, and adoptees also provide evidence of environmental influences.
- Test scores of identical twins raised apart are slightly less similar (though still very highly correlated) than the scores of identical twins raised together.
- Studies of children raised in extremely impoverished environments with minimal social interaction indicate that life experiences can significantly influence intelligence test performance.
- No evidence supports the idea that normal, healthy children can be molded into geniuses by growing up in an exceptionally enriched environment.

Multiple-Choice Questions

1. Heritability relates to the
   a. percentage of a person's intelligence that is due to environmental influences.
   b. percentage of a person's intelligence that is due to genetics.
   c. correlation of intelligence test scores among family members.
   d. extent to which variability among individuals' intelligence scores can be attributed to genetic variation.
   e. genetic stability of intelligence over time.

2. The correlation between the IQ scores of fraternal twins raised together is lower than IQ scores of identical twins raised together. What conclusion can be drawn from this data?
   a. Nothing, because the type of twin has not been held constant.
   b. Nothing, because there is no comparison between twins and adopted children.
   c. Nothing, because cultural differences have not been considered.
   d. There is a genetic effect on intelligence.
   e. There is an environmental effect on intelligence.

3. Which of the following is true of the mental similarities between adoptive children and their adoptive parents as they age?

a. Adoptive children become much more similar to their adoptive families over time.
b. Adoptive children become slightly more similar to their adoptive families over time.
c. There is hardly any similarity, either when the adoptive children are young or when they are older.
d. Adoptive children become slightly less similar to their adoptive families over time.
e. Adoptive children become much less similar to their adoptive families over time.

4. According to Carol Dweck, students are often hampered by a "fixed mindset." This means they believe:

a. intelligence is biologically set and unchangeable.
b. it is never good to change your mind once it is made up.
c. intelligence can be "repaired" by doing specific mental exercises.
d. they have already done everything they can to improve.
e. problems can only be solved a particular way.

Practice FRQs

1. Explain two environmental interventions that might help poverty-level schoolchildren develop better cognitive skills.

Answer

1 point: The presence of more highly qualified teachers is positively correlated with higher student achievement.

1 point: Nutritional supplements can help alleviate the effects of the poor nutrition that often accompanies economic poverty.

2. Explain whether each of the following comparisons indicates a greater influence of genetics on intelligence or a greater influence of environment on intelligence.

- The correlation of intelligence test scores for identical twins raised *together* is about +.85. For identical twins raised *apart,* the correlation is about +.72.
- The correlation of intelligence scores for identical twins raised together is about +.85. For fraternal twins raised together, it is about +.60.

(2 points)

Module 64

Group Differences and the Question of Bias


Hugh Sitton/Corbis

Module Learning Objectives

64-1 Describe how and why the genders differ in mental ability scores.

64-2 Describe how and why racial and ethnic groups differ in mental ability scores.

64-3 Discuss whether intelligence tests are inappropriately biased.

Group Differences in Intelligence Test Scores

If there were no group differences in aptitude scores, psychologists could politely debate hereditary and environmental influences in their ivory towers. But there are group differences. What are they? And what shall we make of them?

Gender Similarities and Differences

64-1 How and why do the genders differ in mental ability scores?

In science, as in everyday life, differences, not similarities, excite interest. Compared with the anatomical and physiological similarities between men and women, our differences are minor. In that 1932 testing of all Scottish 11-year-olds, for example, girls' average intelligence score was 100.6 and boys' was 100.5 (Deary et al., 2003). So far as *g* is concerned, boys and girls, men and women, are the same species.

Yet, most people find differences more newsworthy. Girls are better spellers, more verbally fluent, better at locating objects, better at detecting emotions, and more sensitive to touch, taste, and color (Halpern et al., 2007). Boys outperform girls in tests of spatial ability and complex math problems, though in math computation and overall math performance, boys and girls hardly differ (Else-Quest et al., 2010; Hyde & Mertz, 2009; Lindberg et al., 2010). Males' mental ability scores also vary more than females'. Thus, boys worldwide outnumber girls at both the low extreme and the high extreme (Machin & Pekkarinen, 2008; Strand et al., 2006). Boys, for example, are more often found in special education classes. And among 12- to 14-year-olds scoring extremely high (700 or higher) on the SAT® exam math section, boys outnumber girls 4 to 1 (Wai et al., 2010).

The most reliable male edge appears in spatial ability tests like the one shown in **FIGURE 64.1**. The solution requires speedily rotating three-dimensional objects in one's mind (Collins & Kimura, 1997; Halpern, 2000). Today, such skills help when fitting suitcases into a car trunk, playing chess, or doing certain types of geometry problems. From an evolutionary perspective, those same skills would have helped our ancestral fathers track prey and make their way home (Geary, 1995, 1996; Halpern et al., 2007). The survival of our ancestral mothers may have benefited more from a keen memory for the location of edible plants—a legacy that lives today in women's superior memory for objects and their location.

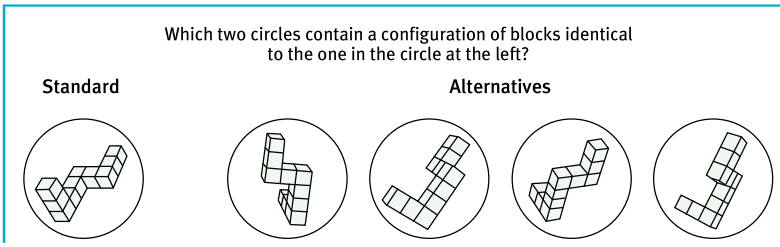


Figure 64.1
The mental rotation test This is a test of spatial abilities. (From Vandenberg & Kuse, 1978.) See inverted answer below.

ANSWER: The first and fourth alternatives.

But experience also matters. One experiment found that playing action video games boosts spatial abilities (Feng et al., 2007). And you probably won't be surprised to know that among entering American collegians, six times as many men (23 percent) as women (4 percent) report playing video/computer games six or more hours a week (Pryor et al., 2010).

Evolutionary psychologist Steven Pinker (2005) argues that biological as well as social influences appear to affect gender differences in life priorities (women's greater interest in people versus men's in money and things), in risk-taking (with men more reckless), and in math reasoning and spatial abilities. Such differences are, he notes, observed across cultures, stable over time, influenced by prenatal hormones, and observed in genetic boys raised as girls. Culturally influenced preferences also help explain women selecting people- rather than math-intensive vocations (Ceci & Williams, 2010, 2011).

Other critics urge us to remember that social expectations and divergent opportunities shape boys' and girls' interests and abilities (Crawford et al., 1995; Eccles et al., 1990). Gender-equal cultures, such as Sweden and Iceland, exhibit little of the gender math gap found in gender-unequal cultures, such as Turkey and Korea (Guiso et al., 2008).


AP Photo/Paul Sakuma

Nature or nurture? At this 2005 Google Inc.-sponsored computer coding competition, programmers competed for cash prizes and possible jobs. What do you think accounted for the fact that only one of the 100 finalists was female?

Racial and Ethnic Similarities and Differences

64-2 How and why do racial and ethnic groups differ in mental ability scores?

Fueling the group-differences debate are two other disturbing but agreed-upon facts:

- Racial groups differ in their average intelligence test scores.
- High-scoring people (and groups) are more likely to attain high levels of education and income.

There are many group differences in average intelligence test scores. New Zealanders of European descent outscore native Maori New Zealanders. Israeli Jews outscore Israeli Arabs. Most Japanese outscore most Burakumin, a stigmatized Japanese minority. Those who can hear outscore those born deaf (Braden, 1994; Steele, 1990; Zeidner, 1990). And White Americans have outscored Black Americans. This Black-White difference has diminished somewhat in recent years, especially among children (Dickens & Flynn, 2006; Nisbett, 2009). Such *group* differences provide little basis for judging individuals. Worldwide, women outlive men by 4 years, but knowing only that you are male or female won't tell us much about how long you will live.

We have seen that heredity contributes to *individual* differences in intelligence. But group differences in a heritable trait may be entirely environmental. Consider one of nature's experiments: Allow some children to grow up hearing their culture's dominant language, while others, born deaf, do not. Then give both groups an intelligence test rooted in

the dominant language, and (no surprise) those with expertise in that language will score highest. Although individual performance differences may be substantially genetic, the group difference is not (**FIGURE 64.2**).

Might the racial gap be similarly environmental? Consider:

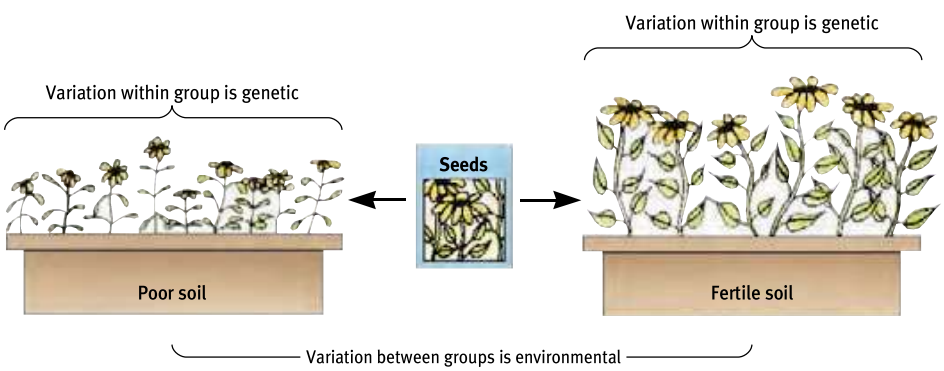
Genetics research reveals that under the skin, the races are remarkably alike. The average genetic difference between two Icelandic villagers or between two Kenyans greatly exceeds the group difference between Icelanders and Kenyans (Cavalli-Sforza et al., 1994; Rosenberg et al., 2002). Moreover, looks can deceive. Light-skinned Europeans and dark-skinned Africans are genetically closer than are dark-skinned Africans and dark-skinned Aboriginal Australians.

Race is not a neatly defined biological category. Some scholars argue that there is a reality to race, noting that there are genetic markers for race (the continent of one's ancestry), that medical risks (such as skin cancer or high blood pressure) vary by race, and that most people self-identify with a given race (Hunt & Carlson, 2007). Behavioral traits may also vary by race. "No runner of Asian or European descent—a majority of the world's population—has broken 10 seconds in the 100-meter dash, but dozens of runners of West African descent have done so," observed psychologist David Rowe (2005). Many social scientists, though, see race primarily as a social construction without well-defined physical boundaries, as each race blends seamlessly into the race of its geographical neighbors (Helms et al., 2005; Smedley & Smedley, 2005). People with varying ancestry may categorize themselves in the same race. Moreover, with increasingly mixed ancestries, more and more people defy neat racial categorization and self-identify as multiracial (Pauker et al., 2009).

The intelligence test performance of today's better-fed, better-educated, and more test-prepared population exceeds that of the 1930s population—by a greater margin than the intelligence test score of the average White today exceeds that of the average Black. One research review noted that the average IQ test performance of today's sub-Saharan Africans is the same as Brit-

Figure 64.2

Group differences and environmental impact Even if the variation between members within a group reflects genetic differences, the average difference between groups may be wholly due to the environment. Imagine that seeds from the same mixture are sown in different soils. Although height differences *within* each window box will be genetic, the height difference *between* the two groups will be environmental. (From Lewontin, 1976.)



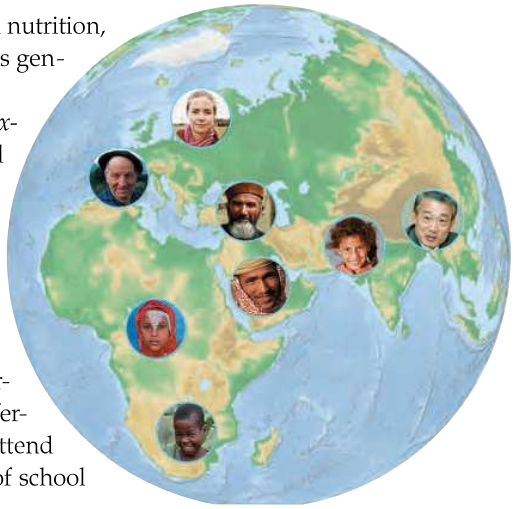
ish adults in 1948, with the possibility of similar gains to come, given improved nutrition, economic development, and education (Wicherts et al., 2010). No one attributes generational group differences to genetics.

When Blacks and Whites have or receive the same pertinent knowledge, they exhibit similar information-processing skill. "The data support the view that cultural differences in the provision of information may account for racial differences in IQ," report researchers Joseph Fagan and Cynthia Holland (2007).

Schools and culture matter. Countries whose economies create a large wealth gap between rich and poor tend also to have a large rich/poor IQ gap (Nisbett, 2009). Moreover, educational policies such as kindergarten attendance, school discipline, and instructional time per year predict national differences in intelligence and knowledge tests (Rindermann & Ceci, 2009). Asian students outperform North American students on math achievement and aptitude tests. This difference may reflect conscientiousness more than competence. Asian students also attend school 30 percent more days per year and spend much more time in and out of school studying math (Geary et al., 1996; Larson & Verma, 1999; Stevenson, 1992).

In different eras, different ethnic groups have experienced golden ages—periods of remarkable achievement. Twenty-five-hundred years ago, it was the Greeks and the Egyptians, then the Romans; in the eighth and ninth centuries, genius seemed to reside in the Arab world; 500 years ago it was the Aztec Indians and the peoples of Northern Europe. Today, people marvel at Asians' technological genius and Jews' cultural success. In today's United States, Jews are 2 percent of the population, 21 percent of Ivy League student bodies, 37 percent of Academy Award–winning directors, and 51 percent of Pulitzer Prize winners for nonfiction; worldwide, they have been 27 percent of Nobel physics laureates and 54 percent of world chess champions (Brooks, 2010). Cultures rise and fall over centuries; genes do not. That fact makes it difficult to attribute a natural superiority to any race.

Moreover, consider the striking results of a national study that looked back over the mental test performances of White and Black young adults after graduation from college. From eighth grade through the early high school years, the average aptitude score of the White students increased, while that of the Black students decreased—creating a gap that reached its widest point at about the time that high school students like you take college admissions tests. But during college, the Black students' scores increased "more than four times as much" as those of their White counterparts, thus greatly decreasing the aptitude gap. "It is not surprising," concluded researcher Joel Myerson and his colleagues (1998), "that as Black and White students complete more grades in high school environments that differ in quality, the gap in cognitive test scores widens. At the college level, however, where Black and White students are exposed to educational environments of comparable quality . . . many Blacks are able to make remarkable gains, closing the gap in test scores."



Nature's own morphing Nature draws no sharp boundaries between races, which blend gradually one into the next around the Earth. Thanks to the human urge to classify, however, people socially define themselves in racial categories, which become catchall labels for physical features, social identity, and nationality.

"Do not obtain your slaves from Britain, because they are so stupid and so utterly incapable of being taught." -Cicero, 106–43 B.C.E.

The Question of Bias

64-3 Are intelligence tests inappropriately biased?

If one assumes that race is a meaningful concept, the debate over race differences in intelligence divides into three camps, note Earl Hunt and Jerry Carlson (2007):

- There are genetically disposed race differences in intelligence.
- There are socially influenced race differences in intelligence.
- There are race differences in test scores, but the tests are inappropriate or biased.

Are intelligence tests biased? The answer depends on which of two very different definitions of *bias* we use.

Two Meanings of Bias

We consider a test biased if it detects not only innate differences in intelligence but also performance differences caused by cultural experiences. This in fact happened to Eastern European immigrants in the early 1900s. Lacking the experience to answer questions about their new culture, many were classified as feeble-minded.

In this popular sense, intelligence tests are biased. They measure your developed abilities, which reflect, in part, your education and experiences. You may have read examples of intelligence test items that make middle-class assumptions (for example, that a cup goes with a saucer). Do such items bias the test against those who do not use saucers? Could such questions explain racial differences in test performance? If so, are tests a vehicle for discrimination, consigning potentially capable children, some of whom may have a different native language, to dead-end classes and jobs? And could creating culture-neutral questions—such as by assessing people's ability to learn novel words, sayings, and analogies—enable culture-fair aptitude tests (Fagan & Holland, 2007, 2009)?

Defenders of the existing aptitude tests note that racial group differences persist on nonverbal items, such as counting digits backward (Jensen, 1983, 1998). Moreover, they add, blaming the test for a group's lower scores is like blaming a messenger for bad news. Why blame the tests for exposing unequal experiences and opportunities? If, because of malnutrition, people were to suffer stunted growth, would you blame the measuring stick that reveals it? If unequal past experiences predict unequal future achievements, a valid aptitude test will detect such inequalities.

The second meaning of *bias*—its *scientific* meaning—is different. It hinges on a test's validity—on whether it predicts future behavior only for some groups of test-takers. For example, if the SAT® exam accurately predicted the college achievement of women but not that of men, then the test would be biased. In this statistical meaning of the term, the near-consensus among psychologists (as summarized by the U.S. National Research Council's Committee on Ability Testing and the American Psychological Association's Task Force on Intelligence) is that the major U.S. aptitude tests are *not* biased (Hunt & Carlson, 2007; Neisser et al., 1996; Wigdor & Garner, 1982). The tests' predictive validity is roughly the same for women and men, for Blacks and Whites, and for rich and poor. If an intelligence test score of 95 predicts slightly below-average grades, that rough prediction usually applies equally to all.

"Political equality is a commitment to universal human rights, and to policies that treat people as individuals rather than representatives of groups; it is not an empirical claim that all groups are indistinguishable." -Steven Pinker (2006)

Test-Takers' Expectations

Throughout this text, we have seen that our expectations and attitudes can influence our perceptions and behaviors, and we find this effect in intelligence testing. When Steven Spencer and his colleagues (1997) gave a difficult math test to equally capable men and women, women did not do as well—except when they had been led to expect that women usually do as well as men on the test. Otherwise, the women apparently felt apprehensive, which affected their performance. With Claude Steele and Joshua Aronson, Spencer (2002) also observed this self-fulfilling **stereotype threat** with Black students. When reminded of their race just before taking verbal aptitude tests, they performed worse. Follow-up experiments confirm that negatively stereotyped minorities and women may have unrealized academic potential (Nguyen & Ryan, 2008; Walton & Spencer, 2009). If, when taking an exam, you are worried that your type often doesn't do well, your self-doubts and self-monitoring may hijack your working memory and impair your performance (Schmader, 2010). For such reasons, stereotype threat may also impair attention and learning (Inzlicht & Kang, 2010; Rydell et al., 2010).

stereotype threat a self-confirming concern that one will be evaluated based on a negative stereotype.

"Math class is tough!" -"Teen talk" talking Barbie doll (introduced July 1992, recalled October 1992)

Critics note that stereotype threat does not fully account for the Black-White aptitude score difference (Sackett et al., 2004, 2008). But it does help explain why Blacks have scored higher when tested by Blacks than when tested by Whites (Danso & Esses, 2001; Inzlicht & Ben-Zeev, 2000). It gives us insight into why women have scored higher on math tests with no male test-takers present, and why women's chess play drops sharply when they *think* they are playing a male opponent (Maass et al., 2008). And it explains "the Obama effect"—

the finding that African-American adults performed better if taking a verbal aptitude test administered immediately after watching Barack Obama's stereotype-defying nomination acceptance speech or just after his 2008 presidential victory (Marx et al., 2009).

Steele (1995, 2010) concludes that telling students they probably won't succeed (as is sometimes implied by remedial "minority support" programs) functions as a stereotype that can erode performance. Over time, such students may detach their self-esteem from academics and look for recognition elsewhere. Indeed, as African-American boys progress from eighth to twelfth grade, there is a growing disconnect between their grades and their self-esteem and they tend to underachieve (Osborne, 1997). One experiment randomly assigned some African-American seventh-graders to write for 15 minutes about their most important values (Cohen et al., 2006, 2009). That simple exercise in self-affirmation had the apparent effect of boosting their semester grade point average by 0.26 in a first experiment and 0.34 in a replication. Minority students in university programs that challenge them to believe in their potential, or to focus on the idea that intelligence is malleable and not fixed, have likewise produced markedly higher grades and had lower dropout rates (Wilson, 2006).

What, then, can we realistically conclude about aptitude tests and bias? The tests are indeed biased (appropriately so, some would say) in one sense—sensitivity to performance differences caused by cultural experience. But they are not biased in the scientific sense of failing to make valid statistical predictions for different groups.

Bottom line: Are the tests discriminatory? Again, the answer can be *Yes* or *No*. In one sense, *Yes,* their purpose is to discriminate—to distinguish among individuals. In another sense, *No,* their purpose is to reduce discrimination by reducing reliance on subjective criteria for school and job placement—who you know, what school you're from, or whether you are the "right kind of person." Civil service aptitude tests, for example, were devised to discriminate more fairly and objectively by reducing the political, racial, and ethnic discrimination that preceded their use. Banning aptitude tests would lead those who decide on jobs and admissions to rely more on other considerations, such as personal opinion.

Perhaps, then, our goals for tests of mental abilities should be threefold. First, we should realize the benefits Alfred Binet foresaw—to enable schools to recognize who might profit most from early intervention. Second, we must remain alert to Binet's fear that intelligence test scores may be misinterpreted as literal measures of a person's worth and potential. Third, we must remember that the competence that general intelligence tests sample is important; it helps enable success in some life paths. But it reflects only one aspect of personal competence. Our practical intelligence and emotional intelligence matter, too, as do other forms of creativity, talent, and character. Because there are many ways of being successful, our differences are variations of human adaptability.

Finally, life's great achievements result not only from "can do" abilities but also from "will do" motivation. Competence + Diligence → Accomplishment.

BananaStock/Jupiter images

Untestable compassion
Intelligence test scores are only one part of the picture of a whole person. They don't measure the abilities, talent, and commitment of, for example, people who devote their lives to helping others.

"Almost all the joyful things of life are outside the measure of IQ tests." -Madeleine L'Engle, *A Circle of Quiet*, 1972

"[Einstein] showed that genius equals brains plus tenacity squared." -Walter Isaacson, "Einstein's Final Quest," 2009

Before You Move On

▶ ASK YOURSELF

How have your expectations influenced your own test performance? What steps could you take to control this influence?

▶ TEST YOURSELF

What is the difference between a test that is biased culturally, and a test that is biased in terms of its validity?

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

Module 64 Review

64-1 How and why do the genders differ in mental ability scores?

- Males and females tend to have the same average intelligence test scores. They differ in some specific abilities.
- Girls are better spellers, more verbally fluent, better at locating objects, better at detecting emotions, and more sensitive to touch, taste, and color.
- Boys outperform girls at spatial ability and related mathematics, though girls outperform boys in math computation. Boys also outnumber girls at the low and high extremes of mental abilities.
- Psychologists debate evolutionary, brain-based, and cultural explanations of such gender differences.

64-2 How and why do racial and ethnic groups differ in mental ability scores?

- Racial and ethnic groups differ in their average intelligence test scores.
- The evidence suggests that environmental differences are largely, perhaps entirely, responsible for these group differences.

64-3 Are intelligence tests inappropriately biased?

- Aptitude tests aim to predict how well a test-taker will perform in a given situation. So they are necessarily "biased" in the sense that they are sensitive to performance differences caused by cultural experience.
- By "inappropriately biased," psychologists mean that a test predicts less accurately for one group than for another. In this sense, most experts consider the major aptitude tests unbiased.
- *Stereotype threat,* a self-confirming concern that one will be evaluated based on a negative stereotype, affects performance on all kinds of tests.

Multiple-Choice Questions

1. Which of the following is true of boys compared with girls?

a. Boys have a higher average intelligence score.
b. Boys are better spellers than girls.
c. Boys are better at detecting emotions.
d. Boys are more verbally fluent.
e. Boys are more likely to have extremely low intelligence scores.

2. Which of the following provides the best evidence that race is more of a social construct than a biological category?

a. People of varying ancestry may categorize themselves in the same race.
b. The races arose in different continents.
c. Behavior traits (like running speed) are associated with race.
d. Skin cancer rates vary by race.
e. The incidence of high blood pressure varies by race.

3. According to most experts, intelligence tests are not biased because

a. the average scores for various racial and ethnic groups do not differ by much.
b. the tests do a pretty good job of predicting what they are supposed to predict.
c. cultural background has little influence on test scores.
d. scores on the test are not very stable even when you don't consider race.
e. scores are increasing for almost all groups because of the Flynn effect.

Practice FRQs

1. Robert and Maya are having an argument about whether intelligence tests are biased. Robert thinks they are but Maya insists they are not. How can they both be right?

2. Explain three reasons why racial differences in intelligence might be caused by environmental factors. *(3 points)*

Answer

1 point: Intelligence tests can be considered biased because they, in part, measure experience. Therefore, people from a middle-class, or higher, background are at an advantage.

1 point: Intelligence tests do a good job of predicting the future no matter what demographic group the test-taker is from. In other words, children who do well on intelligence tests are likely to do well in school no matter what their economic or ethnic background is. Likewise, children from all backgrounds who do poorly on the tests do poorly in school.

Unit XI Review

Key Terms and Concepts to Remember

intelligence, p. 607
intelligence test, p. 607
general intelligence (g), p. 608
factor analysis, p. 608
savant syndrome, p. 609
grit, p. 610
emotional intelligence, p. 612
mental age, p. 618
Stanford-Binet, p. 618
intelligence quotient (IQ), p. 618
achievement test, p. 619
aptitude test, p. 619
Wechsler Adult Intelligence Scale (WAIS), p. 620
standardization, p. 621
normal curve, p. 621
reliability, p. 622
validity, p. 622
content validity, p. 622
predictive validity, p. 622
cohort, p. 625
crystallized intelligence, p. 626
fluid intelligence, p. 626
intellectual disability, p. 629
Down syndrome, p. 629
heritability, p. 632
stereotype threat, p. 642

Key Contributors to Remember

Charles Spearman, p. 608
L. L. Thurstone, p. 608
Howard Gardner, p. 609
Robert Sternberg, p. 611
Francis Galton, p. 617
Alfred Binet, p. 618
Louis Terman, p. 618
David Wechsler, p. 620
Carol Dweck, p. 635