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SEYMOUR MARTIN LIPSET

INTELLIGENCE

In everyday life people commonly refer to each other as being smart or slow. The perception that individuals differ widely in mental adeptness—in intelligence—long preceded development of the IQ test, and there is indeed a large vernacular for brilliance, stupidity, and the many points in between. There has been much sparring over the scientific meaning and measurement of intelligence, both in the rowdy corridors of public debate and in the sanctums of academe. But what do we actually know about intelligence? A lot more in the last decade, and some of it surprising even to experts. Moreover, the data form a very consistent pattern showing that differences in intelligence are a biologically grounded phenomenon with immense sociological import.

MEASUREMENT OF INTELLIGENCE

The effort to measure intelligence variation among individuals is a century old. Two strategies for measuring such differences have emerged, the *psychometric* and the *experimental*. Both spring from the universal perception that, although all people can think and learn, some are notably better at both than others. Accordingly, intelligence research focuses on how people *differ* in cognitive competence, not on what is common to all of us. (Other disciplines such as neuroscience and cognitive psychology specialize in the commonalities.) The aim of intelligence research is thus much narrower than explaining the intricacies of how brains and minds function. These intricacies are relevant to intelligence experts, but generally only to the extent that they illuminate why people in all cultures differ so much in their ability to think, know, and learn.

Psychometric (Mental Testing) Strategy. The IQ test represents the psychometric approach to measuring intelligence. Alfred Binet devised the first such test in France to identify children who would have difficulty profiting from regular school instruction. Binet's idea was to sample everyday mental competencies and knowledge that were *not* tied to specific school curricula, that increased systematically throughout childhood, and that could reliably forecast important differences in later academic performance. The result was a series of standardized, age-graded test items arranged in increasing order of difficulty. A child's score on the test compared the child's level of mental development to that of average children of the same age. Binet's aim was pragmatic and his effort successful.

Innumerable similar tests have been developed and refined in the intervening century (Anastasi 1996; Kaufman 1990). Some are paper-and-pencil tests, called *group tests*, that can be administered cheaply to many individuals at once and with only a small sacrifice in accuracy. Others, such as the various Wechsler tests, are *individually administered tests* that require no reading and are given one-on-one. Today, individually administered intelligence tests are typically composed of ten to fifteen subtests that vary widely in content. The two major categories are the *verbal* subtests, such as vocabulary, information, verbal analogies, and arithmetic, which require specific knowledge, and the *performance* subtests, such as block design, matrices, and figure analogies, which require much reasoning but little or no knowledge. The highly technical field that develops and evaluates mental tests, called *psychometrics*, is one of the oldest and most rigorous in psychology. Its products have been found useful in schools, industry, the military, and clinical practice, where they are widely used.

Professionally developed mental tests are highly *reliable*, that is, they rank people very consistently when they are retested. A great concern in earlier decades was whether mental tests might be culturally biased. *Bias* refers to the systematic over- or underestimation of the true abilities of people from certain groups—a "thumb on the scale"—favoring or disfavoring them. There are many specific techniques for uncovering test bias, and all mental tests are screened for bias today before being published. IQ tests generally yield different average scores for various demographic groups, but the consensus of expert opinion is that those average differences are not due to bias in the tests. The consensus among bias experts, after decades of research often trying to prove otherwise, is that the major mental tests used in the United States today do not systematically understate the developed abilities of native-born, English-speaking minorities, including American blacks. The American Psychological Association affirmed this consensus in its 1996 task force report, "Intelligence: Knowns and Unknowns" (Neisser et al. 1996).

The biggest remaining question about IQ tests today is whether they are *valid*, that is, whether they really measure "intelligence" and whether they really predict important social outcomes. As will be shown later, IQ tests do, in fact, measure what most people mean by the term "intelligence," and they predict a wide range of social outcomes, although some better than others and for reasons not always well understood.

Experimental (Laboratory) Strategy. The experimental approach to measuring differences in general intelligence is older than the psychometric but little known outside the study of intelligence. It has produced no tests of practical value outside research settings, although its likely products could someday replace IQ tests for many purposes. The approach began in the late 1800s when the great polymath Francis Galton proposed that *mental speed* might be the essence of intelligence. He therefore set out to measure it by testing how quickly people respond to simple sensory stimuli such as lights or tones. Galton's measures did not clearly correlate with "real-life" indicators of mental ability, such as educational success, so his *chronometric* approach was quickly dismissed as wrong-headed and far too simplistic to capture anything important about the beautiful complexity of human thought.

Advances in statistics after the mid-twentieth century, however, showed that Galton's data actually had shown considerable promise. New medical and computer technology have since allowed researchers to measure elements of mental processing with the necessary precision that Galton could not. The revival of his approach in the 1970s has revolutionized the study of intelligence. It is the new frontier in intelligence research today. No longer producing "fool's gold" but the real thing, the study of elementary cognitive processes has attracted researchers from around the world. It now appears that some differences in complex mental abilities may, in fact, grow from simple differences in how people's brains process information, including their sheer speed in processing.

There is no single experimental approach, but perhaps the dominant one today is the chronometric, which includes studies of inspection time (IT) and reaction time (RT). Chronometric tasks differ dramatically from IQ test items. The aim is to measure the *speed* of various elementary perceptual and comprehension processes. So, instead of scoring how well a person performs a complex mental task (such as solving a mathematics problem or defining a word), chronometric studies measure how quickly people perform tasks that are so simple that virtually no one gets them wrong. These *elementary cognitive tasks* (ECTs) include, for example, reporting which of two briefly presented lines is the longer or which of several lights has been illuminated. In the former, an IT task, the score is the number of milliseconds of exposure required to perceive the difference. In the latter, an RT task, the score is the number of milliseconds the subject takes to *release* a "home button" (called "decision time") in order to press the lighted response button (called "movement time").

Both average speed and variability in speed of reaction are measured over many trials. It turns out that brighter people are not only faster but more consistent in their speed of stimulus apprehension, discrimination, choice, visual search, scanning of short-term memory, and retrieval of information from long-term memory. In fact, variability in speed is more highly correlated with IQ (negatively) than is average speed. ECT performance correlates more highly with IQ as the tasks become more complex, for example, when the number of lights to distinguish among increases from two to four to eight (respectively, one, two, and three "bits" of information). Composites of various speed and consistency scores from different ECTs typically correlate −.5 to −.7 with IQ (on a scale of −1.0 to 1.0, with zero meaning no relation), indicating that both chronometric and psychometric measures tap much the same phenomena. Psychometric and chronometric measures of mental capacity also trace much the same developmental curve over the life cycle, increasing during childhood and declining in later adulthood. Debates among the experimentalists concern how many and which particular elementary cognitive processes are required to account for differences in psychometric intelligence.

MEANING OF INTELLIGENCE.

The meaning of intelligence can be described at two levels. Nonexperts are usually interested in the *practical meaning* of intelligence as manifested in daily life. What skills does it reflect? How useful are they in school, work, and home life? In contrast, intelligence researchers tend to be interested in the more *fundamental nature* of intelligence. Is it a property of the brain and, if so, which property exactly? Or is it mostly a learned set of skills whose value varies by culture? Personnel and school psychologists, like other researchers concerned with the practical implications of mental capability, are often interested in both levels.

Practical Definitions of Intelligence. The practical meaning of intelligence is captured well by the following description, which was published by fifty-two leading experts on intelligence (Gottfredson 1997a). It is based on a century of research on the mental behavior of higher- versus lower-IQ people in many different settings.

> *Intelligence is a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience. It is not merely book learning, a narrow academic skill, or test-taking smarts. Rather, it reflects a broader and deeper capability for comprehending our surroundings–"catching on," "making sense" of things, or "figuring out" what to do.* (p. 13)

The concept of intelligence refers specifically to an *ability* that is *mental.* It does not encompass many of the other personal traits and circumstances that are important in people's lives. It does not include, for instance, strictly physical skills, creativity, or traits of personality and character such as conscientiousness and drive. IQ tests are not intended to measure these other traits. Three practical definitions that are more specific may illuminate better what intelligence means in daily affairs. Each can be translated into the others, but each highlights a different practical aspect of intelligence: the ability to deal with complexity (Gottfredson 1997b), learn (Carroll 1997), and avoid making cognitive errors (Gordon 1997).

Intelligence as the ability to deal with complexity. IQ test items vary widely in content and format, but they often seem esoteric or narrowly academic. Many people in the past took these superficialities as guides to the nature of what IQ tests measure and therefore mistakenly concluded that they cannot be measuring anything of real consequence, at least outside schools. IQ tests' superficial characteristics, however, are irrelevant to their ability to measure intelligence. What matters is the *complexity,* the amount of mental manipulation, their tasks require: contrasting, abstracting, inferring, finding salient similarities and differences, and otherwise turning things over in one's mind to accomplish the mental task. Complexity is the active ingredient in tests that call forth intelligence. People who score higher on IQ tests are people who deal better with complexity, that is, are more adept at understanding and effectively solving more complex mental challenges.

Any kind of test *vehicle* or content (words, numbers, figures, pictures, symbols, blocks, mazes, and so on) can be used to create different levels of complexity. IQ tests typically do, in fact, contain subtests with different kinds of content. Forward and backward digit span (two memory subtests) illustrate clearly the notion of mental manipulation and task complexity. In digits forward, individuals are asked to repeat a string of from two to nine digits (say, 3-2-5-9-6) that is presented orally at one digit per second. In digits backward, the individual simply repeats the numbers in reverse order (in this case, 6-9-5-2-3). The one extra element in the second task (mentally reversing the list) greatly increases its complexity, nearly doubling its correlation with IQ.

Number series completion subtests can also seem trivial, but they illustrate how the same simple content can be varied to build increasingly complex mental demands. Consider the following three series: 4, 6, 8, 10, 12,— (easy item); 2, 4, 5, 7, 8, 10,— (moderate); and 9, 8, 7, 8, 7, 6,— (difficult). One must discern the relations between succeeding numbers in order to complete the series, and those relations become increasingly complex across the three series (respectively, add 2 to each successive digit; add 3 to each successive set of two digits; subtract 1 from each successive set of three digits). These are similar to the items found in one of the fifteen subtests of the Stanford-Binet Intelligence Scale (SBIS-IV) for school-aged youth. They require very little knowledge. Instead, their challenge is to use that simple information effectively—to contrast and compare, find relations, and infer rules—in order to solve logical problems in the test setting. IQ tests that require this on-the-spot problem solving are referred to as tests of *fluid intelligence*—of mental horsepower, if you will.

Some IQ subtests require test takers to bring considerable knowledge into the test setting in order to perform well, but they, too, illustrate the principle that the active ingredient in IQ tests is the complexity of their mental demands. Vocabulary, for example, is one of the very best subtests for measuring intelligence. The reason is that people do not learn most words (*love, hate*) by memorization or direct instruction, but rather by *inferring* their meanings and their fine nuances in meaning (*love, affection, infatuation, devotion,* and *ardor; hatred, loathing, abhorrence, antipathy,* and *contempt*) from the way other people use them in everyday life. Learning vocabulary is largely a process of distinguishing and generalizing concepts in natural settings.

Table 1 illustrates how vocabulary level reflects differences in the ability to deal with complexity. These results are from an earlier version of the Wechsler Adult Intelligence Scale (WAIS). All the adults tested were able to provide at least a tolerable definition of concrete items such as *bed, ship,* and *penny,* but passing rates dropped quickly for more abstract and nuanced concepts such as *slice* (94 percent), *sentence* (83 percent), *domestic* (65 percent), and *obstruct* (58 percent). Only half could define the words *remorse, reluctant,* and *calamity.* Fewer than one in five knew the words *ominous* and *tirade*, and only 5 percent could provide even a partial definition of *travesty*. Anyone who has attended high school, read newspapers and magazines, or watched television will have encountered these words. Vocabulary tests thus gauge the ease with which individuals have routinely "picked up" or "caught onto" concepts they encounter in the general culture. So, too, do the general information subtests that are included in many IQ test batteries ("Why do homeowners buy home insurance?").

Vocabulary, information, and other tests that require considerable prior knowledge are referred to as tests of *crystallized intelligence* because they measure the knowledge that has formed or crystallized from past problem solving. The greater the mental horsepower, the greater the accumulation. Only knowledge that is highly general and widely available is assessed, however, because otherwise IQ tests would also be measuring the opportunity to learn, not success when given the opportunity to do so. Tests of fluid and crystallized intelligence correlate very highly, despite their very different content, because the key active ingredient in both is the complexity of the problems people must solve.

Intelligence as the ability to learn. One of life's unremitting demands is to learn—that is, to process new information sufficiently well to understand it, remember it, and use it effectively. This is especially so in education and training, but it is also the case in meeting the challenges of everyday life, from learning to use a new appliance to learning the subtle moods of a friend or lover.

IQ level is correlated with speed, breadth, and depth of learning when learning requires thinking, specifically, when it is intentional (calls forth conscious mental effort), insightful (requires "catching on"), and age-related, that is, when older children learn the material more easily than do younger children (because they are mentally more mature) and when the material to be learned is meaningful and hierarchical (mastering earlier elements is essential for learning later ones, as in mathematics). Learning is also correlated with intelligence level when the learning task permits using past knowledge to solve new problems, the amount of time for learning is fixed, and the material to be learned is not unreasonably difficult or complex (which would cause everyone to fall back on trial-and-error learning). In short, intelligence is the ability to learn when the material to be learned is moderately complex (abstract, multifaceted, and so on), as distinct from learning by rote or mere memorization.

Percentage of Adults Age 16–65 Passing[a] WAIS Vocabulary Items

ITEM	% PASSING	ITEM	% PASSING
1. Bed	100	21. Terminate	55
2. Ship	100	22. Obstruct	58
3. Penny	100	23. Remorse	51
4. Winter	99	24. Sanctuary	49
5. Repair	98	25. Matchless	47
6. Breakfast	99	26. Reluctant	50
7. Fabric	92	27. Calamity	50
8. Slice	94	28. Fortitude	36
9. Assemble	90	29. Tranquil	36
10. Conceal	87	30. Edifice	22
11. Enormous	89	31. Compassion	29
12. Hasten	87	32. Tangible	30
13. Sentence	83	33. Perimeter	26
14. Regulate	80	34. Audacious	20
15. Commemce	79	35. Ominous	20
16. Ponder	64	36. Tirade	17
17. Cavern	68	37. Encumber	19
18. Designate	63	38. Plagiarize	13
19. Domestic	65	39. Impale	14
20. Consume	61	40. Travesty	5

Table 1

SOURCE: Matarazzo (1972), Table 5, p. 514.

NOTE: [a]Passing includes getting at least partial credit.

People learn at very different rates. In school, the ratios of learning rates are often four or five to one, and they can go much higher depending on the material. The military has likewise found that recruits differ greatly in how well they learn, which it calls *trainability*. One 1969 (Fox, Taylor, and Caylor 1969) study done for the U.S. Army found, for example, that enlistees in the bottom fifth of ability needed two to six times as many teaching trials and prompts as did their higher-ability peers to reach minimal proficiency in rifle assembly, monitoring signals, combat plotting, and other basic soldiering tasks. Figure 1 illustrates the major differences in trainability at different levels of IQ. People with IQs of about 115 and above can not only be trained in a college format but can even gather and infer information largely on their own. Training for people with successively lower IQs, however, must be made successively less abstract, more closely supervised, and limited to simpler tasks. Low levels of trainability limit not only how much can be learned in a set amount of time but also the complexity of the material that can be mastered with unlimited time.

Intelligence as the ability to avoid *common cognitive errors*. Intelligence can also be conceived, for practical purposes, as the probability of *not* making cognitive errors. The notion is that all people make cognitive errors but that brighter people make fewer of them in comparable situations. They make fewer errors in learning, for example, because they learn more quickly and thoroughly. And they make fewer errors of judgment in new and unexpected situations because they are better able to look ahead, assess the likely consequences of different actions and events, spot incongruities and problems, factor more information into their decision making, and perceive alternative courses of action.

Just as items on intelligence tests are scored right versus wrong or better versus worse, so, too, can many decisions in everyday life be classified in this manner. And just as intelligence tests must use many items to assess intelligence level accurately, so, too, does the meaning of intelligence in daily life manifest itself in the accumulation of good and bad decisions, large and small, throughout one's life. The lifetime advantages of higher intelligence are explored later. The point here is simply that intelligence can also be described as the ability to avoid making common errors in judgment and accumulating a harmful record of them.

These three workaday definitions give an intuitive sense of what it means at the level of personal experience to be more versus less intelligent. Intelligence researchers seek to understand intelligence differences in their more fundamental sense, below the surface of everyday observation. As described next, most have adopted a new working definition of intelligence for this purpose.

Psychometric *g* (Not IQ) as the Research Definition of "Intelligence." The psychometric approach to measuring intelligence cannot by itself tell us what intelligence is fundamentally, say, neurologically. However, it has greatly narrowed the possibilities. Most importantly, it has shown that intelligence is a highly general ability and that it is the backbone or supporting platform for the more specific mental abilities. This finding rests in turn on the discovery of a single, common, and replicable means for isolating for study what most people mean by intelligence. As explained, it is not the IQ but *g*, which is short for the *general mental ability factor* (Jensen 1998). The latter has replaced the former as the gold standard for measuring intelligence. Researchers do not yet know exactly what aspect of mind or brain *g* represents, but *g* has become the de facto definition of intelligence for most intelligence researchers, some of whom would drop the term "intelligence" altogether.

From the earliest days of mental testing, researchers observed that people who do well on one test tend to do well on all others. That is, all mental tests intercorrelate to some degree. This prompted Charles Spearman, Galton's student and one of the earliest theorists of intelligence, to invent the statistical technique of factor analysis to isolate that common component from any set of mental tests. Once the common factor, *g*, is statistically extracted from a large, diverse set of tests, each individual's standing on it (the person's *g* level) can then be calculated. So, too, conversely, can the ability of different tests to measure *g* (their *g-loadings*). Among mental tests, IQ tests provide the most accurate measures of *g*. Scores on the great variety of IQ tests are all highly *g*-loaded, that is, they all correlate highly with *g* (with .9 being a typical value for tests of the Wechsler variety). This high correlation means that IQ scores are quite adequate for most practical purposes; therefore, *g* scores are generally actually calculated only for research purposes.

The replicability of g. Research reveals that the same *g* dimension characterizes all demographic groups yet studied. Virtually identical *g* factors have been extracted from all large, diverse sets of mental tests, regardless of which method of factor analysis was used and regardless of the age, sex, or race of the test takers. The same *g* is called forth by tests that require much cultural knowledge as by ones requiring virtually none. It can be called up

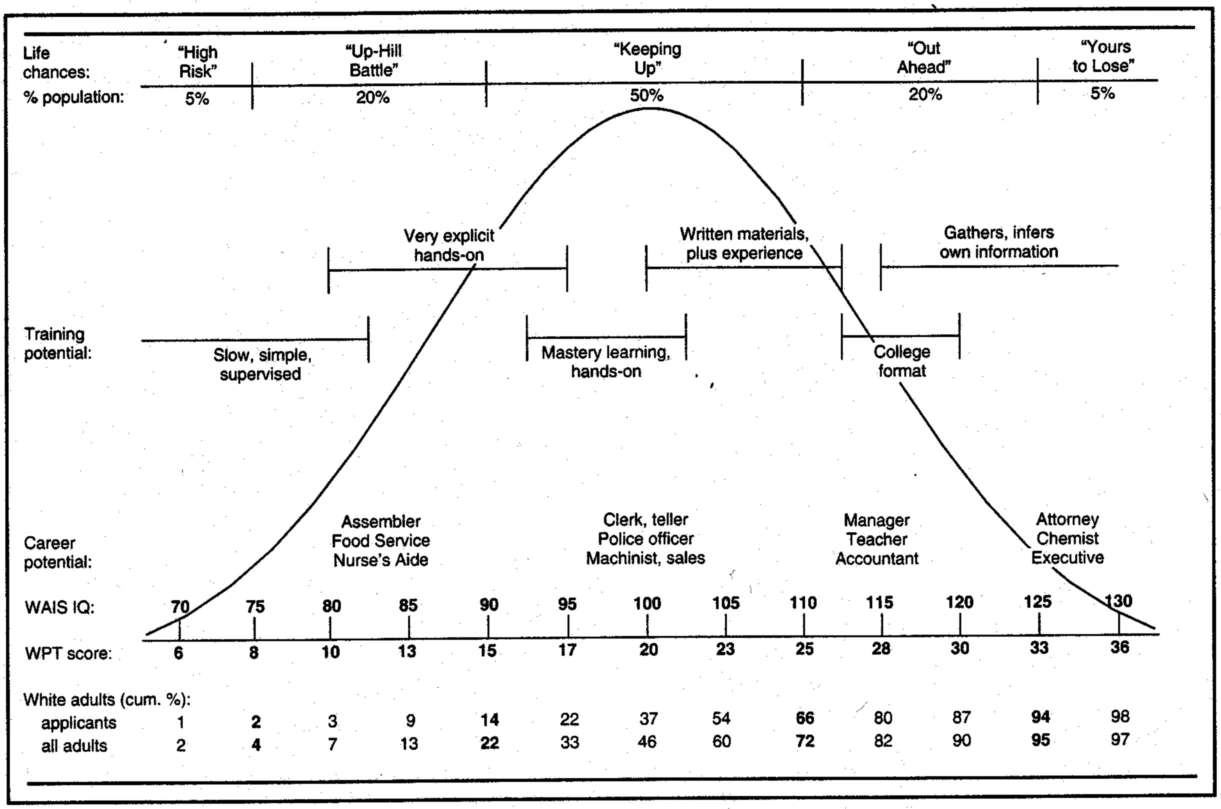

Figure 1

by any kind of item content (numbers, letters, shapes, pictures, blocks, and the like), a phenomenon that Spearman called *indifference of the indicator.*

Mental tests often measure more specific aptitudes in addition to *g* (say, verbal or spatial ability), but *g* is the crucial backbone of all mental tests. Efforts to create useful mental tests that do not measure *g* (for example, verbal aptitude tests that do not tap *g*) have all failed. Although mental tests are suffused by a common factor, no analogous common factor can be found among different personality tests (which test for extroversion, conscientiousness, sociability, and so on). The absence of a general personality factor illustrates that the general mental ability factor *g* is not an artifact of factor analysis but a real phenomenon.

To be sure, the existence of the *g* factor can be obscured by inappropriate testing (for example, when some test takers do not know the language well) and by narrow sampling (when all test takers are similar in intelligence). When allowed to manifest itself, however, the *g* factor clearly shows itself to transcend the particulars of content and culture. This is not to say that culture cannot affect the development of *g* or its social significance, but only that culture does not determine its fundamental nature. The nature of *g* seems to be surprisingly independent of culture, as other sorts of research have confirmed.

The generality of g. The great generality of *g* is perhaps psychometrics' most crucial discovery about the nature of intelligence. As noted, the identical *g* factor is the major distinction in mental abilities in all groups of people and tests, regardless of cultural context or content. As also noted, all mental ability tests measure mostly *g*, no matter what specific abilities they were intended to measure (verbal aptitude, mathematical reasoning, memory, intelligence, and so on). The manifest skills most associated with intelligence in both fact and public perception—reasoning, problem solving, abstract thinking, and learning—are themselves highly general, context-independent thinking skills. The psychometric vehicles (tests and test items) for measuring *g* are necessarily culture-bound to some degree, but the *g* abstracted from them appears not to be.

There are, of course, other mental aptitudes, but, unlike *g*, they seem specific to particular domains of knowledge or activity (language, music, mathematics, manipulating objects in three-dimensional space). Moreover, none of these narrower abilities seem so integral as *g* to the expression of all the others. Many decades of factor-analytic research on human abilities have confirmed what is called the hierarchical structure of mental abilities (Carroll 1993). As shown in the simplified version in Figure 2, abilities are arrayed from the top down, with the most general placed at the top. Research always finds *g* at the top of this generality hierarchy for mental abilities.

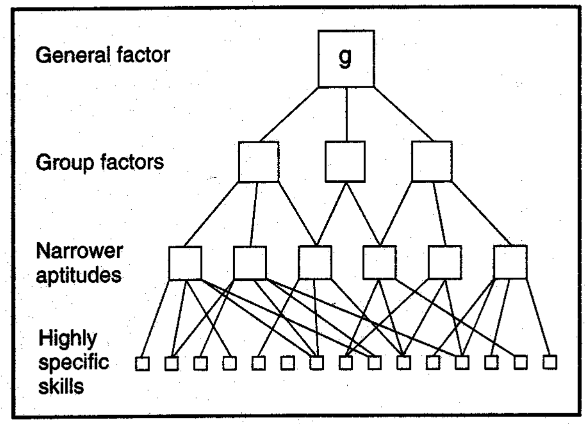

Figure 2

The generality of intelligence was less clear when researchers relied on IQ as their working definition of intelligence. The reason is that all IQ tests are imperfect measures of *g* and each often captures the flavor of some specialized ability or knowledge in addition to *g*. That is, all IQ tests share a large *g* component, but their small non-*g* components often differ in size and content. Attempting to understand intelligence by studying IQ scores has been akin to chemists trying to understand the properties of a particular chemical element by each studying samples that were impure to different degrees and with different additives. This ensured a muddied and fractious debate about the essence of intelligence. In contrast, the *g* factor is a stable, replicable phenomenon. When researchers study *g*, they can be confident they are studying the same thing, even when the *g*'s they use were extracted from different sets of tests. Moreover, *g* has the advantage over IQ that it cannot be confused with the attributes or contents of any particular test, because *g* is always extracted from some large, mixed set of them. One must look below the surface characteristics of IQ tests, to *g*, to explain the core phenomenon they measure.

The g*-loadings of tests and tasks.* The ability to classify tests according to their correlation with *g* is also a major advance in the study of intelligence. It allows research on why tasks vary in their ability to call forth *g* and thus helps predict where in life higher levels of intelligence are most useful. Stated another way, mental tests can now be used to compare environments, not just people, and figure out why some environments are more cognitively demanding than others.

Evidence suggests that tasks are more *g*-loaded when they require more complex information processing, for example, when there are more pieces of information, when there are more operations to perform, and when the information is abstract, nested or incomplete. For instance, spelling and arithmetic tests pose much less complex and *g*-loaded tasks for adolescents and adults than do vocabulary and mathematical reasoning tests. Spelling and computing well in adolescence and beyond depends less on *g* level than does comprehending higher-level verbal and mathematical concepts, despite their superficially similar content.

As will be seen, many work tasks and occupations have been ranked in their demands for *g*. In theory, a *g* loading can be calculated for virtually everything we do in daily life. Life is like a series of mental tests in the sense that its demands vary considerably in complexity and consequent *g*-loading. This means that the advantages of being brighter will vary systematically across different life settings according to their cognitive complexity.

The finding that the subtests in an IQ test battery differ systematically in their ability to measure *g* has been cleverly used to explore the biological as well as the sociological meaning of *g*. By the method of *correlated vectors*, the *g*-loadings of IQ subtests are themselves correlated with other attributes of the subtests. For example, tests' *g*-loadings have been found to predict the genetic heritability of their scores, degree of inbreeding depression, and the subtests' correlations with brain size, faster glucose metabolism in the brain, and greater complexity and speed of onset of various electroencephalogram (EEG) brain waves. This pattern of correlations reinforces other findings which suggest that *g* is a biologically grounded capability to process complex information regardless of its explicit content.

Mental test scores–including the IQ–are composed of both *g* and non-*g* components, however. The non-*g* component might reflect more specific abilities, specific bits of cultural knowledge, aspects of personality or the testing situation, or other unspecified impurities that are independent of *g*. The decomposition of test scores into their *g* versus non-*g* components is also an enormously important development for understanding the meaning of intelligence. For example, it has been shown that it is almost exclusively the *g* component, not the non-*g* components, of tests that accounts for their ability to predict later school achievement and job performance. This considerably narrows the range of possible explanations for why IQ tests predict differences in individuals' later achievement. The explanation cannot reside mostly in the context-specific bits of knowledge that an IQ might reflect, but in the highly general mental capability that *g* represents in all contexts and cultures.

Experimental Study of the Components of *g*. If psychometrics has discovered that *g* is a very general information-processing capability, laboratory studies of intelligence are aimed at teasing out its components or building blocks. The debate among experimentalists has been about whether individual differences in general intelligence are more like differences in computer hardware or computer software. Both views, however, perceive differences in *g* or IQ as differences among individuals in the speed and quality of their information processing.

The "software" view argues that differences in intellectual performance originate in the better or worse use of the same hardware, for example, in the use of better strategies or algorithms for using information and solving problems. These *metacognitive* skills might include better allocation of time to the different components of a problem, monitoring of progress or responding to feedback, and otherwise better controlling how the different components of a task are executed. Such studies might look, for example, at the kinds of planning subjects use in solving verbal analogies or the ways they use their time in comprehending a passage of text. In this view, the general factor *g* reflects not a general underlying ability but the greater conscious use of separate planning and control strategies of general value, in all of which individuals could presumably be trained.

The "hardware" view postulates that differences in the speed and quality of information processing originate in differences in basic brain physiology, such as nerve conduction velocity. The great enthusiasm over the "top-down" software view during the 1970s and 1980s waned as research began more and more to support the claims of the "bottom-up" hardware view of intelligence. People can indeed be observed to use different strategies in solving problems, but differential motivation, effort, or strategy use do not seem to account for IQ differences, and the successful strategies are fairly task-specific.

Although research has not yet proven that differences in lower-level information processing abilities actually *cause* differences in higher-level ones, measures closer to the physiological level offer more promising explanations of *g* (Vernon 1993). For example, simultaneous recordings of subjects' RTs and brain-wave activity (specifically, average evoked potentials [AEP] measured by the EEG) have shown that speeds of ECT responses are moderately to highly correlated with complexity and speed of onset of certain brain waves, both of which occur in less time than required for *conscious* awareness of a stimulus. Much other research shows that both ECT and AEP responses are, in turn, moderately to highly correlated with IQ scores and, most importantly, with *g* itself. The *g* factor is the only mental ability with which ECT scores correlate.

Accordingly, some intelligence researchers now argue that intelligence may not be an ability per se, but rather a chemical, electrical, or metabolic property of the brain. Specific aptitudes, such as verbal and spatial ones, appear to reside in particular regions of the brain, but *g* may represent a global property permeating all regions. Nerve conduction velocity is currently being investigated as one such possible global property. Differences in velocity may in turn result from differences in nerve myelination (myelin is the fatty sheath around nerve axons). While still speculative, the velocity and myelination hypotheses are consistent with a well-established pattern of differences that any putative cause of intelligence will have to explain, namely, both the steady rise and then fall of fluid intelligence over the life cycle as well as the enduring differences in *g* among people at any single age.

Popular Contending Theories. Any theory of intelligence must take into account the basic facts about intelligence, whether it is measured as IQ or *g*. These include its high generality, heritability (discussed shortly), and correlations with elementary perceptual and physiological processes of the brain. Some of the theories that are most popular outside expert circles contradict or ignore these facts and thus are not viable contenders to the emerging *g* theory of intelligence. Others remain untested hypotheses. The major contenders to *g* theory can be characterized as either *specificity* or *multiplicity* theories of intelligence.

Specificity theories. Some scholars have argued that intelligence is not an underlying ability but merely the accumulation of specific *bits of knowledge*. For them, being "smart" is nothing more than knowing a lot, no matter how much time and effort went into that learning or what was learned. It is akin to the accumulation of marbles in a jar, signifying nothing other than that many marbles have been collected by whatever means. The apparent assumption is that people do not differ in their ability and efficiency in gathering marbles. However, intelligence has to be more than knowledge per se because, among other reasons, differences in intelligence show up on tests that require no knowledge whatsoever. Moreover, as noted, people differ greatly in their ability to acquire knowledge even when given the same opportunity to learn. There are "fast" students and "slow" students, irrespective of motivation and quality of instruction. For many experts, differences in the ability to *acquire* knowledge are at the heart of intelligence.

Another variant is the *cultural specificity* theory, which is that intelligence is merely the display of traits, whatever they may be, that are highly regarded in a particular culture. For example, one claim is that because IQ tests are typically developed by white European males, they inevitably measure beliefs, behavior, and knowledge that white European males value but that may have no intrinsic value. Intelligence, they say, might be defined completely differently in another culture, such as skill at hunting, navigating, or cooperating for the general good. The first claim is false and the second is irrelevant, even if true. As noted, the same *g* is extracted from all diverse sets of mental tests and for all cultural groups. (Besides, Asians tend to do better than whites on tests developed by the latter.) Whether different cultural groups recognize, value, and reward the phenomenon represented by *g* is interesting and important, but it does not erase the phenomenon itself as a scientific fact any more than rejecting the concept of evolution brings evolution to a halt.

Perhaps the best-known variant is the *academic specificity* theory, which says that IQ and intelligence are simply "book smarts," a narrow "academic" skill that is useful inside but not outside schools and bookish jobs. According to this theory, intelligence may be an enduring personal trait, but only a narrow one. As will be shown, *g* is indeed highly useful in education and training. However, the very generality of *g*—the ability to deal with complexity, to learn, and to avoid mistakes—argues against the narrow "book smarts" conception of intelligence. So, too, does much research, discussed later, on the many practical advantages conferred by higher levels of *g*. Carpenters as well as bank tellers, sales agents as well as social scientists, routinely deal with complexity on the job and are aided by higher levels of *g*.

Multiplicity theories. Robert Sternberg (1985) argues that there are several intelligences, including "analytical," "practical," and "creative." Howard Gardner (1983) is famous for postulating eight and possibly nine intelligences: linguistic, logical-mathematical, musical, spatial, bodily-kinesthetic, intrapersonal, interpersonal, naturalist, and (possibly) existential. Daniel Goleman's 1995 book on "emotional intelligence" has taken the country by storm. All three theories are engaging, are popular in lay circles, and describe undeniably important skills, knowledges, and achievements. All three theories suggest that *g*, if it exists, is only one of various coequal abilities. This is, indeed, why multiple intelligence theories are so popular. They are often interpreted—wrongly—as suggesting that everyone can be smart in some useful way.

The question, however, is whether the "intelligences" these theories describe are actually comparable to *g* in any fundamental way. Specifically, are they even abilities, or might they be the *products* (literary, scientific, or artistic) of exercising *g* together with specific abilities in specific settings with specific kinds of training and experience? Are the purported intelligences even *mental* rather than, say, physical abilities or aspects of personality? And for those that are mental abilities, are they comparable to *g* in their *general applicability*? Unfortunately, the research necessary for answering these questions credibly has not been conducted. Almost none of the "multiple intelligences" has actually been measured, and none have been shown independent of *g* in representative samples of the population. Verbal descriptions of them leave many experts doubtful that they are comparable to *g* in any important way.

Some of them, like emotional intelligence, seem to be a combination of many different traits, some being abilities and others not, some being mental and others not. Verbal definitions suggest that practical intelligence (like "street smarts") may be the accumulation of highly context-specific knowledge gathered through strictly informal experience (for example, knowing the special argot and norms of a particular neighborhood, occupation, or other subculture). Gardner's intelligences are different forms of highly valued cultural accomplishment. As such, they require not only the ability to succeed but also the personality traits, such as drive and persistence, needed to transform that potential into a valued product. This is not to deny that personality is important for great accomplishment, but only that it is useful to distinguish between the separate ability, personality, and other factors contributing to it.

In addition, some of Gardner's intelligences seem to mirror more specific and psychometrically well-studied traits, such as verbal, mathematical, and spatial aptitude. Much research has shown that these so-called group factors are highly correlated with *g* but appear below it in the hierarchical structure of human mental abilities (see Figure 2). Gardner himself has stated that exemplary levels of all his intelligences require IQ levels over 120, meaning that the eight intelligences are not alternatives to *g* but narrower abilities pervaded by it. In short, they appear to be different cultural playgrounds for the cognitively rich. All the purported "multiple intelligences" are important topics for study, but they cannot be assumed to be comparable to *g* in either generality or practical importance by virtue of being labeled "intelligences."

HERITABILITY AND ENVIRONMENTALITY OF INTELLIGENCE

Behavioral genetics is a method for studying the influence of *both* genes and environments on human behavior. In recent decades the field has shown that mental abilities, personality, vocational interests, psychopathology, and even social attitudes and life events are shaped by both genes and environments (Loehlin 1992; Plomin et al. 1997). More research has been conducted on the heritability of intelligence than on any other psychological trait, and much of it has been longitudinal.

Behavioral genetics focuses on explaining *variation* in a particular population. Its basic method is to look at similarities between relatives of different degrees of genetic and environmental relatedness: identical twins reared apart, adopted siblings reared together, identical versus fraternal twins, and so on. Such research can also test, among other things, whether *specific* environmental factors create IQ similarities and differences and, if the research is longitudinal, whether change (and stability) in IQ ranking is due to the operation of genes, environments, or both. It can also test whether two heritable traits or behaviors, such as IQ and academic achievement, share the same genetic and environmental roots.

Such research does not reveal *how* genes affect intelligence, only that they do. Explanations of how genes influence intelligence will come from molecular genetics, which has only recently isolated the first gene for intelligence. Molecular genetic research also holds promise for detailing exactly how environments might influence the actions of genes.

Individual Differences. Behavioral genetics has focused historically on explaining differences among individuals *within* a population. The following such findings should be generalized only to the sorts of populations studied so far, most of them. Western and none extreme in terms of either deprivation or privilege.

IQ is substantially heritable. Heritability (h^2) refers to the percentage of observed differences in a trait (in *phenotypes*) that is due to differences in genes (*genotypes*). Estimates of the heritability for IQ typically range between .4 and .8 (on a scale from 0 to 1.0). This means that from 40 percent to 80 percent of the observed differences in individuals' IQs are due to the genetic differences among them. This means, conversely, up to 20 percent to 60 percent of IQ differences are environmental in origin. Aptitudes measured by the most *g*-loaded tests are the most heritable. Aptitudes measured by tests of more specific abilities, such as verbal and spatial visualization, are moderately heritable, but less so than *g*.

IQ heritability rises with age. This discovery was a surprise even to behavioral geneticists because, like virtually all social scientists, they had assumed that environmental effects cumulate over a lifetime to reduce the influence of genes. Not so, apparently. The heritability of IQ is about .4 in the preschool years, rises to .6 by adolescence, and increases to about .8 in late adulthood. The reason for this increase is unclear. The major hypothesis, however, is that "genes drive experience" and lead people to seek different social niches. That is, different genotypes tend to choose, create, and elicit different environments in childhood and beyond, which in turn shape intellectual development. For example, bright and dull youth receive different encouragement and opportunities. They also tend to choose different experiences for themselves, especially as they become more independent of parents, teachers, and other authorities. As individuals take a greater hand in shaping their environments, for better or worse, their IQ phenotypes begin to mirror their IQ genotypes more closely. The correlation between IQ phenotypes and genotypes (which is the square root of heritability) rises to .9 by later adulthood.

The surprising rise in heritabilities is consistent with the disappointing results of socioeducational interventions (similar to Head Start) that were designed to raise low childhood IQs. To date, all have exhibited *fade-out*, meaning that the initial improvements in IQ dissipated within a few years. Improvements in more malleable outcomes (such as fewer children being held back a grade) may be observed, but permanent rises in *g* are not. The same IQ fade-out occurs with genetically at risk children adopted into more advantaged families: By adolescence, their early favorable IQs fall back to the average for their nonadopted biological relatives.

IQ-relevant environments are partly genetic in origin. Social scientists have tended to think of environments as conditions strictly "out there" to which people are passively "exposed." Children's environments correlate with their genes, however, partly because they passively receive both from their parents. People's environments are also heritable to some degree because people choose, make, remake, elicit, and interpret them. Because people's genetic proclivities help shape their environments, real and perceived, behavioral geneticists often refer to people's proximal environments as, in effect, their *extended phenotypes*. That is, people's near environments are to some degree an extension of themselves because they are partly *products* of the person's genotype for intelligence, personality, and the like.

When people's environments are studied with the same behavioral genetic techniques as are their psychological traits and behaviors, research consistently shows that rearing environments, peer groups, social support, and life events are, in fact, moderately heritable. For example, one measure of individual infant and toddler rearing environments found that those environments were 40 percent heritable. Moreover, half of the environmental measure's ability to predict cognitive development could be accounted for by that measure's genetic component. In other words, IQ-relevant environments are partly genetic in origin. This is an example of what behavioral geneticists refer to as the operation of nature *via* nurture.

Shared family effects on IQ dissipate by adolescence. Behavioral genetic research confirms that environments have substantial influence in creating IQ differences. However, providing yet another surprise, the research showed that environmental influences had been completely misunderstood. Psychologists–behavioral geneticists David Rowe (1994) and Sandra Scarr (1997) call this mistaken view, respectively, "family effects theory" and "socialization theory." This is the still widespread but false assumption that differences between families in their socioeconomic circumstances (income, parental education, occupation, income, and so on) and child-rearing styles (cold, authoritative, and so on) create differences between their children in ability and personality. These presumed effects are called *shared* or *between-family* influences because they affect all children in the family in the same way and thus make children in the same families more alike and children in different families less alike.

As it turns out, such shared effects influence IQ (but not personality) in early childhood, but they are disappear by adolescence. Nor is it known what these temporary influences are. The only environmental effects that continue to influence IQ beyond adolescence are *nonshared* or *within-family* effects on IQ. Nonshared effects are factors that influence one sibling but not others in a family. What they consist of regarding IQ is not yet known, but they could include random biological events, illness, and differential experiences in parent–child or sibling relationships. Nonshared effects help to explain why biological siblings who grow up together are so different in IQ. They differ by about 12 IQ points, on the average, compared to the average 17-point IQ difference between any two random strangers. Much of that difference is due to their genetic differences, however, because biological siblings share, on the average, only 50 percent of their segregating genes.

The dissipation of "family effects" and the rising influence of genes with age can be seen clearly in adoption research. The IQs of adopted siblings are similar in childhood but not in adolescence. By adolescence, their IQs also cease to resemble the IQs of their adoptive parents but become more like the IQs of the biological parents they have never known.

Special abilities, ECTs, and school achievement have common genetic roots with g. As noted, there are many mental abilities, whether at the level of ECTs, such as choice reaction time, or at the level of group factors, such as verbal ability. However, they all correlate with *g*. To the extent that they overlap each other and *g* phenotypically, that overlap is due almost entirely to a common genetic source. Conversely, only a small portion of the genetic component of specific aptitudes—such as verbal skills, memory skills, and speed of processing—is not *g*-related. The same general pattern is found for the sizable correlation between academic achievement and IQ. To the degree that they correlate, that similarity is almost entirely genetic; to the degree that they diverge, the cause is mostly environmental.

IQ stability is mostly genetic in origin whereas age-to-age change in IQ rank originates mostly in nonshared environments. Rank in IQ relative to agemates is highly stable. Genes and shared environments both contribute mostly to IQ stability rather than to age-to-age change. It is the nonshared environment that causes age-to-age change. Marked change is rare and tends to be idiosyncratic, transient, and difficult to attribute to any particular event.

Cautions in interpreting heritabilities. High heritabilities do *not* mean that a trait is not malleable. Heritability and malleability are separate phenomena. Certain heritable conditions (such as diabetes) are treatable and certain nongenetic effects (such as those of lead poisoning) are not. All that a high heritability means is that current differences in environmental conditions do not create much intelligence variation beyond that owing to genetic differences. If environments were equalized for everyone, phenotypic variation might be reduced somewhat, but heritability would rise to 100 percent. In contrast, if environments could be individually tailored to compensate for genetic differences (by providing insulin for diabetics, changing the diets of those with phenylketonuria, providing the best education to the least intelligent, and the like), both heritability and variability would fall.

Moreover, heritability is the degree to which genes explain phenotypic *variance* in a trait, so a high heritability does not rule out shifts in population *averages* over time. Something that affects everyone can change a group's average without changing its variability. Recent generations have been getting taller, but height is still highly heritable within generations. The same is true for IQ levels, which have been increasing several points a decade this century in developed countries. Both increases are still scientific puzzles, but some scholars have suggested a common explanation—societywide improvements in nutrition, reduction in disease, and the like. Researchers have yet to establish, however, to what extent the rises in IQ reflect increases in the *g* versus non-*g* components of mental tests and thus an increase in *g* itself.

What is clear, however, is that *shared* family environments that vary within the *normal* range of family environments in the developed world do *not* have create lasting differences in IQ. Within the normal range of variation, different families have basically the same effects in promoting mental growth. The key to understanding how environments create IQ differences among age peers lies in understanding *nonshared* effects. These are the environments, whether biological or social, and both within and outside family settings, that affect siblings differently and make them less alike. The shattering of shared effects theory as an explanation for adult differences in IQ is a revolutionary development, albeit one yet to be accepted by many social scientists. The discovery of lasting nonshared influences opens exciting new ways of thinking about IQ-relevant environments. We may have been looking in all the wrong places. Behavioral genetics provides the best tools at present for ferreting out what those nongenetic factors are.

To reiterate a cautionary note, we do *not* know the effects of environments that are extreme or that do not allow individuals the personal freedoms that most Westerners enjoy. We do not know, either, what the effects of entirely novel environments or interventions would be, whether social or biological. We can predict, however, that any social or educational intervention would have to fall outside the normal range of variation already studied in order to change the distribution of IQs very much. For instance, supplying a typical middle-class family environment to all lower-class children cannot be expected to narrow the average IQ gap between middle- and lower-class adolescents. Middle-class children themselves range across the entire IQ spectrum (as do lower-class children) despite the advantages (or absence thereof) of middle-class life.

Group Differences. There is little scientific debate anymore about whether valid *phenotypic* differences exist among races, ethnicities, and social classes. Average group differences in IQ are the rule, not the exception, both worldwide and in the United States. To the extent that the matter has been investigated, group IQ differences appear to reflect differences in *g* itself and are mirrored by group differences in performance on the simple laboratory tasks described earlier.

Group IQ differences can be pictured as the displacement of the IQ bell curves of some social groups somewhat upward or downward on the IQ continuum compared to others. All groups' bell curves overlap greatly; the differences consist in where along the IQ continuum each group is centered. Ashkenazic Jews tend to score as far above average (about IQ 112) as American blacks score below average (about IQ 85), with most other groups spread in between. It should be noted, however, that black cultural subgroups differ among themselves in average IQ, as do the constituent subgroups of Jews, gentile whites, Asians, Hispanics, and Native Americans.

The most contentious debate regarding intelligence is whether average group IQ differences are partly genetic in origin. The favored assumption in the social sciences for the last half-century has been that race differences are entirely environmental. However, research designed to prove this has not done so. It has succeeded in finding environmental factors that might possibly explain at most a third of the American black–white average difference. This failure does not rule out an entirely environmental explanation based on factors yet to be assessed. It does rule out several factors, however, that were once assumed to account for the bulk of the average difference, namely, family income and social class. Large average IQ differences between black and white children are found at all levels of family income and social class.

Behavioral geneticists have recently developed statistical methods for estimating the extent to which average differences among social groups (races, sexes, and so on) might be due to genetic differences among them. Perhaps not surprisingly, few behavioral geneticists have actually applied those methods to available data, and those who have been willing to do so have experienced unusual barriers to publishing their results. As a result, there is little direct published evidence one way or the other. When surveyed in 1988, about half of IQ experts reported a belief that race and class differences result from *both* genetic and environmental influences. This should be considered a reasonable but unproven hypothesis.

The earlier caution should be repeated here. Research has so far studied only the normal range of environmental variation within any race or ethnic group. American minority children may more often grow up in extremely deprived environments. Studies of very low-IQ Appalachian communities suggest that biologically unhealthy and cognitively retarded family environments can permanently stunt cognitive development.

Some people fear that any evidence of genetic differences between groups would have dire social consequences. This fear is unwarranted. A demonstration of genetic differences would not dictate any particular political reaction. Both liberal and conservative social policy can humanely accommodate such an eventuality, as some policy analysts and behavioral geneticists have illustrated (Kaus 1992; Rowe 1997). Depending on one's politics, for example, genetic differences by race could be used to argue either for forbidding or for requiring racial preferences in education and employment. Moreover, environmentalism and hereditarianism have both on occasion helped undergird tyrannical regimes that practiced mass murder, for example, respectively, the Stalinist Soviet Union and Nazi Germany. Political extremism (or moderation) is neither guaranteed nor precluded by scientific conclusions one way or the other. Scientific facts and political reactions to them are independent issues. Developing *effective* social policy does depend, however, on working in concert with the facts, not against them, whatever they may be.

SOCIAL CORRELATES AND CONSEQUENCES OF DIFFERENCES IN INTELLIGENCE

Much research has focused on how *individuals'* own behavior and life outcomes are affected by their intelligence level. There has been little research yet on what may ultimately interest sociologists more, namely, the ways in which *interpersonal contexts* and *social institutions* are shaped by the cognitive levels of the individuals populating them.

Individual Level. American adults clearly value intelligence highly because they rate it second only to good health in importance. Differences in intelligence do, in fact, correlate to some extent with just about everything we value, including mental and physical health, success in school and work, law-abidingness, emotional sensitivity, creativity, altruism, even sense of humor and physical coordination. The scientific question, however, is whether differences in intelligence actually *cause* any of these differences in people's behaviors and outcomes. Or might intelligence as often be their consequence as their cause?

Questions of causality. Most IQ variability is genetic from adolescence on, meaning that it cannot be mostly "socially constructed." Moreover, to the extent that it has nongenetic sources, evidence leans against their being the usual suspects in social research (parents' income, education, childrearing practices, and the like). If intelligence is not caused (much) by its major social correlates, does it cause them?

Pieces of an answer are available from experimental and quasi-experimental research conducted by educational, employment, and training psychologists in public, private, and military settings for more than a half-century. Differences in *prior* mental ability are strong—in fact, the strongest—predictors of *later* performance in school, training, and on the job when tasks are at least moderately complex. Moreover, the correlations are stronger with objective than subjectively measured performance outcomes (for example, standardized performance rather than teacher grades or supervisor ratings). The military services also have extensive experience attempting to nullify the effects of ability differences on recruits' later performance in training and on the job. Their failed attempts testify to the stubborn functional import of such differences—as does the failure of lengthy job experience to neutralize differences in worker intelligence.

IQ is moderately highly correlated with a nexus of good outcomes—higher education, high-status jobs, and income growth over a career. In view of the *g*-loadedness of the educational and occupational worlds, it would be surprising were IQ not found to be an important precursor to these outcomes. IQ is, in fact, the best predictor of later educational level attained, and it helps predict occupational status and income growth even after controlling for education and family background.

IQ is also correlated to varying degrees (negatively) with a nexus of bad outcomes—dropping out of school, unemployment, incarceration, bearing illegitimate children, dependence on welfare, and living in poverty as an adult. This nexus of social pathology has been the focus of recent lively debates about the role of intelligence, where protagonists typically pit intelligence against an array of external factors, including various aspects of family background, to see which is the stronger predictor. Intelligence generally equals or exceeds the predictive ability of any small set of such variables, although the relations tend to be modest in both cases. One possible explanation for the relation of IQ to social pathology is that lack of socioeconomic competitiveness may precipitate a downward social spiral.

However, IQ may play a direct role, too. Committing crimes, bearing illegitimate children, and other such personal behavior may result in part from errors of judgment in conducting one's life, perhaps due in part to lack of foresight and ability to learn from experience. Conversely, higher *g* may help insulate people from harmful environments. Research has shown, for instance, that higher intelligence is a major attribute of "resilient" children, who prosper despite terrible rearing conditions, and of those who avoid delinquency despite living in delinquent environments. The hypothesis is that their greater ability to perceive options and solve problems constitutes a buffer.

Either the genetic or nongenetic components of phenotypic intelligence might be responsible for its causal impact. Because intelligence is highly genetic, it is reasonable to assume that its causal impact is mostly due to its genetic component. This has, in fact, been found to be the case with its effect on standardized academic achievement. The latter shares all its genetic roots with IQ. Similar *multivariate genetic analyses* are now accumulating for various socioeconomic outcomes that depend on mental competence. Educational and occupational level are both moderately genetic in origin, with estimates (for males) ranging from .4 to .7 for education and .3 to .6 for occupation. Part of that genetic portion overlaps the genetic roots of IQ. In the best study so far (Lichtenstein and Pedersen 1997), occupational status was more than half genetic in origin. Half that *genetic* portion was shared jointly with the genetic roots of *both* IQ and years education, and half was independent of both. The remaining variability in phenotypic occupational status was split between *nonshared* environmental effects that (1) were shared with education (but not IQ) and (2) were unique to occupation.

One of the biggest confusions in the debate over the causal role of intelligence results from the mistaken equating of intelligence with genetic factors and of social class with nongenetic factors by some of the most visible protagonists in the debate. While the former assumption has some justification owing to the high heritability of *g*, it nonetheless muddies the conceptual waters. The latter assumption is even less warranted, however, because many social "environments" turn out to be moderately genetic. All social "environments" must now be presumed partly genetic until proven otherwise. Not being genetically sensitive, virtually all current research on the effects of social and family environments is actually uninterpretable. Progress in the causal analysis of environments and their relation to *g* will come only when more social scientists begin using genetically sensitive research designs.

Principles of importance. Although the causal role of intelligence has yet to be clarified, research leaves no doubt that people's life chances shift markedly across the IQ continuum. Those shifts in specific life arenas will be discussed later, but it would help first to state four principles that summarize what it means for intelligence to have *practical importance* in individuals' lives.

First, importance is a matter of better *odds*. Being bright is certainly no guarantee of happiness and success, nor does being dull guarantee misery and failure. Most low-IQ people marry, work, have children, and are law-abiding citizens. Being brighter than average does, however, systematically tilt the odds toward favorable outcomes. Higher levels of intelligence always improve the odds, sometimes only slightly but often substantially, depending on the outcome in question.

Second, importance *varies systematically* across different settings and life arenas. Intelligence level tilts the odds of success and failure more in some arenas of life (such as academic achievement) than others (such as good citizenship). For instance, the correlations of IQ with years of schooling completed (.6) and composites of standardized academic achievement (.8) are over twice that for IQ correlations with delinquency (–.2 to –.3). Correlations in the same life arena can also vary depending on complexity of the tasks involved. For instance, correlations of job performance with test scores range from .2 in unskilled work to .8 in the most cognitively demanding jobs.

Third, importance is *relative* to other known influences and one's particular aims. Many personal traits and circumstances can affect the odds of success and failure in different arenas of life. Intelligence is never "everything" in the practical affairs of life. Depending on the outcome in question, personality, experience, peers, family background, and the like can tilt the odds of success, sometimes more than intelligence does and sometimes less. As noted earlier, IQ predicts standardized achievement better than it does persistence in education, probably because personality and circumstances affect the latter much more than the former. Weak prediction at the individual level does not mean the predictor is unimportant in a pragmatic sense, as illustrated by the relation between delinquency and social class. The correlation is generally below −.2 but usually thought quite important for policy purposes, as is the similarly low correlation at the individual level between smoking and various health risks.

Fourth, importance is *cumulative*. Small individual effects can be quite important when they cumulate across the many arenas and phases of one's life. Many of *g*'s daily effects are small, but they are consistent and ubiquitous. Like the small odds favoring the house in gambling, people with better odds win more often than they lose and can thus gradually amass large gains. Likewise, although smart people make "stupid" mistakes, they tend to accumulate fewer of them over a lifetime. Although the odds of any particular unfavorable outcome may not always be markedly higher in the lower IQ ranges, lower-IQ people face worse odds at every turn in life, meaning that their odds for experiencing *at least one* destructive outcome may be markedly higher.

Education and training. Schooling is the most *g*-loaded setting through which citizens pass en masse. Its unremitting demand is to learn and, moreover, to learn increasingly complex material as young people progress through it. It therefore highlights the intellectual distinctions among citizens better than does any other life setting and in ways plainly visible to the layperson. To be sure, schools enhance everyone's cognitive development, but they currently seem to have little impact on making people either more alike or less alike in intelligence. Sociologist Christopher Jencks estimated in 1972 that if quantity and quality of schooling were made identical for everyone, such equalization would reduce the variance in test scores by only 20 percent. When Poland's Communist government rebuilt Warsaw after World War II, it allocated housing, schools, and health services without regard to residents' social class. This far-reaching equalization of environments did little or nothing either to equalize the IQs of the next generation of children or to reduce the correlation of their IQs with parental education and occupation (Stein, Susser, and Wald 1978).

As already noted, brighter students and military recruits learn much more from the same learning opportunities and often require less than one-fourth the exposure than do their less able peers for the same degree of learning. This difference in ability to capitalize on learning opportunities also greatly influences the maximum level of attainment youngsters are likely to reach. People with an IQ of 75 (the threshold for mental retardation) have roughly only a 50–50 chance of being able to master the elementary school curriculum; an IQ of about 105 is required for the same odds of getting grades good enough in high school to enter a four-year college; and an IQ of 115 is required for 50–50 odds of doing well enough in college to enter graduate or professional school.

Figure 3, similarly to Figure 1, summarizes accumulated employer experience about the most effective sorts of training for people at different ranges of IQ. Figure 3 is based on research with the Wonderlic Personnel Test (WPT), a short group intelligence test. Above the WPT equivalent of IQ 115–120 (which includes about 10 to 15 percent of the general white population), people can basically train themselves; the middle half of the IQ distribution (IQ 91–110) can learn routines quickly with some combination of written materials, experience, and mastery learning; but people below IQ 80 (10 percent of the general white population) require slow, concrete, highly supervised, and often individualized training. The military is prohibited by law from inducting anyone below this level because of inadequate trainability, and current minimum standards exclude anyone below the equivalent of IQ 85.

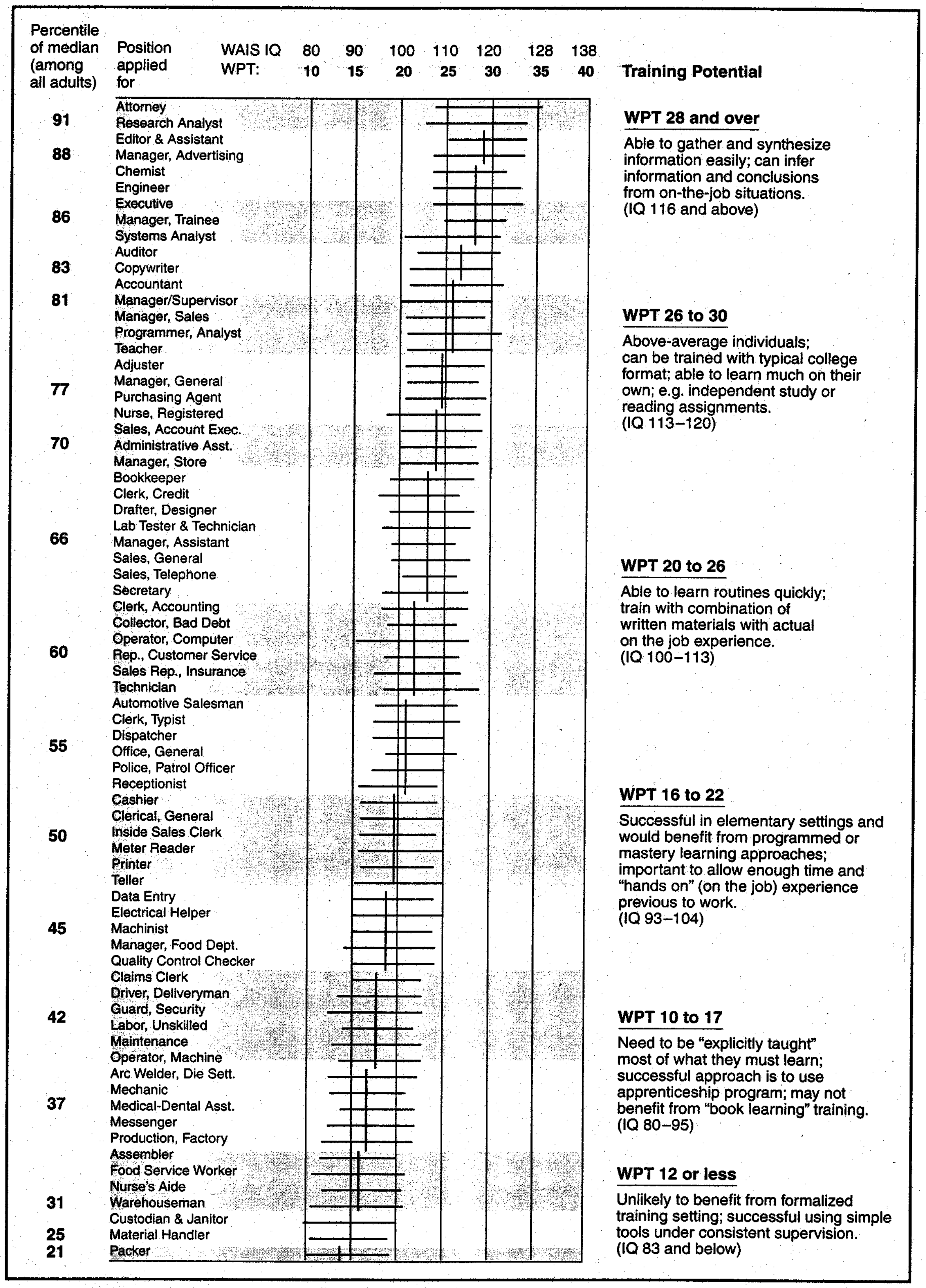
Percentile of median (among all adults)
Position applied for
WAIS IQ 80 90 100 110 120 128 138
WPT: 10 15 20 25 30 35 40
Training Potential
91
88
86
83
81
77
70
66
60
55
50
45
42
37
31
25
21
Attorney
Research Analyst
Editor & Assistant
Manager, Advertising
Chemist
Engineer
Executive
Manager, Trainee
Systems Analyst
Auditor
Copywriter
Accountant
Manager/Supervisor
Manager, Sales
Programmer, Analyst
Teacher
Adjuster
Manager, General
Purchasing Agent
Nurse, Registered
Sales, Account Exec.
Administrative Asst.
Manager, Store
Bookkeeper
Clerk, Credit
Drafter, Designer
Lab Tester & Technician
Manager, Assistant
Sales, General
Sales, Telephone
Secretary
Clerk, Accounting
Collector, Bad Debt
Operator, Computer
Rep., Customer Service
Sales Rep., Insurance
Technician
Automotive Salesman
Clerk, Typist
Dispatcher
Office, General
Police, Patrol Officer
Receptionist
Cashier
Clerical, General
Inside Sales Clerk
Meter Reader
Printer
Teller
Data Entry
Electrical Helper
Machinist
Manager, Food Dept.
Quality Control Checker
Claims Clerk
Driver, Deliveryman
Guard, Security
Labor, Unskilled
Maintenance
Operator, Machine
Arc Welder, Die Sett.
Mechanic
Medical-Dental Asst.
Messenger
Production, Factory
Assembler
Food Service Worker
Nurse's Aide
Warehouseman
Custodian & Janitor
Material Handler
Packer
WPT 28 and over
Able to gather and synthesize information easily; can infer information and conclusions from on-the-job situations.
(IQ 116 and above)
WPT 26 to 30
Above-average individuals; can be trained with typical college format; able to learn much on their own; e.g. independent study or reading assignments.
(IQ 113–120)
WPT 20 to 26
Able to learn routines quickly; train with combination of written materials with actual on the job experience.
(IQ 100–113)
WPT 16 to 22
Successful in elementary settings and would benefit from programmed or mastery learning approaches; important to allow enough time and "hands on" (on the job) experience previous to work.
(IQ 93–104)
WPT 10 to 17
Need to be "explicitly taught" most of what they must learn; successful approach is to use apprenticeship program; may not benefit from "book learning" training.
(IQ 80–95)
WPT 12 or less
Unlikely to benefit from formalized training setting; successful using simple tools under consistent supervision.
(IQ 83 and below)

Figure 3

Employment. Many studies have found that the major distinction among occupations in the U.S. economy is the cognitive complexity of their constituent tasks. The most complex jobs are distinguished by their greater requirements for dealing with unexpected situations, learning new procedures and identifying problems quickly, recalling task-relevant information, reasoning and making judgments, and similar higher-order thinking skills that are prototypical of intelligence. Other job attributes that correlate highly with the *occupational complexity factor* include writing, planning, scheduling, analyzing, decision making, supervising, negotiating, persuading, instructing, and self-direction. So, too, do responsibility, criticality, and prestige. As already noted, mental ability test scores correlate most highly with performance in the most complex jobs. That is, differences in intelligence have a bigger impact on performance—"more bang for the buck"—when work is more *g*-loaded.

Not surprisingly, then, an occupation's overall complexity level correlates extremely highly with the average IQ of its incumbents. As Figure 3 illustrates, all occupations draw applicants from a wide range of IQ, but the minimum and average IQ levels rise with job level. Although wide, the typical IQ recruitment ranges for different occupations do not overlap at the extremes of job level (professional versus unskilled). The average IQ of applicants to middle-level jobs (about IQ 105), such as police work, is 15 IQ points (one standard deviation) lower than for applicants to professional jobs but 15 IQ points higher than for applicants to semiskilled work, such as food service worker. No occupation seems to recruit its workers routinely from below IQ 80.

The foregoing results for jobs suggest a high practical utility for higher intelligence in other aspects of life. Many jobs (child care, sales, accounting, teaching, managing) pose the same mental challenges (persuading, instructing, organizing, and ministering to people) that pervade nonpaid activities (parenting, home and financial management, civic responsibilities, friendships, and so on).

Daily life. Daily life has become considerably more complex during the twentieth century. Increased size, bureaucratization, and regulation of social institutions and services, together with greater reliance on continually changing information technologies, have greatly increased the cognitive complexity of daily life. Life may be physically easier, healthier, and more pleasant today, but it has become mentally more challenging in developed societies. Some of this complexity is captured well by the U.S. Department of Education's 1992 National Adult Literacy Survey (NALS; Kirsch et al. 1993). Although the NALS was not designed as an intelligence test, it closely mimics the key attributes of an IQ test battery: Its intent was to measure complex information-processing skills by sampling a broad range of tasks from universally relevant contexts and contents; the relative difficulty of its items stems from their complexity, not their manifest content; and its three scales reflect one general factor.

Figure 4 illustrates items at different levels of the three NALS subscales; Figure 1 translates the NALS scores into IQ equivalents. These items do not involve esoteric "book smarts" but represent practical, everyday skills in dealing with banks, restaurants, transportation systems, and social agencies; understanding the news and one's options; and providing basic information about oneself. Nonetheless, about 15 percent of white adults and 40 percent of black adults routinely function no higher than Level 1 (225 or less), which corresponds to 80 percent proficiency in skills such as locating an expiration date on a driver's license and totaling a bank deposit. Another 25 percent of whites and 36 percent of blacks routinely function no higher than Level 2 (226–275), which includes proficiency in such skills as locating an intersection on a street map, entering background information on an application for a Social Security card, and determining the price difference between two show tickets.

These are examples of the myriad daily tasks that require some independent learning and reasoning as one navigates life. None may be critical by itself, but the more often one fails such tasks, the more one is hampered in grasping opportunities, satisfying one's needs and desires, and assisting family and friends. A national education panel concluded, in fact, that Level 1 and 2 skills are not sufficient for competing successfully in a global economy or exercising fully the rights and responsibilities of citizenship. Consistent with this, the

PROSE	DOCUMENT	QUANTITATIVE
149 Identify country in short articles	69 Sign your name	191 Total a bank deposit entry
210 Locate one piece of information in sports article	151 Locate expiration date on driver's license	
224 Underline sentence explaining action stated in short article	180 Locate time of meeting on a form	
	214 Using pie graph, locate type of vehicle having specific sales	
226 Underline meaning of term given in government brochure on supplemental security income	232 Locate intersection on a street map	238 Calculate postage and fees for certified mail
	245 Locate eligibility from table of employee benefits	246 Determine difference in price between tickets for two shows
250 Locate two features of information in sports article	259 Identify and enter background information on application for social security card	270 Calculate total costs of purchase from an order form
275 Interpret instructions from an appliance warranty		
280 Write a brief letter explaining error made on a credit card bill	277 Identify information from bar graph depicting source of energy and year	278 Using calculator, calculate difference between regular and sale price from an advertisement
304 Read a news article and identify a sentence that provides interpretation of a situation	296 Use sign out sheet to respond to call about resident	308 Using calculator, determine the discount from an oil bill if paid within 10 days
316 Read lengthy article to identify two behaviors that meet a stated condition	314 Use bus schedule to determine appropriate bus for given set of conditions	
	323 Enter information given into an automobile maintenance record form	325 Plan travel arrangments for meeting using flight schedule
328 State in writing an argument made in lengthy newspaper article		331 Determine correct change using information in a menu
347 Explain difference between two types of employee benefits	342 Identify the correct percentage meeting specified conditions from a table of such information	

(continued)

(continued)

PROSE	DOCUMENT	QUANTITATIVE
359 Contrast views expressed in two editorials on technologies available to make fuel-efficient cars	348 Use bus schedule to determine appropriate bus for given set of conditions (a harder question than the similar one above)	350 Using information stated in news article, calculate amount of money that should go to raising a child
362 Generate unfamiliar theme from short poems		368 Using eligibility pamphlet, calculate the yearly amount a couple would receive for basic supplemental security income
374 Compare two metaphors used in poem		375 Calculate miles per gallon using information given on mileage record chart
382 Compare approaches stated in narrative on growing up	379 Use table of information to determine pattern in oil exports across years	382 Determine individual and total costs on an order form for items in a catalog
410 Summarize two ways lawyers may challenge prospective jurors	387 Use table comparing credit cards. Identify the two categorices used and write two differences between them	405 Using information in news article, calculate difference in times for completing a race
423 Interpret a brief phrase from a lengthy news article	396 Using a table depicting information about parental involvement in school survey to write a paragraph summarizing extent to which parents and teachers agree	421 Using calculator, determine the total cost of carpet to cover a room

Figure 4

NALS study found that, compared to adults with Level 5 skills (376–500, reached by about 4 percent of whites and less than 0.5 percent of blacks), adults with Level 1 skills were five times more likely to be out of the labor force, ten times more likely to live in poverty, only 40 percent as likely to be employed full time, and 7 percent as likely to be employed in a managerial or professional job–if employed at all.

Two daily activities where mental competence may have life-and-death implications are driving and health behavior. A large longitudinal study of Australian servicemen found that the death rate from motor vehicle accidents for men with IQs above 100 (52 per 10,000) was doubled at IQ 85–100 (92 per 10,000) and tripled at IQ 80–85 (147 per 10,000). The study authors suggested that the higher death rates might be due to poorer ability to assess risks. Medical research has likewise documented that many nonretarded patients have difficulty reading labels on prescription medicine and following simple physician instructions about self-care and future appointments.

Nexus of social pathology. Table 2 shows how the odds of social pathology fall (or rise) the further one's IQ exceeds (or falls below) the average IQ. It shows the percentages of young white adults in five successive IQ ranges who experience certain bad outcomes. As shown, the odds of incarceration, illegitimate births, poverty as an adult, and the like all double at each successively lower IQ range. The ratios in the last column show how the odds of bad outcomes thus differ greatly even for people who are only somewhat below average (IQ 76–90) versus somewhat above average (IQ 111–125) in IQ. Among these young white adults, for instance, 17 percent of the former IQ group versus only 3 percent of the latter live in poverty as adults, for a ratio of about 5:1. The odds are less discrepant for some bad outcomes (3:2 for divorce and unemployment) but more discrepant for others (7:1 for incarceration and 88:1 for dropping out of high school). The disparities in odds across IQ groups are even more extreme at the extremes of IQ. Good and bad outcomes can be found at all IQ levels, but what is *typical* differs enormously, as was also illustrated with the NALS data.

Moreover, the odds of dropping out of school, illegitimate births, poverty, and welfare dependence all increase with lower IQ among siblings within the very same family and even when the families are intact and not poor. There is something about below-average IQ itself that puts individuals at serious social risk, whatever their family circumstances.

Overall life chances. Figure 1 and Table 2 together paint a vivid picture of how greatly overall life chances differ by IQ level. People with IQs below 75 are clearly in the "high-risk" zone, where trainability and employability are very low and the odds of various social pathologies are much elevated. Although risks fall substantially for individuals with IQs only somewhat below average (IQ 76–90), these people still face an "uphill battle" because they are not very competitive for many training programs and jobs. The middle 50 percent of the population (IQ 91–110) is competitive for many of a modern economy's jobs but likely only to be just "keeping up" relative to others. Their brethren of somewhat above-average IQ (IQ 111–125) are more likely "out ahead" socioeconomically because they are highly trainable and competitive for better jobs. Their rates of pathology are also very low. People with IQs above 125 are so competitive cognitively and so seldom hobbled by *g*-related social pathology that socioeconomic success is truly "theirs to lose."

Interpersonal Context. One of the most fascinating questions in the study of intelligence has received virtually no attention: How does the *mix* (average and variability) of intelligence levels in a setting—its *IQ context*—affect behavior in that setting? How might one's fate be affected by the intelligence level of the *other* people in one's interpersonal settings—of one's parents, siblings, neighbors, friends, and other close compatriots?

The basic issue is this: A difference in IQ of one standard deviation (about 15 points) is socially perceptible and meaningful. Interpersonal communication becomes fraught with increasing difficulty beyond this distance because of larger gaps in vocabulary, knowledge, and ability to draw inferences or "catch on," as well as the emotional discomfort such gaps create. Figure 1 reveals how IQ ranges of about one standard deviation also mark off substantial differences in options for education, training, and career, and thus the likelihood of entering different social niches. As shown in the figure, the normal range of intelligence (IQ 70–130, which includes roughly 95 percent of the general white population) spans four standard deviations of IQ. Socially and cognitively, that is an enormous difference. How, then, do people communicate and congregate across the IQ continuum in their daily lives? The average difference between siblings and spouses is about 12 IQ points, which means that most people in a biological family fall within the range of ready cognitive communicability. Any two random people in the population, however, differ by 17 IQ points, which represents the borderline for communicating effectively and as social equals.

Communication, cooperation, and reciprocity. The ability to communicate as equals constitutes a social tie, as does the ability to trade information and assistance. Such reciprocity is the basis of longer-term cooperation. Lack of reciprocity creates not only social distance but also animosity where reciprocity had been expected. There are many bases for cooperation and reciprocity, but sharing information and helping to solve problems is crucial in many settings. Ethnographic studies of middle school children, for instance, show how patterns of mutual assistance and friendship, rather than resentment and unwillingness either to provide help to classmates or to seek it from them, evolve from similarities and differences in students' competence in answering homework and test items. Similar *g*-driven interpersonal relations can be expected in many workgroups

Percentage of Young White Adults with Particular Life Outcomes, by IQ Level

LIFE OUTCOME IQ:	75 and Below "Very dull"	76–90 "Dull"	91–110 "Normal"	111–125 "Bright"	Over 125 "Very Bright"	Ratio of Dull to Bright
Out of labor force 1+ mo/yr (men)	22	19	15	14	10	4:3
Unemployed 1+ mo/yr (men)	12	10	7	7	2	3:2
Divorced in 5 yrs	21	22	23	15	9	3:2
% of children below IQ 75 (mothers)	39	17	6	7	–	2:1
Had illegitimate child (women)	32	17	8	4	2	4:1
Lives in poverty	30	16	6	3	2	5:1
Went on welfare after first child (women)	55	21	12	4	1	5:1
Ever incarcerated/ doing time (men)	7	7	3	1	0	7:1
Chronic welfare recipient (mothers)	31	17	8	2	0	8:1
High school dropout	55	35	6	0.4	0	88:1

Table 2

SOURCE: Herrnstein and Murray (1994): (respectively) 158, 163, 174, 230, 180, 132, 194, 247/248, 194, 146.

and other settings in which teammates depend on one another for technical competence.

People of markedly different ability levels also tend to have different interests, which further impedes their ability to develop rapport. Assortative mating studies show that individuals explicitly seek mates of similar IQ levels and that spouses' IQs are, in fact, moderately correlated (about .4), perhaps more so than any other personal characteristic (except gender). Cognitive incompatibility is certainly responsible for the extreme social isolation often experienced by both the mentally retarded and the highly gifted. Extremely gifted children, who may be four standard deviations or more above average (IQ 160 and above), often feel, and are treated as, alien. These children are as different from the borderline gifted (IQ 130) as the latter are from the average child (IQ 100). With extraordinary vocabularies for their age, the highly gifted speak virtually a different language from their agemates. Although less extreme, the same type of alienation develops across much smaller gaps in IQ. In short, cognitive similarity seems to affect the formation of social bonds, which themselves are the building blocks of "social structure."

Social separation and segregation. Because rough similarity in *g* promotes interpersonal reciprocity and rapport, it should not be surprising that people segregate themselves somewhat by cognitive ability when free to do so, marriage being the most intimate example. Segregation occurs along IQ lines for other reasons as well, many related to the functional value of intelligence in obtaining higher education and better work.

In the typical school, students enter grade 1 spanning at least mental ages four to nine, which translates quickly into markedly different grade-equivalent achievement levels. By reducing *g* variability within learning groups, ability grouping and tracking represent schools' attempt, albeit a perennially controversial one, to accommodate students of different cognitive levels. Its pedagogical merits aside, grouping reinforces friendships within IQ ranges and is but the first of many ways by which schools and employers direct individuals toward different occupational and income groups, and thence into residential neighborhoods, partly along IQ lines.

A 1933 epidemiological survey in New York City documented that the *average* IQ levels of white school children across a large sample of the city's 273 Health Areas ranged from 74 to 118, a range of three standard deviations. The parents of these children would differ even more in average IQ. Consistent with genetic expectations, parents of any ability level produce children at virtually all ability levels, but their children's average IQ is closer to the population average than is their own.

Social clustering along IQ lines can be expected to increase familiarity, communication, and mutual assistance by enhancing within-group similarity, at least when the groups are minimally competent. Enhanced similarity can elevate the risks of low IQ, however, when IQ clustering results in a *critical mass* of individuals below some *critical threshold* in IQ. That threshold may be IQ 75, which is the level below which individuals need considerable assistance from family, friends, or social agencies to live independently in modern societies. When critical mass is reached in a family or community, networks of competent help become overwhelmed by sticky webs of bad judgment, which in turn produce a physically unhealthy and socially dysfunctional environment for all members, as sympathetic social anthropologists have documented.

In any case, greater *within-group* similarity produces greater *between-group* dissimilarity and distance. A contested but reasonable hypothesis of Richard Herrnstein and Charles Murray's 1994 book, *The Bell Curve*, is that society is becoming *increasingly* stratified along cognitive lines, jeopardizing national unity. That specter raises much anxiety in democratic societies, perhaps accounting for the quick distaste the thesis roused in many quarters. Any societal divisions that *g* creates would, however, be softened somewhat by *g*'s genetic basis. The laws of genetics guarantee that many children will differ substantially from their parents, producing intergenerational mobility across IQ and social-class lines and thereby assuring some cross-group ties. Whether or not it is increasing over time or permeable in nature, social clustering by *g* is nonetheless considerable. It is therefore a perennial matter of public debate, whether the question be where to locate Section 8 or other public housing or how to integrate social classes and races in educational settings.

Social networks and subcultures of attitudes, behavior, and knowledge. The Bell Curve's thesis about the dangers of cognitive stratification rests in its assumption that different cognitive strata create distinct and somewhat discordant cultures. Sociologist Robert A. Gordon (1997) has outlined at the level of small groups how different IQ contexts do actually represent different subcultures. These different subcultures in turn expose their members to different experiences, risks, knowledge, opinions, assistance, and expectations, as suggested earlier. IQ-discrepant subgroups, for example, differ not so much in the social ideals they espouse as in tolerance for their violation. They also differ in the degree to which they diffuse news and information from the broader culture rather than propagate rumor, misinformation, and even the AIDS virus.

The New York City neighborhoods mentioned earlier differed not only in IQ but also in rates of birth, death, infant mortality, and juvenile delinquency, illustrating that different IQ contexts probably constitute notably different social milieus for developing children. Children of, say, IQ 100 surely live different lives with different opportunities when raised in IQ contexts of 85 versus 115, both of which are common in the United States. Not only is such a child substantially above average in the first context while below average in the second, which creates its own opportunities and obstacles for the child, but there are also significant differences across the two contexts in the quality of ambient advice, information, and personal examples. Children's IQ levels seem not to be permanently affected by their IQ contexts, but their more malleable behaviors and outcomes may be, as studies of youthful career aspirations and delinquency suggest. Epidemiological analyses of the *g*-related contagion of certain risky health and social behaviors would further illuminate how risks rise or fall according to the level of "local intelligence" in which one is embedded.

Societal Level. The interpersonal contexts that influence an individual's behavior are themselves shaped partly by the *g* levels of the people inhabiting them, as just described. IQ contexts thus represent an impact of *g* on an individual level that is above and beyond the effects of that individual's own IQ. IQ contexts have "macro" as well as "micro" effects in a society, however, because they create gradients of information flow, status and stigma, power and influence across a nation. These societal-level effects of *g*, via IQ contexts, may be the most important of all for a society, and they cry out for sociological analysis. Only a few such analyses have been done, but they illustrate the promise of a *sociology of intelligence*.

Evolution of social structures. If knowledge is power, then brighter people can be expected to advance further in any society freely allowing its accumulation. What is less obvious, except in hindsight, is that the routes to success may themselves be shaped by enduring variation in *g* within a population. Wide dispersion in *g* is a biological fact that all societies must accommodate. What norms and institutions evolve to promote such accommodation, especially where *g* has high functional value?

Consider the occupational hierarchy, that gradient of occupations from high to low in status, income, and educational requirements, which sociologists have shown to be replicated around the world. The consequences for individuals of their placement in it is clear, but its evolution is not. As described earlier, the major dimension underlying the hierarchy seems to be the complexity, not the content, of the tasks comprising the occupations arrayed along it. The occupational hierarchy is, then, a set of stable task configurations ranked in desirability according to their *g*-loadedness.

The structural question is how tasks gradually become sorted over time by their *g*-loadings into more *g*-homogeneous sets *within* occupations, thereby creating sharper distinctions in *g*-loading *between* occupations. This segregation of tasks by *g*-loading into a *g*-based occupational hierarchy most likely gradually arises from the natural sorting and reassignment of people *and* tasks to each other in the effort to improve aggregate performance of an organization's or society's essential functions. When workers are sorted more consistently by *g* level into occupations, occupational content can evolve to better fit the typical incumbent. For example, employers can gradually remove easy tasks from, and add complex tasks to, jobs whose usual incumbents are bright, and do the opposite for jobs typically peopled by less bright workers (Gottfredson 1985).

Of course, *g* is hardly the only contributor to job performance, and job performance is not the only basis for how work and workers are organized in firms and societies. But to the extent that *g* is the most functionally important worker attribute overall *and* that people become sorted to work by *g* level, there will arise a *g*-based occupational hierarchy whose distinctions gradually expand or contract when the *g*-related efficiency of sorting workers rises or falls. This theory illustrates how the biological fact of differences in *g* can constrain the evolution of social institutions. That biological fact clearly rules out common utopian fantasies in which all citizens are assigned, rotated through, or ascend to jobs of equal difficulty and status.

Racial politics. When two social groups differ substantially in average *g* and *g* has functional value, they can also be expected to differ in *g*-related outcomes. The average difference in outcomes will depend on, among other factors, the size of the average group difference in *g* and the *g*-loading of the outcome in question. The *g*-generated differences in outcome have many sociopolitical reverberations, because they are pervasive, frequently large, and sometimes involve races once subjugated. The societal-level reverberations have the power to alter many aspects of a nation's culture. This can be illustrated by the national effort in recent decades to eliminate racial disparities in education and employment despite continuing racial disparities in *g*.

A key practical dilemma for educators and employers is that unbiased, valid measures of mental ability are generally the best predictors of school and job performance but, owing to phenotypic differences in *g* across racial groups, they have considerable *disparate impact*. That is, they screen out disproportionate numbers of candidates from some races. Unless group disparities in *g* are eliminated, there will continue to be a trade-off between selecting the most able applicants and selecting a racially balanced student body or work force, especially in highly *g*-loaded settings such as graduate school and the professions. In both employment law and public perceptions, unequal selection rates by race constitute prima facie evidence of illegal discrimination, often making it risky to use *g*-loaded predictors.

This combination of scientific facts and legal constraints has precipitated in personnel selection psychology a desperate but unsuccessful search for non-*g* substitutes for mental tests. There turns out to be no substitute for higher-order thinking skills. This failure created additional pressure on the field to reduce employers' legal vulnerability while retaining mental tests by instituting racial preferences. Eventually the U.S. Congress banned the most efficient such "solution" as an undisguised quota (the race-norming of employment tests, which means ranking applicants on separate racial curves). That ban in turn increased the pressure to covertly reduce or eliminate the *g* component of tests (to remove crucial mental demands), the results of which led to enormous controversy—and litigation—in personnel selection psychology. The same controversial effort to reduce the *g*-loading of employee selection criteria is now occurring for college admissions in states where racial preferences have been banned or might be. Being the most *g*-loaded predictor of student performance, the SAT has been the first target. In short, *g*-related group differences in outcomes have long been driving widespread changes in standards for admission, hiring, promotion, and more, sometimes improving selection and sometimes not, but always causing controversy.

Selection psychology is only one microcosm for observing the sorts of societal waves created by *g*-related group disparities. Virtually every school practice, from instructional and grouping practices to discipline to teacher assignment and funding, has been modified in recent decades to neutralize either the reality or the appearance of racial differences in phenotypic intelligence and their real-world effects. Keen disappointment at the failure of these modifications to accomplish that neutralization has itself has sparked mutual recriminations between blacks and whites, led to more expansive definitions of discrimination and racism, and in many other ways shifted national politics. As is apparent, the societal-level ramifications of group differences in *g* hinge critically not only on how large they are and whom they affect but also on how a society explains and reacts to the differences.

Inequality and the democratic paradox. A population's IQ bell curve may bunch up or spread out somewhat with environmental change, and it may shift a bit up or down the IQ continuum over time. Nonetheless, it will remain as much a biological fact as are differences in height. The bell curves for different demographic groups may also shift somewhat relative to each other along the IQ continuum, but gaps will likely persist.

As indicated in Figure 1, the IQ continuum represents a gradient of functional advantage for the individuals and groups arrayed along it. Happiness and regard may be available to all, but money, power, and prestige all tend to flow up the continuum, especially in a free society. Accordingly, envy flows up and stigma down. The IQ continuum is thus a strong current deep within the body politic that influences its surface dynamics in myriad ways and can frustrate efforts to steer a society in certain directions. Perhaps for this reason, political efforts to regulate or defy those dynamics have sometimes been violent in spirit if not in act. A 1980 analysis of genocides earlier in the century found that all but one of the targeted groups (Gypsies) were of apparently *higher* average intelligence than those seeking to exterminate them, for instance, the Jews in Germany, Armenians in Turkey, Ibos in Nigeria, and the educated classes in Cambodia.

Any humane society will moderate the effects of unequal biological and social advantage, preventing unbridled competition and the degradation of its weaker members. If resources naturally flow up the IQ continuum, societies can consciously redistribute some of them back down it—in a word, by helping. Such is the realm of charity and, increasingly, social policy, although such measures are seldom conceived in terms of helping the less "able" because that in itself would be stigmatizing. More often today, help is couched in terms of assisting the "deprived," as though all social inequality were the result of some social groups illegitimately expropriating from others what would have otherwise naturally accrued to them. Some inequality may be, but much is not.

Extreme egalitarianism is as problematic, however, as unbridled individualism, for it hobbles talent and deadens ambition. John Gardner outlined the trade-offs between promoting individual merit and equalizing social outcomes in his 1984 book, *Excellence: Can We Be Equal and Excellent Too?*

In that eloquent little book, he asked the question that writers from both the political left and right have since tried to answer in more detail: How can we create a valued place for people of all ability levels and bring out the best in all? The proffered answers differ primarily in the difficult trade-offs the authors settle for among personal liberty, equality of socioeconomic outcomes, and an emphasis on human excellence and productivity, three principles that are somewhat inconsistent owing to meaningful differences among people.

If such are the political dilemmas that the deep current of *g* inevitably creates, the debates over their resolution seldom seem cognizant of the dilemma's roots in human variation. Democracy is itself a social leveler because its grants *political* equality to people who are in numerous ways *biologically* unequal. But this strength is also its torment, because democracy excites the desire for yet more leveling, to which biological inequalities—especially intelligence differences—pose an obstacle. Mother Nature is no egalitarian. As Alexis de Tocqueville observed almost 200 years ago ([1835, 1840] 1969), "When there is no more hereditary wealth, class privilege, or prerogatives of birth, and when every man derives his strength from himself alone, it becomes clear that the chief source of disparity between the fortunes of men lies in the mind . . . [T]here would still be inequalities of intelligence which, coming directly from God, will ever escape the laws of man" (pp. 457–458, 538).

Biological diversity in *g* is a core challenge to democratic societies and to the scholars who are responsible for helping citizens understand how their society works. The challenge is exacerbated as technology advances, because such advance favors higher-*g* over lower-*g* people owing to their better ability to capitalize on it. Western democracies view democracy and technology as their twin engines of progress, however, and so haplessly seek solutions to inequality by pursuing yet more of both. That is the *democratic paradox*. The answer to the dilemma lies not in pursuing the opposite strategy—that is, curtailing both democracy and technology, as is sometimes hinted—but most likely in better understanding how differences in *g* orchestrate and constrain social life, to the extent that they do. For sociologists of intelligence, there is much to do.

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INTERGENERATIONAL RELATIONS

Throughout recorded history, concern has been expressed about relations among the generations. Historians have identified changing patterns of relationships between the old and the young, pointing out that in some epochs veneration of the aged was common, while in other eras, the aged were more likely to be held up to scorn and ridicule. In contemporary American society, these contrasts are muted, and themes of both consensus and conflict are present.

Sociologists have explored intergenerational relations extensively, using both macrosociological and microsociological approaches. Scholars who have taken a macrosociological approach have examined the discontinuity caused by the succession of different groups of individuals who were born during the same time period and therefore age together (Foner 1986). Sociologists refer to such groups as "cohorts." Many important questions have been raised regarding relations among cohorts, including: How do people differ as a result of membership in a specific cohort? How and why do cohorts come into conflict with one another? Does a "generation gap" exist?

In contrast, sociologists who have taken a microsociological approach have focused on intergenerational relations within families. These scholars have examined the content and quality of relationships among family members in different generations, posing such questions as: How much contact do adult children have with their parents? What kinds of exchanges occur between older and younger generations? What is the role of grandparents in families? Under what circumstances does conflict among the generations in families occur? To fully understand intergenerational relations, it is essential to study both levels and to draw connections between them.

MACROSOCIOLOGICAL PERSPECTIVES

Mannheim's View of Generations. Karl Mannheim provided one of the most enduring analyses of relations between cohorts (he used the term "generation," however, instead of the contemporary sociological term "cohort"). Mannheim argued that the individuals born into a given cohort experience the same set of sociopolitical events while