In Colangelo, N., & Davis, G. A. (Eds.) Handbook of gifted education (3rd ed.). Boston: Allyn & Bacon, 2003.

3

The Science and Politics of Intelligence in Gifted Education

LINDA S. GOTTFREDSON, University of Delaware

g is probably the most controversial single result in psychology, as well as being one of the most important.

—Deary, 2000, p. 8

Why is it so hard to persuade schools that gifted children have special needs? Why are people who advocate their needs tagged as elitists—even *antidemocratic*—for doing so ("To group or not to group: Is that really the question?" was the title of a 1995 debate between William Durden and Robert Slavin)? And why do public schools often treat exceptionally gifted students as, literally, an embarrassment of riches? The full list of laments is long and all too familiar to educators of gifted children.

Nor are the critics persuaded when gifted educators cite the research evidence—for example, that ability grouping and accelerated instruction enhance the performance of intellectually gifted students without harming the less able (Kulik & Kulik, 1997; Page & Keith, 1994). Or that gifted children thrive on the challenge of more demanding work and, on the other hand, resent being exploited in mixed-ability classrooms as either as tutors or workhorses in cooperative-learning groups (Colangelo & Davis, 1997; Robinson, 1997).

As in other arenas of political life, the scientific facts often carry little weight. Indeed the facts are often shaped to fit the political claims being argued. Hence, textbooks regularly report, falsely, that ability grouping harms less able students (e.g., Mulkey, 1993, p. 132) and that more "democratic" instructional strategies (e.g., cooperative learning in mixed ability groups) are more effective for student learning (Glazer, 1990). To argue the facts that cooperative learning does not help everyone is itself sometimes greeted as a cover for elitism, or worse.[1]

The Political Reality

These political realities are not unique to gifted education, for they reflect an ambivalence about talent that pervades employee selection, admissions to college, and many other aspects of American life where talent matters (Colangelo & Davis, 1997; Gottfredson, 2000a; Tannenbaum, 1996). Since this nation's early days (deTocqueville, 1990/1835; Gardner, 1984), Americans at once celebrate the self-made man who rises through sheer talent and grit, and deplore the inequalities that the freedom to advance (or fall behind) on one's own merits allows. Wanting to believe that "all men are created equal" in talent as well as basic rights, Americans are made uneasy by the consequences of people having the liberty to capitalize on their unequal strengths. They nourish the myth that with hard work *anyone* can rise to great heights if given the opportunity. Of special relevance to gifted education, Americans look to the schools to be the Great Equalizer; hence the sensitivities over gifted education—it seems to help the rich get richer.

Because educational policy makers tend to equate democracy more with equality than with freedom, they generally give priority to equal *results* in academic achievement over equal *opportunity* to reach one's potential. They relax this priority when there is external political pressure to use the "best and brightest" for some collective national purpose, such as competing with the Soviet Union in space or with

1. See Chapter 22 by Robinson.

Japan in the marketplace. Their usual preferences thus create special challenges for those advocating programs for gifted children.

How is one to respond? Clearly, not by thoughtlessly accepting *or* dismissing the politics or science of gifted education's critics—say, the political preference that equal results be our first principle, or the (false) claim that equality of endowment is a fact. There is no scientific fact that can tell us how much we should value equality of results over equality of opportunity, or vice versa, when the two conflict. Rather, this is an important social debate that gifted educators should enter with political awareness but a confident voice.

Equality of endowment is, however, a scientific issue, and there is much evidence on the matter. Unfortunately, the scientific facts are often either unknown by or misrepresented to the public. Nowhere is this truer than on the topic of intelligence. Differences in general intelligence are the core fact relating to giftedness, but are also its biggest political millstone. Sometimes, it seems as if the more researchers learn about intelligence and ways of measuring it, the louder skeptics complain.

Accordingly, it may help to lay out the basics of what is known about intelligence as it relates to key questions in gifted education. For instance, are there multiple, independent kinds of giftedness, or of intelligence itself? Does intellectual giftedness result mostly from nature or nurture? If giftedness is to some extent innate, doesn't nurture supersede nature anyway as children advance through school? Can IQ tests predict great cultural achievement? Is a high IQ even necessary for it? And what abilities does an IQ score even represent, in the first place? Can all students develop high abilities if given proper instruction and sufficient opportunity to practice? Could we all be Mozarts?

Journalists opined on these questions at length after publication in 1994 of *The Bell Curve: Intelligence and Class Structure in American Life* (Herrnstein & Murray, 1994). Most of them asserted the answers to be, respectively, "yes" (intelligence is multidimensional), nurture dominates, any impact of the genes recedes with age, great cultural achievement is unrelated to and does not require high intelligence, IQ tests measure only narrow academic skills, and all students could develop such skills if given the opportunity and encouragement. Moreover, they often described claims to the contrary as already discredited views of ideologically driven pseudo-scientists.

What does the scientific research actually show? Just the opposite. Alarmed at the crescendo of disinformation, fifty-two leading intelligence researchers issued a statement in 1994 ("Mainstream Science on Intelligence"), first published in the *Wall Street Journal* (December 13, 1994), and later republished as an editorial in the journal *Intelligence* (Gottfredson, 1997a). Its twenty-five ABCs of confirmed knowledge on intelligence can be found in the major textbooks and scientific treatises on the topic (e.g., Brody, 1992; Carroll, 1993; Deary, 2000; Jensen, 1980, 1998; Plomin, DeFries, McClearn, & McGuffin, 2001), as well as in an American Psychological Association (APA) task force report published soon after (Neisser et al., 1996). I echo their main points below and elaborate on their relevance to the debate over gifted education. The truth, as we shall see, is more complex and far more interesting than most people might suspect.

The Scientific ABCs of Intelligence: Its Generality, Demographics, Genetics, and Pragmatics

Generality

Perhaps the single most important fact about general intelligence is its great generality. People who are high in one mental aptitude tend to be high in all. The positive correlations among all mental tests, despite their vast differences in format (e.g., written versus oral; group-administered versus individually administered) and manifest content (e.g., words, figures, numbers, drawings), indicate that all mental tests tend to measure something in common. That common factor can be extracted from the scores on any large, diverse battery of mental tests by applying the statistical technique of factor analysis. The resulting common factor, which can be separated from other components of the tests, is called *g* (short for the *g*eneral mental ability factor). Most mental tests measure *g* more than anything else, and researchers have been unable to develop meaningful mental tests that do not measure mostly *g*. Moreover, virtually identical *g* factors emerge from different test batteries (as long as they are large and diverse) and from different age, racial-ethnic, sex, and national groups (Bouchard, 1998; Jensen, 1998, chap. 4), which suggests that there exists a single, humanity-wide ladder of general mental competence.

Because the *g* continuum is common to all tests and human groups, despite their superficial dissimilarities, the variations in mental competence that the *g* factor represents must be fairly independent of the vagaries of culture and context. Indeed, intelligence has often been verbally defined in precisely such terms—as the ability to learn, think abstractly, reason, and solve problems. In more colloquial terms, it is the ability to catch on, make sense of things, and figure out what to do. Most globally, *g* is the ability to process information of any sort.

g as the Common Core of All Mental Abilities. The existence of a strong *general* factor does not mean that intelligence is the only mental ability or a unitary mental process. People rightly have a broader conception of human talent, and the argument for a *g* factor—a general intelligence factor—should not be misconstrued as an argument that intellectual ability or achievement itself is unidimensional. Different mental abilities are only moderately to moderately highly correlated, and factor analyses show that the *g* factor accounts for only about half the variance in scores in any broad battery of mental tests. In addition, although more specific mental abilities such as verbal and spatial aptitude share mostly the same genetic roots as does *g*, they still tend to be somewhat genetically distinct from *g* (Bouchard, 1998; Plomin et al., 2001, Chap. 10).[2]

The point is that a highly general intelligence factor forms the common core for all mental abilities yet studied. It is therefore likely that a favorable *g* level forms an essential foundation for most, if not all, highly valued forms of cultural achievement, such as in music, the arts, science, and politics. High intelligence obviously is not sufficient for high levels of achievement, but it may be necessary. Howard Gardner (1983), the proponent of multiple intelligence theory, has himself said that all the exemplars of his seven or more "intelligences" probably exceeded IQ 120 (Jensen, 1998, p. 128), which is the 90th percentile in intelligence.[3] On the other hand, as I discuss later, high intelligence is not a *sufficient* condition for greatness. But, to repeat, although intellectual potential is not unidimensional and potential must be accompanied by other personal traits and opportunities to result in actual achievement, higher than average *g* may be *necessary* for high levels of either potential or actual achievement.

2. See Chapter 9 by Plomin and Price.

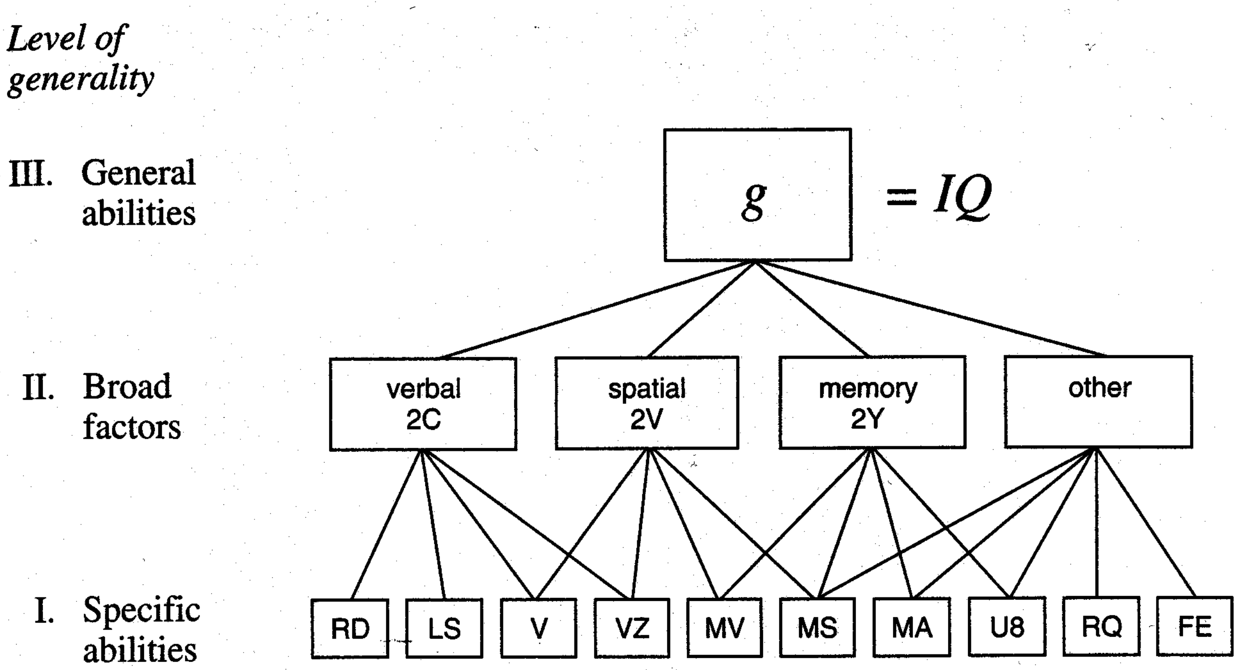
3. See Chapter 8 by von Károlyi, Ramos-Ford, and Gardner.

Hierarchical Model of Mental Abilities. Intelligence researchers now favor what they call the *hierarchical* model of cognitive abilities (Deary, 2000). It is a major advance in the field of intelligence because it unifies major theories that had once been thought irreconcilable. It does so, first, by distinguishing abilities according to how broad versus narrow they are and, second, by showing how the more general abilities actually form the foundation of the more specific ones. This unified model helps to clarify (even settle) the debate over whether there exists one intelligence or many. It also helps clarify the derivative debate over giftedness—is there one form or many?

As shown in Figure 3.1, the hierarchical model consists of three strata or layers of abilities, where the higher strata represent the more general abilities (Carroll, 1993, Chap. 16). The crowded bottom layer includes many specific abilities, the middle layer about ten broad abilities, and the top stratum only highly general capabilities. If *giftedness* represents fairly broad abilities and *talent* more specific ones, then talents appear lower in the hierarchy than do different forms of giftedness. The many highly specific Stratum I abilities are measured by tests with names such as lexical knowledge, reading comprehension, associative memory, free recall memory, spatial relations, spatial scanning, and musical discrimination. All the tests correlate among themselves, but some more strongly than others based on like content (verbal, spatial, numerical, etc.). This indicates that the individual tests within a cluster are all tapping some common ability—some *broad ability factor*—in addition to whatever they each may measure uniquely, but that different clusters reflect different broad ability factors.

It is this set of broad ability factors, statistically derived from the Stratum I tests, that constitute the middle layer of the hierarchy. Examples of these Stratum II factors include "general memory and learning," "broad spatial perception," and "broad auditory perception." Factors at this level of generality tap the broad sorts of distinctions in talent that we commonly observe among students: for instance, a quantitative versus a verbal bent.

Stratum II factors are themselves moderately to highly correlated among themselves, indicating that they, in turn, measure something even more general. Stratum III, the apex of the hierarchy, includes these most general capabilities that, because they are so general, fit the description of intelligences. The big question has been: How many are there? Independent analyses have determined there to be just *one*. It is,



This simplified rendition of the hierarchical model draws from Carroll's (1993, Chap. 15) three-stratum summary of the evidence. Verbal, spatial, and memory represent three of his eight Stratum II factors, respectively, crystallized intelligence (2C), broad visual perception (2V), and general memory and learning (2Y). The Stratum I abilities sampled here are reading decoding (RD), listening ability (LS), verbal (printed) language comprehension (V), visualization (VZ), visual memory (MV), memory span (MS), associative memory (MA), maintaining and judging rhythm (U8), quantitative reasoning (RQ), and expressional fluency (FE). See Carroll (1993, p. 626) for the five other Stratum II factors in his summary model, as well as for the other Stratum III factors that are correlated with the Stratum II factors shown here.

Figure 3.1 Hierarchical Model of Mental Abilities.

moreover, the same general mental ability factor, *g*, that was discovered in the first years of intelligence research a century ago. As well as researchers can tell, it is a general capacity—perhaps even a property of the brain—that reflects the speed and efficiency with which we process information of any sort. Stratum II abilities are composed mostly of this single Stratum III factor, *g*, and relatively little remains when *g* is statistically partialled out of them.

Multiple Intelligences: Where Do They Fit In? But how can there be only one highly general ability? Hasn't Howard Gardner (1983) shown that there are at least seven (linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal, and intrapersonal)? And doesn't Robert Sternberg argue that intelligence researchers have found just one general intelligence only because they have not looked for any others (Sternberg et al., 2000, p. xii)?[4] He proposes a triarchic theory in which there are three types of intelligence, academic, practical, and creative, which he sometimes combines under the umbrella concept "successful intelligence" (Sternberg, 1997). Both Gardner and Sternberg argue that g may infuse one or so of their "intelligences" (e.g., Gardner's logical-analytical and Sternberg's academic), but that the others reflect independent kinds of intellectual prowess.

Both of their theories are popular among educators for reasons explained earlier—they are widely interpreted as promises that everyone can be smart in some way, that Mother Nature is an egalitarian after all. However, intelligence researchers have explored many kinds of abilities over the years, intellectual and not, also in a quest for major mental abilities that are independent of *g*. Their searches have yielded none. Many hundreds of studies have analyzed the structure of mental abilities, that is, the relations among them. John B. Carroll (1993) painstakingly gathered and reanalyzed 450 such studies, the best of nearly a century's worldwide research on the topic. His reanalysis yields only one highly general ability, *g*. Carroll (1993) concluded, moreover, that four of Gardner's

4. See Chapter 7 by Sternberg.

"intelligences" (linguistic, logical-mathematical, spatial, and perhaps musical) probably represent broad abilities at the Stratum II level, all of which, it should be recalled, consist primarily of *g*. Gardner's other three intelligences do not seem to be as clearly cognitive in nature, and may mostly reflect traits that have already been studied under other rubrics, such as personality and emotions. Gardner's claims about his intelligences could be easily tested were Gardner or others actually to measure the proposed intelligences and to correlate them with one another as well as with other oft-measured psychological traits such as *g*. This has never been done (Hunt, 2001). In contrast to Gardner, Sternberg and his colleagues claim to have performed such research and successfully demonstrated that there exist separate academic and practical intelligences. However, their evidence turns out to be scanty and to crumble altogether when it is independently examined (Gottfredson, in press a). In short, there is much evidence supporting the claim for only one highly general mental ability, *g*, but none for claims for several co-equal general intelligences.

Research has, however, discovered a kernel of truth to multiple intelligence theory that is relevant to gifted education. Although different abilities tend to come bundled together (if you are high in one you tend to be high in all others), this linkage seems to get looser at higher IQ levels (Detterman & Daniel, 1989; see literature review by Jensen, 1998). That is, whereas low-IQ people tend to be low in all mental abilities, high-IQ people are not as likely to be high in all abilities. The latter's ability profiles are more uneven. To paraphrase past summaries of the finding, "dullness is general but giftedness is not." This conclusion is consistent with descriptions of gifted children. Ellen Winner (1996), for instance, describes amazingly gifted children whose unusual gifts seem confined to one realm of endeavor—art, or mathematics, or reading.[5] Nonetheless, with few exceptions (idiot savants), highly gifted children are above average in IQ. If multiple intelligences exist in this limited sense, they are the playground of the cognitively rich.

In sum, there are different forms of giftedness, but these different gifts do not represent independent intelligences. Rather, they are more like differently flavored ice creams—wonderfully different but all depending on the same basic ingredient. Each form may require a different means of identification and different environmental supports (Stanley, 1997), but none will be found or flourish independent of *g*.

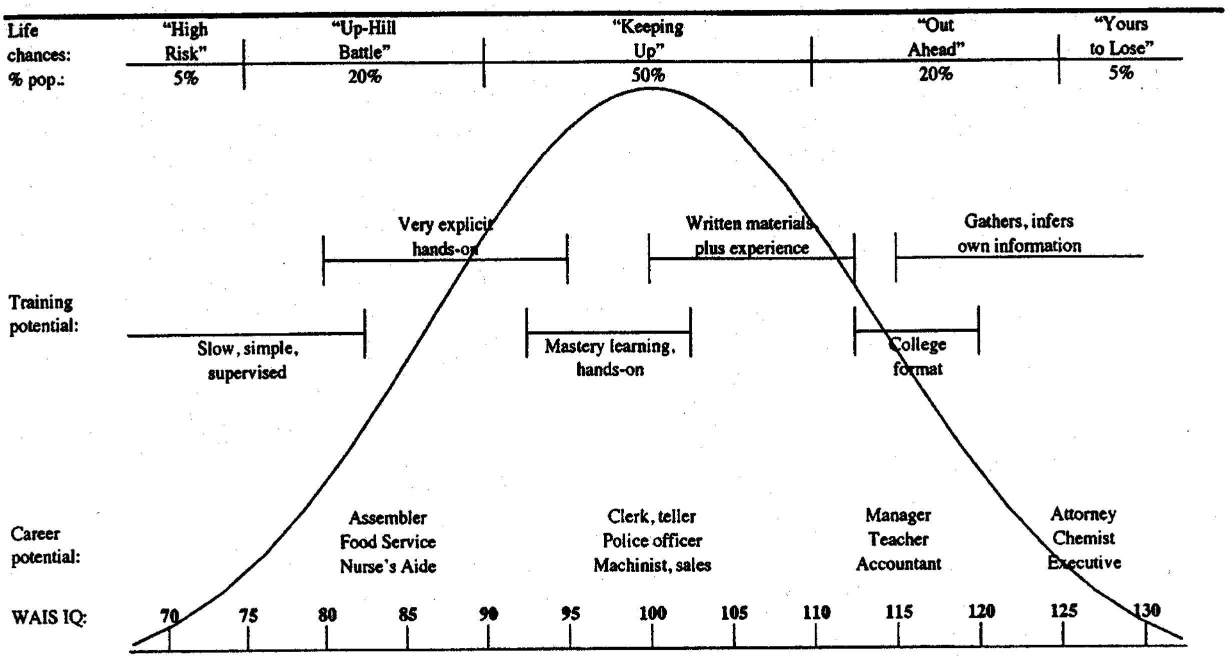
5. See Chapter 26 by Winner and Martino.

Demographics

Differences Along the IQ Continuum. The most important fact about the distribution of general intelligence is this: Most people cluster around the average IQ and are therefore much alike, but there is a significant minority of individuals at the extremes of high and low intelligence and who are thus quite unlike the average person. As with height and many other human traits, IQ is distributed according to the bell-shaped curve. The range of normal IQ is shown in Figure 3.2. It is referred to as the "normal" range because IQ 70 is often considered the threshold for borderline mental retardation and IQ 130 the threshold for intellectual giftedness. This 60-point IQ range includes about 95% of the general American population.

Fully half of the population is found within just 10 IQ points of the average, IQ 100. People in this large middle cluster (IQ 90–110) probably do not appear terribly different from one another in intellectual competence in most day-to-day encounters. The same cannot be said, however, of individuals even halfway toward the boundaries of "normal" intelligence, that is, at IQ 85 versus IQ 115 (about the sixteenth and eighty-fourth percentiles). As shown in the figure, individuals of IQ 115 are usually capable of learning abstract information in a college (semi-independent) format, whereas individuals of IQ 85 generally require hands-on instruction for even concrete tasks. At the ends of the normal range (IQs 70 and 130), learning ability differs markedly—and so too, therefore, must education if it is to meet the distinctive needs of the individuals involved.

Note that we have just compared people of only *mild* retardation or giftedness. Imagine now the extremely gifted. Consider children of IQ 160, for instance, who are hardly the most extremely gifted. Were they to be represented in Figure 3.2, they would be placed as far to the right of the threshold for giftedness (IQ 130) as the latter is from the average IQ (IQ 100)—that is, off the book's page altogether. It is no wonder that children of extraordinarily high IQ are sometimes viewed as alien or freaky. They *are* outside our normal range of experience. They can do things—read, draw, master algebra—that we had thought impossible for anyone their age, even for persons years older! Children of IQ 160 differ as much



Ever incarcerated (%, white men)	7	7	3	1	0
Chronic welfare recipient (%, white mothers)	31	17	8	2	0
Had illegitimate child (%, white women)	32	17	8	4	2
High school dropout (%, whites)	55	35	6	0.4	0

Adults (cum. %):	70	75	80	85	90	95	100	105	110	115	120	125	130
white	2	4	7	13	22	33	46	60	72	82	90	95	97
black	10	18	30	44	59	73	84	92	96	98	99	99+	99+

B/W ratio within range	5:1	2:1	3:4	1:6	1:30

Cumulative percentages for adults were based on mean Wechsler Adult Intelligence Scale (WAIS) IQs of 101.4 for whites and 86.9 for blacks and SDs of 14.7 for whites and 13.0 for blacks (Reynolds, Chastain, Kaufman, & McLean, 1987, p. 330). Percentiles for IQ scores were estimated by use of cumulative normal probability tables. Copyright 1997 by Elsevier Science. Reprinted with permission.

Figure 3.2 The Distribution of People and Life Chances Along the IQ Continuum.

from the average child intellectually as the average child does from one of IQ 40, which is near the border between "moderate" (Wechsler IQ 40–54) and "severe" mental retardation (Wechsler IQ 25–39). With moderate retardation, a child usually "can learn functional academic skills to approximately fourth grade level by late teens if given special education" (Matarazzo, 1972). Below that IQ level, children usually "cannot learn functional academic skills."

No one would ever claim that a moderately retarded child will thrive in a regular classroom without special attention, but schools regularly presume as much for the moderately gifted child. This (mis)treatment is akin to placing a child of average intelligence in a class for the moderately retarded, or putting a child of IQ 130 in a special education class for the mildly retarded, and then dismissing complaints of inappropriate placement by asserting that the "gifted" child will "succeed in any case." Educating a profoundly gifted child (of, say, IQ 180–200) in a regular classroom may be as intellectually stultifying as the unthinkable proposition of educating a normal child among the "profoundly" retarded (below IQ 20).

Age Differences. Age, gender, and ethnic differences raise other concerns in gifted education. With regard to age, there are two key issues. Obviously, *absolute* mental capability increases with age, quickly in early childhood and more slowly in adolescence, at which point it begins to level off. Eighteen-year-olds are much more facile at processing information than are eight-year-olds. The IQ score does not capture this growth in mental age, however, because it measures mental competence only *relative* to one's agemates. Thus, an IQ of 100 represents considerably greater mental horsepower at age eighteen than at age eight.

The first issue involving age is whether IQ (i.e., rank in IQ) is stable during development. Do smart children become smart adolescents? For the most part, yes. In one of the best studies to date, Moffitt, Caspi, Harkness, and Silva (1993) followed 800 children every two years from ages seven to thirteen and found "negligible" IQ change for most. Even in the minority of cases where changes were "marked and real," they were "variable in timing, idiosyncratic in source, and transient in course" (p. 455)—that is, unpredictable.

A recent study (Deary, 2000) of IQ stability across the longest age span yet, ages eleven to seventy-seven, reported a correlation of 0.73 (0.63 when not corrected for statistical artifacts). This is among the lower correlations reported for key studies, which often range into the 0.80s and 0.90s. The overall picture, then, is one in which large shifts in IQ rank are the exception and stability the rule. In fact, behavioral geneticists have devoted considerable attention to explaining this stability: Is it owing mostly to genetics or environment? The estimates they derive from large, longitudinal studies indicate that genes account for most of the stability but also some of the change (Plomin et al., 2001). Therefore, although high intellectual ability may not always be noticed or nourished, it is probably fairly continuous from early childhood and seldom, if ever, springs forth entirely anew at some later age.

The second age-related issue concerns later-life declines in mental power. Sadly, what goes up during youth also tends to come down in adulthood. It is well known that the facility to learn and reason declines with age, beginning in the twenties to thirties. According to Salthouse (2000), the decline from age eighteen to eighty in such abilities is comparable to their increase from age eight to eighteen. Moreover, he and others describe how specific information-processing abilities all tend to decline together, suggesting either that all specific abilities depend on a single general mental ability that is vulnerable to aging, or else that there is a general aging process that affects distinct abilities in the same way (see Deary, 2000, Chap. 8; Schaie, 1996).

The relevance of this fact to giftedness concerns its expression in adulthood. Extraordinary achievement in some fields (physics, mathematics) may depend more on raw reasoning ability than it does in others, where notable advances require the accumulation and synthesis of vast amounts of information and personal experience (e.g., literature, history, philosophy). Whereas so-called processing power declines, stores of knowledge continue to grow until very old age, when they may begin to decay. This may partly account for why "best contributions" tend to be made at earlier ages in the former than the latter fields (Simonton, 1994).

This distinction between the vulnerable raw processing power and the sustainable mental skills that have distilled from the many years of exercising that power is the distinction between *fluid* and *crystallized* intelligence. Fluid intelligence (Gf) represents the ability to learn new things, while crystallized intelligence (Gc) is the *general* knowledge (e.g., vocabulary) that has crystallized from past learning. The two are highly correlated Stratum II abilities (although fluid *g* turns out to be identical to *g* itself), but with advancing age crystallized intelligence becomes a better indicator of past than current fluid intelligence. That is why crystallized intelligence is sometimes referred to as "hollow" in old age. Others (Baltes, 1993) draw essentially the same distinction when they refer to the *mechanics* versus the *pragmatics* of intelligence: The latter is maintained even as its original basis—the mechanics—wanes.

Racial-Ethnic Differences. Perhaps the most contentious question in the field of intelligence is whether genders or racial-ethnic groups differ in mental ability. If there truly are average group differences in general ability (*g*) or group factors (e.g., quantitative or spatial abilities), then we can expect any gifted program that targets those abilities to result in differential selection by gender or ethnicity. Racial-ethnic differences in selection are rife in employment, college admissions, and assignment to special education, and these differentials have provoked much litigation. The question is whether the test score differences reflect *real* differences in developed competence or the result of test bias and, even if tests are *not* biased, whether intelligence and its surrogates (SAT scores, grades, and so on) are *legitimate* bases for selection. I deal here with the "Are they real?" question, and leave the "Are they a valid basis for selection?" question until later.

Looking first at the racial-ethnic disparities, the answer to the first question is that the major mental tests are *not* biased against native-born, English-speaking Americans, including Black Americans. This question was scientifically settled in 1980 (Jensen, 1980). The same mental test score *does* mean the same thing, on the average, for all individuals meeting the foregoing description, regardless of group membership. The average IQ differences represent real differences in the higher-order thinking skills that people have developed.

Individuals in all racial-ethnic groups span the full range of intelligence, of course. The average group differences result from their members tending to cluster along different stretches of the IQ continuum: Among Americans, Blacks tend to cluster around IQ 85, gentile Whites around IQ 100, and Ashkenazi Jews around IQ 115. The averages for Hispanics and Native Americans tend to fall between those for Blacks and gentile Whites; those for Asian-Americans between gentile Whites and Jews. Each racial-ethnic group can itself be further divided into subgroups, whose IQ averages also reliably differ. For instance, Blacks from the Caribbean tend to have higher IQs than do other subgroups of American Blacks; Cuban Americans tend to score higher than other Hispanic groups; and gentile Whites differ somewhat among themselves depending on country of family origin. Regardless of what causes these average group differences (they remain unexplained), group differences are the rule and not the exception within the United States as well as around the world.

This partial separation of IQ bell curves might not matter much except for two reasons. First, some of the average differences are quite large. I focus here on the average Black-White difference because it has been of most concern. For instance, the average for American Blacks is located near the White 15th percentile. If we take IQ 130 as the threshold for intellectual giftedness, this corresponds to about the 97th–98th percentile among Whites, as shown in the lower rows of Figure 3.2. The 98th percentile among Blacks, in contrast, is around IQ 115 (which is about the 82nd percentile for Whites and 50th for Jews). In terms of learning ability, Figure 3.2 shows that this is the difference between gathering and inferring information on one's own (being self-instructing, so to speak) and relying on a college format. If we were to select the top two percent (or five percent or ten percent) of the two populations, the two selected groups would therefore differ noticeably in their ability to handle challenging instruction (cf. Gottfredson, 2000b).

Second, giftedness concerns not averages, but one extreme of the IQ distribution. Because of the shape of the bell curve, with its tapering tails, any average group difference is magnified at the tails of the respective distributions. The further out the tails we look, the more magnified becomes the group difference. This is illustrated in the last line of Figure 3.2. Take, for instance, the per capita ratio of Blacks to Whites in different segments of the IQ distribution. For IQs 91–110, the Black:White ratio is 3:4, or close to even. For IQs 111–125, the ratio falls to 1:6, and for IQs above 125, it is 1:30.

Clearly, if IQ level plays even a major role in selection for gifted instruction, Blacks will be greatly underrepresented when the same criteria are used to select Blacks and Whites from representative samples of their respective populations. Nationwide, it would result in only a tiny proportion of Blacks in gifted education programs. Asian-American and Jewish-American children, however, would be overrepresented, owing to their greater representation at the higher reaches of IQ. Such racially-disparate results also occur in selection for elite occupations and graduate education; they have created considerable legal and political turmoil there, too.

Many school systems have broadened their definitions of giftedness by not restricting their programs to academic talents, and thereby obtaining a more representative demographic mix of students. Others have opened the selection process, for example, by admitting students based on nominations from parents and teachers, regardless of test scores (Stanley, 1997). Neither change can accommodate the accelerated instruction that is beneficial for highly able students, because many students in the broadened pools cannot cope with such acceleration. This democratization of gifted education, therefore, has the frequent result of transforming gifted education into generic pull-out enrichment programs that only supplement, not accelerate, regular instruction. Although enrichment can enhance performance as well as relieve the boredom of regular instruction, it falls far short of the results of acceleration.

Gender Differences. The story on gender differences is not as clear, partly because any average sex difference is small (at most several IQ points). The most direct test of the sex-difference-in-*g* hypothesis failed to support it (Jensen, 1998). There are other gender differences, however, that are relevant to gifted education. One is that the variance in many abilities, including IQ, is greater for males than females, which means that we might expect more males at the retarded and gifted extremes of the ability distribution. Selection ratios for both types of program are consistent with this expectation (Gallagher, 1995).

Of equal or greater importance are the well-documented sex differences in *profiles* of mental ability, even when controlling for interest and instruction in the relevant areas. Males tend to score better in spatial and mathematical reasoning and females in certain verbal proficiencies. In terms of the hierarchical model of human mental ability, these are differences in Stratum II abilities. Males average about one-third to one-half standard deviation higher than females in spatial ability (which is analogous to 5–8 IQ points). The *average* sex difference in mathematical reasoning is small, but the disproportion becomes dramatic among the most talented. To illustrate, male:female ratios among gifted seventh and eighth graders are 2:1 above SAT-M 500, 4:1 above SAT-M 600, and 13:1 above SAT-M 700 (Lubinski & Benbow, 1992). Thus, although such sex differences may not be very noticeable for the bulk of the population, they can become stark at the level from which workers are recruited to high-level math and science occupations requiring these aptitudes (e.g., physics).

In short, average group disparities in mental abilities are common, and they can reflect differences in either profile or magnitude. Each group disparity poses a political challenge to school systems. Because average differences have bigger effects at the "tails" of any ability distribution, they become glaring and pose especially prickly political challenges for gifted and special education.

Genetics

Most people view the unusually high abilities of some children as "gifts"—as windfalls that owe little or nothing to the efforts of the children themselves. The disagreement has been over whether such gifts come from nature or nurture. While the origins of extremely high intelligence are far less understood than the origins of retardation and dementia, research on the genetics of normal intelligence (IQ differences in general) provides a useful guide to the debate. The following discussion deals only with *individual* differences in intelligence, because the causes of average *group* differences remain unknown. It also focuses on general intelligence, *g*, rather than special aptitudes, because the genetic sources of the latter turn out to be mostly shared with *g*, as noted earlier.

Heritability of *g*. When behavioral geneticists speak of the *heritability* of a trait, they are actually using a short-hand phrase that can be easily misunderstood. Degree of heritability—say, 40 percent or 80 percent—is not a physical constant, free of time and place, like absolute zero in temperature. Heritability is simply the proportion of (a) phenotypic (observed) variation in an attribute that can be attributed to (b) genotypic variation in the group studied. Heritability estimates therefore apply only to environments and populations *like the ones studied,* not to all possible ones. Eliminating all environmental differences among us, for example, would reduce our differences in intelligence, with the result (perhaps counterintuitive) that all remaining differences in IQ would be genetic—that is, 100% heritable. Our genes will not have changed, but heritabilities will have. Conversely, greater differences among environments are likely to *reduce* heritability by simply adding more environmentally induced variation to a trait's phenotypic pot (the denominator of the heritability ratio). Current estimates of heritability have been derived from populations in rich and poor, Western and non-Western populations, but not often from the extremes of environmental privilege or deprivation. The emerging pattern of estimates, therefore, may not apply to all human groups.

With that caveat in mind, the estimates have brought startling news. They tell us that all sides of the nature-nurture debate had badly misunderstood how genes and environments affect our behavior. Because Robert Plomin discusses the topic in Chapter 9, I shall highlight only a few of the more pertinent surprises from the large corpus of behavioral genetic studies of intelligence.

Heritability of *g* *Rises* with Age. Even among geneticists, the common expectation had been that any genetic effects would fade with age owing to greater exposure to the vicissitudes of life, good and bad. In actuality, the heritability of intelligence rises with age, from about 20 percent in infancy, to 40 percent in the preschool years, to 60 percent by adolescence, to 80 percent in adulthood. With age, phenotypic differences therefore come to correlate about 0.9 (the square root of 0.80) with genotypic differences in IQ. This is a truly astonishing finding. Recent evidence shows that the heritabilities of school achievement and the narrower Stratum II abilities likewise increase with age (Plomin et al., 2001). This may follow from the fact that, although they have lower heritabilities than does *g*, their heritable components mostly overlap those for *g* (Bouchard, 1998; Plomin et al., 2001).

Shared Family Effects *Disappear* with Age. A second big surprise concerns *environmental* influences on IQ. It had long been assumed, by behavioral geneticists too, that they consist largely of the family influences that siblings share but which differ between families (parents' child-rearing style, income, education, and the like). Such shared family influences do, in fact, rival genetic influences in early childhood, but they virtually disappear by adolescence. Only *non-shared* environments—aspects of environments that affect one individual at a time (e.g., illness, injury)—continue to influence IQ. Their effect is to make siblings in the same home *less* alike over time.

Siblings by adoption illustrate the two surprising findings simultaneously. With age, they become less like their environmental siblings and parents but *more* like the biological ones they have never met. By adolescence, adoptive siblings are no more alike than strangers. In contrast, identical twins reared apart correlate almost as highly in adult IQ (0.72–0.78) as do identical twins who were reared together (.86; Plomin et al., 2001, p. 168). What is true for *g* is also true of personality and virtually all other traits and behaviors yet studied, including height and weight (but excluding juvenile delinquency).

How could it be that intelligence becomes more genetic with age while the influences of family advantage and disadvantage vanish? Currently, the major theory is that people to some extent seek out and create their own environments based on their genetic proclivities. Scarr's "niche-seeking" theory (Scarr & McCartney, 1983), which is similar to Bouchard and colleagues' "genes-drive-experience" theory (Bouchard, Lykken, Tellegen, & McGue, 1994), is that children increasingly choose and change their own environments as they become more independent of their families. They bring their environments more in line with their latent tastes and abilities, which further enhances the development of those tastes and abilities. Early *shared* family influences cease to operate about the age when children leave home.

The genes-drive-experience-and-niche-seeking theory supports the notion that individuals have a hand in creating themselves and their own destiny. It tells us that we are not the hapless putty of *either* nature or nurture. It also seems consistent with observations of gifted children. Many of them are relentless in reshaping their environments. Winner (1996), for example, describes how "David" enlisted his mother's help to learn to read at age three. "By the time he was three and a half, the library waived the limit on how many books David could take out so that his mother would not have to bring him in every day" (p. 18). Nor would he "rest until he had an answer that satisfied him," such as "where wind came from" (p. 20). Or consider three-year-old "Michael," who "exhausted his parents" with his rage for mastering mathematics, greeting his father every day after work with an insistent request that they "go do work" with his math books (p. 21).

The Nature of Nurture. In fact, behavioral genetic research has shown that many of the environments (e.g., rearing conditions) and events (marital history, job loss, and so on) that we experience are to some extent genetic in origin, that is, the product of our own genotypes (Plomin et al., 2001). Environments are thus not entirely external or "out there." Rather, to some degree they represent our *extended phenotypes*—the expression of our own genes. Accordingly, many of life's environments and events also turn out to be somewhat heritable (Plomin, 1994;

Plomin & Bergeman, 1991). Although environments can shape us, they themselves are partly shaped by our family's collective genes. As behavioral geneticists say, this is the operation of nature *via* nurture.

The real question, then, is not whether nature or nurture dominates, but how the two work together. The two forces are not independent and parallel, but the venue for each other's operation. Two phenomena that illustrate this are highly relevant to understanding giftedness: First, our genotypes influence our *sensitivity* to environments and, second, they influence our *exposure* to them. With regard to sensitivity, genetic differences often make people differentially susceptible or responsive to identical drugs, life stresses, instruction in reading, and the like. As physicians and educators know first-hand, treatments that help some individuals do not help others, and may even hurt them. In the parlance of behavioral genetics, these are gene-environment *interactions*. Their practical implication for gifted education is that the optimal school environment is one that provides a *menu of opportunity* for a wide range of genotypes. This is hardly news, of course, to parents and educators. They know that children don't all react in the same way to the same treatment, educational or otherwise. And it is a consistent theme in gifted education, in particular. What behavioral genetics research adds is evidence that our individuality stems in part from the unique genotypes with which we all are born (except identical twins) and that, like plants, some of us wither in environments where others may thrive. Thus, although schools may not be able to create giftedness, they can provide the conditions essential for it to flower into high accomplishment.

The second phenomenon, which is genetically driven exposure to environments, refers to gene-environment *correlation*. This is simply the fact that genetically distinct individuals (different genotypes) are not randomly distributed across environments. Rather, they tend to be clustered in different environments. This happens partly because the same parental genes that produce the child's genotype also influence the environment the parents create for the child. This is called *passive* gene-environment correlation. But the most interesting reasons for gene-environment correlations are that people with different genotypes (shyness, aggressiveneşs, high intelligence, and so on) *evoke* different responses from their environments, and they also actively *create* different environments for themselves. These are labeled, respectively, "evocative" (or reactive) and "active" gene-environment correlations. Winner's (1996) David and Michael exhibited both of these processes, as do we all.

The active-organism portrait painted by behavioral genetic research has important practical implications. The phenomenon of gene-environment interaction makes it unwise to try imposing identical environments. Such effort is unwise because instruction that is helpful for low-g students can stall the progress of high-g students, and vice versa. It suggests that, ideally, genetically appropriate environments may be key in capitalizing on children's different potentials.

The phenomenon of gene–environment correlation actually makes the effort to equalize environments futile. Genetically different individuals will use, misuse, modify, and interpret the same environments in different ways. It is literally impossible to provide identical environments to genetically different people.

But futile or not, much educational policy seems directed at just that—leveling all distinctions in the services that schools provide to all but the learning disabled, where the ultimate criterion of success is that all students succeed in mastering the same material. This is the strong educational tide against which advocates for the gifted must perennially row. Worse yet, in stressing the distinctive educational needs of gifted students, advocates must necessarily stress what makes them distinctive, which is their superior intellectual potential. It is exactly the "innate superiority" of some individuals over others, however, that schools seem loathe to recognize, let alone nourish. Genetic reality runs headlong into today's political reality. The political challenge, then, is to create the educational conditions for individuality to express itself and for gifted potential to be realized *despite* the fact that such conditions will produce greater inequality of result.

Pragmatics

Researchers will continue to puzzle for decades over what g "really" is, biologically and psychologically, but there is no doubt that having more of it rather than less provides an individual enormous advantages in life. As reported elsewhere, "IQ is strongly related, probably more so than any other single measurable human trait, to many important educational, occupational, economic, and social outcomes" (Gottfredson, 1997a, p. 14).

The most important fact about *g*—its generality—accounts for its pervasive and lifelong practical utility. Recall that the general intelligence factor, *g*, reflects a highly content- and context-independent capacity for apprehending, comprehending, integrating, and drawing inferences from information of any type. This includes all learning beyond rote memorization, as well as applying old learning to new situations. Life is a long train of activities that constantly requires just this—learning, thinking, problem solving, and decision making of some sort—in short, the exercise of *g*. General intelligence is not just a narrow "academic" ability, but one of global, life-long value. People may not use it fully or to good purpose, but *g* is perhaps the most versatile tool in the toolkit of human abilities.

g Has Pervasive Practical Consequences. The *g* factor is the best single predictor—and a better one than social class background—of standardized school achievement, years of education obtained, occupational level achieved, performance in job training, performance once on the job, delinquency, and more (Brody, 1992; Gottfredson, 1997b). This is why mental tests have been so useful in educational and occupational settings. They help predict who will perform best and therefore can raise the average performance in a student body or workforce when they are used to select among applicants. Many decades of research (e.g., Schmidt & Hunter, 1998) confirm that they are valid—legitimate—for this purpose, and that average performance falls when selection procedures disregard *g*.

g's ability to predict important life outcomes ranges from strong (standardized school achievement), to moderate (job performance), to weak (law-abidingness), but it seems to predict to some degree just about everything people value. From reading restaurant menus to using medicines correctly, higher *g* helps in the daily activities of life. It is thus a constant headwind making it difficult for people of below average IQ to prosper and get ahead in life—or even keep up. As functional literacy and health literacy researchers have documented, poor comprehension of life's daily tasks and opportunities—managing everything from money, an educational career, a family, and a chronic illness such as diabetes or hypertension—can accumulate to produce, poverty, poor health, and other bad outcomes. A large longitudinal study of Australian servicemen showed, for instance, that the risk of death from auto accidents doubled for men of IQ 85–100 compared to men of IQ 100–115, and it tripled for men of IQ 80–85 (O'Toole, 1990). To take another example, a large study of Medicaid patients found that annual health costs were four times higher for those with inadequate literacy than for the average Medicaid patient (Weiss et al., 1994), suggesting they had worse health as well.

Just as low *g* is at the center of a nexus of bad life outcomes (poverty, illegitimacy, school dropout, and crime), so too high *g* is at the center of a nexus of good outcomes (high education, occupation, and income) (Gottfredson, in press b; Herrnstein & Murray, 1994). This can be seen in Figure 3.2. Whereas adults who are somewhat above average in IQ (IQ 111–125) are "out ahead" in terms of competing for college admission and high-level jobs and having low rates of poverty, illegitimacy, school dropout, and incarceration, people of somewhat below average IQ (IQ 76–90) struggle in an up-hill battle. They are competitive only for low-level jobs, and they experience various social pathologies at many times the rate of their brethren of merely somewhat above average IQ: from four times the rate for bearing illegitimate children to about 80 times the rate for dropping out of school. The different risk rates stem from differences in intelligence rather than social class, because essentially the same inequalities are found among siblings of different IQ growing up in the very same home (Murray, 1997).

This is not to say, of course, that *g* is the only risk factor in life outcomes, nor even that it is the major one in many cases. Other advantages, such as favorable family circumstances, lengthy practice or experience, persistence, or a winning personality can compensate for below-average *g* in some realms of life. None, however, can substitute for missing information-processing skills when people confront life's relentless flow of demands and opportunities for learning and decision making. For instance, army research has shown that experienced soldiers in the 10th–30th percentiles of general mental ability can outperform brighter soldiers with little or no experience, but that their superiority disappears once the brighter men get a few months of experience (Wigdor & Green, 1991). In other words, no matter what else might increase a person's odds for success, lower *g* always lowers them. The reverse is also true, of course. High *g* always raises one's odds of success, but other traits or conditions (fecklessness, illness, lack of opportunity) can harm them. High *g* is no guarantee of success, but, like money, it certainly helps to have more rather than less. Simonton (1994, p. 226) has shown this to be true for the very highest levels of cultural achievement, too.

Narrower Abilities Have Narrower Effects. One might reasonably suppose that tests of math ability would predict achievement in math better than in reading, and that tests of verbal ability would do the opposite. Much research has disconfirmed this hypothesis. Specialized abilities seldom add much, if anything, to the prediction of performance beyond that afforded by *g*, regardless of academic subject or occupation. Generally, tests of narrower abilities (such as verbal or quantitative aptitudes) tend to predict performance in all academic subjects about equally well, or poorly, in broad samples of students (Jencks et al., 1979; Thorndike, 1986). Job performance researchers find the same thing. It seldom matters much which aptitude test you use as long as it is a good measure of *g* (Schmidt & Hunter, 1998, 2000; Thorndike, 1986). It is always the *g* component of a test or test battery that carries the freight of prediction, and tests that measure *g* less well tend to predict performance less well. Where special abilities do add noticeably to prediction, their value seems limited to a narrow domain of tasks (clerical speed in clerical jobs).

As with the genetic research, then, research in education and personnel selection psychology finds that the special aptitudes have some independent influence, but that it is small relative to *g*. They are bit players in the drama of social inequality. Because they are largely coincident with *g* itself in composition as well as consequence, domain-specific talents are not likely ever to provide a multiple-intelligences route to greater social equality. This does not mean that we should expect gifted individuals to be uniformly gifted, but—once again—only that we should not expect there to be routes to giftedness and high achievement that are independent of *g*. Specific talents can add to, but not substitute for, *g*.

Where and Why *g* Matters Most. Just as the question of whether differences in *g* "result from nature *or* nurture" is passé, so too is the question of whether they "matter in real life." The interesting question, instead, is where *g* matters most and least, and why. The clearest evidence on *g*'s gradients of effect comes from the century of research in personnel selection psychology. The research documents four important factors that increase the correlations we observe between *g* and performance: (1) the task is more complex, (2) the task is instrumental rather than socioemotional in character, (3) the group has not already been winnowed on the basis of *g* (say, owing to selection on test scores or educational level), and (4) the people involved have similar levels of *relative* experience at the task. The first two get at the heart of why higher levels of *g* are more useful in some activities than others, whereas the latter two concern artifacts that can camouflage the impact of *g* by artificially lowering its correlation with other variables.

The importance of task complexity is well established. Complexity is the key distinction between high and low-level jobs, difficult and easy functional literacy tasks, and difficult and easy IQ test items—*regardless* of their manifest content (Gottfredson, 1997b). The more complex a job is, the better *g* tends to predict differences in worker performance (with validities rising from about 0.2 to about 0.8 for individual jobs).

Predictive validities are uniformly lower, however, for activities with a high socioemotional content, for instance, the citizenship (reliability, teamwork) rather than core-technical aspects of jobs (engine repair, architectural design). It appears then, that *g* probably predicts best when activities are instrumental ones that people perform as individuals, but that other personal traits (e.g., extraversion) become increasingly important when tasks depend more on emotional or interpersonal behaviors.

The greater utility of *g* in complex or instrumental tasks emerges clearly when individuals are drawn from a wide range of intelligence but similar task-relevant experience, as would generally be the case among applicants for entry-level jobs or college admissions. *g*'s utility can be totally disguised, however, by the other two factors that affect IQ correlations by artificially depressing them, namely, when individuals represent only a truncated segment of the ability distribution or differ widely in relevant experience. The latter was illustrated by the situation, discussed earlier, where dull but experienced soldiers were found to (temporarily) outperform bright but inexperienced soldiers. The impact of restriction in range can be seen in the correlations of IQ with standardized academic achievement. The observed correlations fall from 0.6–0.7 in elementary school to 0.3–0.4 in graduate school, not because higher education is less intellectually demanding (it certainly is not!), but because more people of below-average (and then average) IQ fall by the wayside at each successive step up the educational ladder (Jensen, 1980, p. 319).

A practical implication of the "complexity effect" is that more intellectually demanding programs will produce bigger differences in student performance and leave more students behind than will less demanding ones, especially when selection into the program deemphasizes *g*. However, the "instrumental versus socioemotional task effect" predicts that *g* level will have relatively less effect when the programs involve task domains that are less strictly intellectual because they call for emotional maturity or life experience, as is the case in writing rather than mathematics. A practical implication of the third, "restriction in range effect" is that it is easy to debunk the importance of IQ for gifted levels of achievement by correlating IQ with performance in a group of gifted students, National Merit Finalists, or the like. Other traits are guaranteed to loom large compared to *g* in accounting for differences in performance in such groups, but it hardly means that less able students would succeed in the program were they to be admitted. Another false but effective debunking strategy is to capitalize on the fourth, "differential experience effect" by correlating IQ with performance when some students in the sample have already had instruction or experience (say, with a musical instrument) but others not. This is sure to obscure the value of higher *g* in mastering the task.

Relation Between *g* and Great Achievement. The foregoing evidence dealt with what might be called garden-variety success—a graduate or professional degree, a high-level job, and a good income. Such were the outcomes of Terman's highly able sample of men and women, for instance (Oden, 1968). But what about the ability of *g* to predict remarkably high levels of achievement—of culturally recognized greatness? Dean Keith Simonton's chapter deals with this question, so I will comment only briefly.[6]

In some sense, the story of greatness is the same as for garden-variety success in a culture. Above-average intelligence is probably essential; additional increments are helpful; but even the highest levels of intelligence are not by themselves sufficient. Simonton's (1994) discussion of famous Western artists, intellectuals, and political leaders illustrates how higher increments of intelligence have some value, albeit limited, in predicting different degrees of greatness.

Genius or greatness depends on a confluence of several favorable traits, high intelligence being only one among them. Discussions of extraordinarily gifted children refer, for instance, to their precocity, insistence on marching to their own drummer, and a rage to master (Winner, 1996); to adult genius as the product of high ability, high productivity, and high creativity (Eysenck, 1995; Jensen, 1996); and to greatness as involving high intelligence, determination, and energy (Simonton, 1994). Simonton captures the crucial role of non-intellectual traits:

> [M]aking it big ["becoming a star"] is a career. People who wish to do so must organize their whole lives around a single enterprise. They must be monomaniacs, even megalomaniacs, about their pursuits. They must start early, labor continuously, and never give up the cause. Success is not for the lazy, procrastinating, or mercurial (p. 181).

As Simonton (2001) points out, greatness may be a genetically emergenic phenomenon. *Emergenesis* is a lucky combination in the genetic lottery that does not run in families precisely because it is the *rare conjunction* of traits inherited separately (Lykken, 1982). If greatness is thus *multiplicative* in nature, the lack of any single component—including high intelligence—dooms one to nongreatness.

Greatness also tends to be domain-specific rather than general. Mozart was not a Gauss or Shakespeare too. Whatever role environmental influences and opportunities play in tilting individuals toward one form of greatness or another, the direction that greatness takes is probably also influenced by the person's particular confluence of abilities, general and specific. But like *g* itself, specific talents would not be sufficient for greatness. No ability, no matter how strong or versatile, is more than a tool. It must be honed and wielded with enormous dedication and long practice to produce anything extraordinary.

SUMMARY AND CONCLUSIONS

The general mental ability factor, *g*, is a general capacity for processing information of any type. It is manifested in daily life as the ability to learn, reason, and solve problems, and it therefore corresponds to

6. See Chapter 28 by Simonton.

what many people think of as intelligence. This general ability is measured well by IQ tests; it is highly practical in daily affairs; and it helps predict many valued life outcomes. Higher levels of *g* provide bigger advantages when the task is more complex. The *g* factor is the major component of all broad mental abilities and is therefore probably a crucial component of all forms of intellectual giftedness. The genetic heritability of IQ increases from 40 percent in the early elementary school years to 80 percent in adulthood, but appropriate environments are necessary for high levels of *g* to blossom into actual achievement. Moderately high levels of *g* are generally necessary but not sufficient for high levels of educational and occupational achievement. The same seems to be true for cultural greatness or genius. Moderately high intelligence is necessary, but must be accompanied by other highly favorable attributes, such as great zeal, tenacity, and perhaps a special verbal, quantitative, spatial, musical, or other talent in order for extraordinary achievement to result.

The fact that differences in intelligence are real, stable, and important creates a political dilemma for Americans. Although providing everyone equal opportunity to achieve on the basis of their talents and efforts will not produce equal results, Americans tend to want both forms of equality. The belief of many educational policy makers that schools should be used to decrease social inequality makes it difficult to advocate special programs for the gifted. While regular academic programs may harm the development of the gifted, programs that meet their needs are often criticized as only helping the "rich to get richer." Behavioral genetic research on the genetic and environmental sources of individuality are consistent with a call for schools to provide a large menu of opportunities that corresponds to the full diversity of their students.

QUESTIONS FOR THOUGHT AND DISCUSSION

1. Examine some major published debate or disagreement over gifted education. To what extent were the arguments over goals and values (politics), and to what extent were they over empirical facts (scientific evidence)? For the politics, what were the key points of implicit or explicit contention? For the science, how much and what kind of evidence was actually provided?

2. Explain the three-tiered hierarchical (pyramid) model of intelligence that Gottfredson says is widely accepted. How can the model (or Gottfredson) account for extraordinary musical, mathematical, or other highly specific capability?

3. Explain Gottfredson's criticism of multiple types of intelligence (i.e., those of Gardner and Sternberg).

4. In fact, many schools and districts continue to use IQ tests (*g*) for G/T program selection. Consider political realities, political correctness, and your conscience. What do you think about other selection criteria, such as self-nominations, parent nominations, teacher nominations, grades (achievement), observed art or science talent, or even a high interest in program participation? Also, would different students be selected? Explain.

5. Explain "gene-environment interaction" and implications for teaching gifted students.

REFERENCES

Baltes, P. B. (1993). The aging mind: Potential and limits. *The Gerontologist, 33*(5), 580–594.

Bouchard, T. J., Jr. (1998). Genetic and environmental influences on adult intelligence and special mental abilities. *Human Biology, 70*(2), 257–279.

Bouchard, T. J., Jr., Lykken, D. T., Tellegen, A., & McGue, M. (1994). Genes, drives, environment, and experience: EPD theory revised. In C. P. Benbow & D. Lubinski (Eds.), *Intellectual talent: Psychometric and social issues* (pp. 5–43). Baltimore: Johns Hopkins University Press.

Brody, N. (1992). *Intelligence* (2nd ed.). San Diego: Academic Press.

Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies.* Cambridge: Cambridge University Press.

Colangelo, N., & Davis, G. A. (1997). Introduction and overview. In N. Colangelo & G. A. Davis (Eds.), *Handbook of gifted education* (2nd ed., pp. 3–9). Boston: Allyn & Bacon.

Deary, I. J. (2000). *Looking down on intelligence: From psychometrics to the brain.* Oxford: Oxford University Press.

de Tocqueville, A. (1990/1835). *Democracy in America.* New York: Vintage.

Detterman, D. K., & Daniel, M. H. (1989). Correlations of mental tests with each other and with cognitive vari- ables are highest for low IQ groups. *Intelligence, 13,* 349–359.

Eysenck, H. J. (1995). *Genius: The natural history of cr- ativity.* Cambridge: Cambridge University Press.

Gallagher, J. J. (1995, January). Education of gifted st- dents: A civil rights issue? *Phi Delta Kappan,* 408–41

Gardner, H. (1983). *Frames of mind: The theory of multi- intelligences.* New York: Basic Books.

Gardner, J. W. (1984). *Excellence: Can we be equal and cellent too?* (2nd ed.). New York: Norton.

Glazer, S. (1990). Why schools still have tracking. *Congressional Quarterly's Editorial Research Reports, 1*(48), 746–759.

Gottfredson, L. S. (1997a). Editorial: Mainstream science on intelligence: An editorial with 52 signatories, history, and bibliography. *Intelligence, 24*(1), 25–52.

Gottfredson, L. S. (1997b). Why g matters: The complexity of everyday life. *Intelligence, 24*(1), 79–132.

Gottfredson, L. S. (2000a). Pretending that intelligence doesn't matter. *Cerebrum, 2*(3), 75–96.

Gottfredson, L. S. (2000b). Skills gaps, not tests, make racial proportionality impossible. *Psychology, Public Policy, and Law, 6*(1), 129–143.

Gottfredson, L. S. (in press a). Dissecting practical intelligence: Its claims and evidence. *Intelligence.*

Gottfredson, L. S. (in press b). *g*, jobs, and life. In H. Nyborg (Ed.), *The scientific study of mental ability: Tribute to Arthur R. Jensen.* New York: Pergamon.

Herrnstein, R. J., & Murray, C. (1994). *The bell curve: Intelligence and class structure in American life.* New York: Free Press.

Hunt, E. B. (2001). Multiple views of multiple intelligence [Review of *Intelligence reframed: Multiple intelligence in the 21st century*]. *Contemporary Psychology, 46*(1), 5–7.

Jencks, C., Bartlett, S., Corcoran, M., Crouse, J., Eaglesfield, D., Jackson, G., McClelland, K., Mueser, P., Olneck, M., Schwartz, J., Ward, S., & Williams, J. (1979). *Who gets ahead? The determinants of economic success in America.* New York: Basic Books.

Jensen, A. R. (1980). *Bias in mental testing.* New York: Free Press.

Jensen, A. R. (1996). Giftedness and genius: Crucial differences. In C. P. Benbow & D. Lubinski (Eds.), *Intellectual talent: Psychometric and social issues* (pp. 393–411). Baltimore: Johns Hopkins University Press.

Jensen, A. R. (1998). *The g factor: The science of mental ability.* Westport, CT: Praeger.

Kulik, J. A., & Kulik, C.-L. C. (1997). Ability grouping. In N. Colangelo & G. A. Davis (Eds.), *Handbook of gifted education* (2nd ed., pp. 230–242). Boston: Allyn & Bacon.

Lubinski, D., & Benbow, C. P. (1992). Gender differences in abilities and preferences among the gifted: Implications for the math-science pipeline. *Current Directions in Psychological Science, 1*(2), 61–66.

Lykken, D. T. (1982). Research with twins: The concept of emergenesis. *Psychophysiology, 19*, 361–373.

Matarazzo, J. D. (1972). *Wechsler's measurement and appraisal of adult intelligence.* Baltimore: Williams & Wilkins.

Moffitt, T. E., Caspi, A., Harkness, A. R., & Silva, P. A. (1993). The natural history of change in intellectual performance: Who changes? How much? Is it meaningful? *Journal of Child Psychology and Psychiatry, 34*(4), 455–506.

Mulkey, L. M. (1993). *Sociology of education: Theoretical and empirical investigations.* New York: Harcourt Brace Jovanovich.

Murray, C. (1997). IQ will put you in your place. *Sunday London Times,* May 25.

Neisser, U., Boodoo, G., Bouchard, T. J., Jr., Boykin, A. W., Brody, N., Ceci, S. J., Halpern, D. F., Loehlin, J. C., Perloff, R., Sternberg, R. J., & Urbina, S. (1996). Intelligence: Knowns and unknowns: *American Psychologist, 51*, 77–101.

Oden, M. H. (1968). The fulfillment of promise: Forty-year follow-up of the Terman gifted group. *Genetic Psychology Monographs, 77*, 3–93.

O'Toole, B. J. (1990). Intelligence and behavior and motor vehicle accident mortality. *Accident Analysis and Prevention, 22*, 211–221.

Page, E. B., & Keith, T. Z. (1994). The elephant in the classroom: Ability grouping and the gifted. In C. P. Benbow & D. Lubinski (Eds.), *Intellectual talent: Psychometric and social issues* (pp. 192–210). Baltimore: Johns Hopkins University Press.

Plomin, R. (1994). *Genetics and experience: The interplay between nature and nurture.* Thousand Oaks, CA: Sage.

Plomin, R., & Bergeman, C. S. (1991). The nature of nurture: Genetic influence on "environmental" measures. *Behavioral and Brain Sciences, 14*, 373–427.

Plomin, R., DeFries, J. C., McClearn, G. E., & McGuffin, P. (2001). *Behavioral genetics* (4th ed.). New York: Worth.

Reynolds, C. R., Chastain, R. L., Kaufman, A. S., & McLean, J. E. (1987). Demographic characteristics and IQ among adults: Analysis of the WAIS-R standardization sample as a function of the stratification variables. *Journal of School Psychology, 25*, 323–342.

Robinson, A. (1997). Cooperative learning for talented students: Emergent issues and implications. In N. Colangelo & G. A. Davis (Eds.), *Handbook of gifted education* (2nd ed., pp. 243–252). Boston: Allyn & Bacon.

Salthouse, T. (2000, December). Analytic models of intellectual aging. Invited address to the annual meeting of the International Society for Intelligence Research, Cleveland, OH.

Scarr, S., & McCartney, K. (1983). How people make their own environments: A theory of genotype → environmental effects. *Child Development, 54*, 424–435.

Schaie, K. W. (1996). Intellectual development in adulthood. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (4th ed.). San Diego: Academic Press.

Schmidt, F. L., & Hunter, J. E. (1998). The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. *Psychological Bulletin, 124*(2), 262–274.

Schmidt, F. L., & Hunter, J. E. (2000). Select on intelligence. In E. A. Locke (Ed.), *The Blackwell handbook of principles of organizational behavior* (pp. 3–14). Malden, MA: Blackwell.

Simonton, D. K. (1994). *Greatness: Who makes history and why.* New York: Guilford.

Simonton, D. K. (2001). Talent development as a multidimensional, multiplicative, and dynamic process. *Current Directions in Psychological Science, 10*(2), 39–43.

Stanley, J. C. (1997). Varieties of intellectual talent. *The Journal of Creative Behavior, 31*(2), 93–119.

Sternberg, R. J. (1997). *Successful intelligence.* New York: Plume.

Sternberg, R. J., Forsythe, G. B., Horvath, J. A., Wagner, R. K., Williams, W. M., Snook, S. A., & Grigorenko, E. L. (2000). *Practical intelligence in everyday life.* New York: Cambridge University Press.

Tannenbaum, A. J. (1996). The IQ controversy and the gifted. In C. P. Benbow & D. Lubinski (Eds.), *Intellectual talent: Psychometric and social issues* (pp. 44–77). Baltimore: Johns Hopkins University Press.

Thorndike, R. (1986). The role of general ability in prediction. *Journal of Vocational Behavior, 29,* 332–339.

"To group or not to group: Is that really the question?" (1995, September). *Johns Hopkins Magazine,* pp. 46, 48–52.

Weiss, B. D., Blanchard, J. S., McGee, D. L., Hart, G., Warren, B., Burgoon, M., & Smith, K. (1994). Illiteracy among Medicaid recipients and its relationship to health care costs. *Journal of Health Care for the Poor and Underserved, 5,* 99–111.

Wigdor, A. K., & Green, B. F., Jr. (Eds.) (1991). *Performance for the workplace. Volume 1.* Washington, DC: National Academy Press.

Winner, E. (1996). *Gifted children: Myths and realities.* New York: Basic Books.