IQ's Evolutionary Breakdown

Intelligence may have more facets than testers realize

By BRUCE BOWER

First of two articles

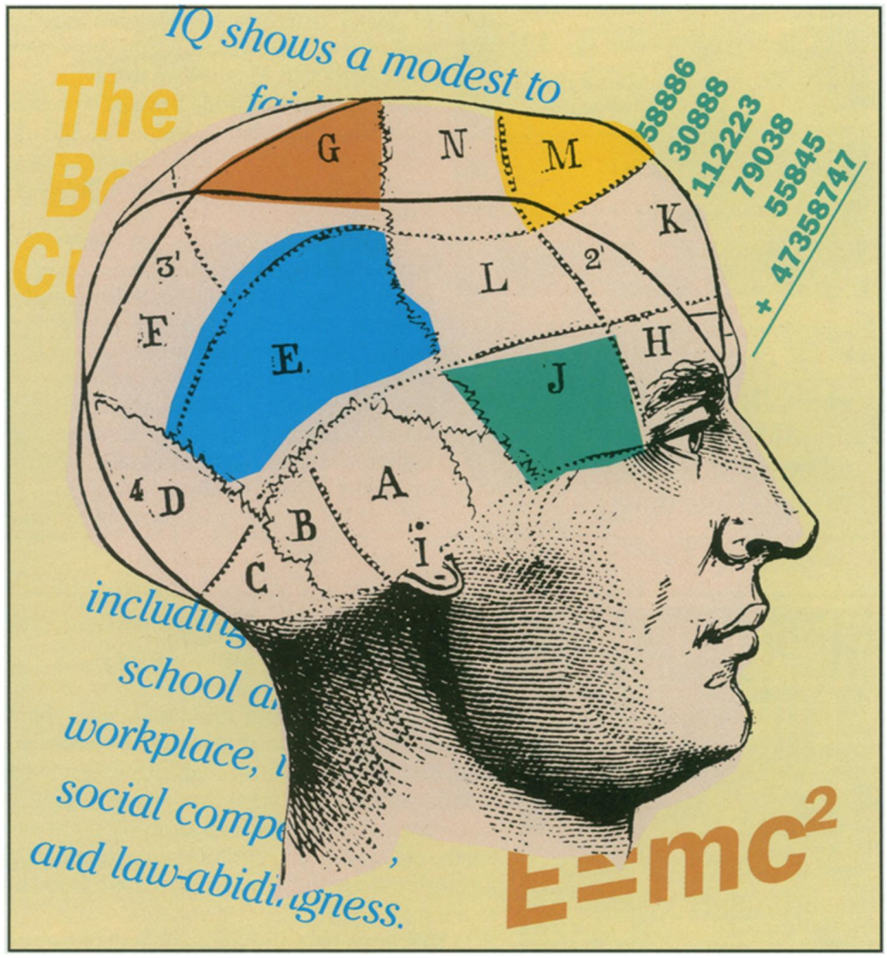
Forrest Gump, the most successful cinematic celebrator of slow-wittedness to date, defends his abilities succinctly: "Stupid is as stupid does."

The Bell Curve (1994, Free Press, New York), the most successful (and controversial) literary lionization of quick-wittedness to date, drives home a related point: Intelligent is as intelligent does — on an IQ test.

A majority of social scientists accept the latter notion, recently advanced in *The Bell Curve* by political scientist Charles Murray and the late psychologist Richard J. Herrnstein. IQ shows a modest to fairly strong correlation with many personal achievements, including success in school and the workplace, income, social competence, and law-abidingness. Much of IQ's predictive power — which outstrips that of any other single factor researchers have examined, including childhood affluence or poverty — is captured in a measure known as the general factor of intelligence, or *g*.

First devised in 1904 by British psychometrician Charles Spearman, *g* represents the degree to which a person's scores on various intelligence scales match each other. People and groups performing well or poorly on one component of IQ tests — say, verbal memory — tend to do similarly on other components, such as solving nonverbal problems. Thus, *g* encapsulates much of what IQ tests tap into, fueling the suspicion that an all-purpose engine in the brain powers all makes and models of intelligent behavior.

Despite renewed controversy over IQ tests, that suspicion maintains a strong hold on scientists. Witness an editorial in the Dec. 13, 1994, Wall Street Journal signed by 52 prominent intelligence researchers: "Intelligence is a very general mental capability," they write, "that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly, and learn from experience."



Yet some investigators, known as evolutionary psychologists, dispute this long-standing attachment to general intelligence, even as they acknowledge the predictive potency of *g*. Terms such as "intelligence," "learning," and "rationality," these scientists argue, explain little without a better understanding of the numerous specialized thinking mechanisms assembled in the brain through evolutionary processes acting over hundreds of thousands of years or more (SN: 10/12/91, p.232). These individual cognitive tools evolved to produce behavior that solved Stone Age problems in areas, or domains, critical to survival and reproduction, such as finding a mate, acquiring a native language, getting along with immediate family members, and cooperating with others to obtain and divvy up food.

The human brain's array of problem-solving tools arose mainly in small groups of hunters, gatherers, scavengers, and foragers, evolutionary theorists argue, and later made possible the transitions to agricultural, industrial, and information-based societies. These cognitive arrangements continue to frame human experience.

Evolved facets of intelligence far outnumber those proposed in most alternatives to the *g*-centered approach, evolutionary psychologists note. The best-known such theory, devised by Harvard University psychologist Howard Gardner, sets out seven broad forms of intelligence — linguistic, logical-mathematical, musical, spatial, bodily-kinesthetic, intrapersonal, and interpersonal.

"From an evolutionary perspective, we have to reconcile the many domain-spe-

cific components of intelligence with the statistical unity of *g*," asserts David M. Buss, a psychologist at the University of Michigan in Ann Arbor.

The tendency of individuals to perform equally well or poorly on the variety of verbal and spatial tasks an IQ test comprises may have arisen only in the last several hundred years, Buss theorizes. In industrialized nations, young adults have increasingly gained the freedom to choose their own marriage partners, often on the basis of similarity in intelligence and other personal traits. Many couples now meet at colleges or universities, where they have been pooled into groups of ascending cognitive ability. Those who do not attend college and pair up in their hometowns or neighborhoods make up another set of couples, generally matched for lower cognitive ability.

Married partners have grown more alike in intelligence over the past century, Buss says. And sorting out in this way would, after a few generations, produce a population that shows progressively larger individual differences on IQ tests. Over that same time period, he says, children of cognitively compatible pairings would also become more likely to score similarly well or poorly on all parts of an IQ test.

The authors of *The Bell Curve* agree that such a trend exists and argue that it has fostered the emergence of a "cognitive elite" in Western societies. Whether or not they are right, selective mating based on intelligence has probably woven a statistical unity into *g* that blankets the many domains of intelligence honed by evolution, Buss holds.

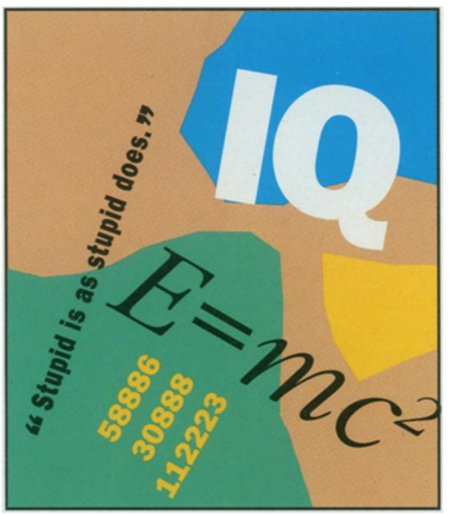
For instance, he suspects that a psychometrist somehow transported back to the Stone Age would find much less similarity between the scores achieved by individuals on various IQ scales. This time traveler would instead need to search for thinking tools employed by all people (or by one or the other sex) in the Paleolithic environment. Prehistoric people probably differed in the degree to which they successfully wielded cognitive tools to reach their goals, Buss says, but not in the kinds of tools at their disposal.

Today's scientists could assess this theory by administering IQ tests to relatively isolated hunter-gatherers still living in some parts of the world, the Michigan psychologist adds. Individuals in these groups may show considerable disparity in their scores on various IQ scales, he predicts.

Such studies would begin to address the underlying nature of intelligence. "For 70 years, the intelligence debate has not moved beyond psychometrics to address the connection between statistical measures and a theory of brain function," contends John Tooby, an anthropologist at the University of California, Santa Barbara.

For instance, researchers have neglected the study of ways in which certain environments may evoke more or less brain growth in the womb and in early life, Tooby points out. Brain tissue guzzles fuel, especially as it grows; evolutionary forces may have primed the brain metabolism of human infants to slow down in response to a lack of sufficient calories or other cues that energy must be preserved, he argues. Dampening of brain growth in this way could hinder a child's ability to absorb information and integrate it into problem-solving skills.

Environmental forces of this type could well account for racial differences in IQ attributed largely to genes in *The Bell Curve,* Tooby argues.



Tooby and Santa Barbara psychologist Leda Cosmides study what they call "reasoning instincts," which, in their view, have evolved to orchestrate human decisions about social exchanges and many other situations (SN: 1/29/94, p.72). The relation of reasoning instincts to evolved brain mechanisms that allow for creative and insightful problem solving remains murky, Tooby notes.

"It's also not clear whether there is an underlying unity to *g*, since it's a fairly artificial measure that focuses on the ability to succeed at unfamiliar and out-of-the-ordinary tasks," he adds. Most people, regardless of IQ scores, show remarkable ability in the "natural" competencies of the human species, such as learning to speak a native language, whereas the infamous bell curve depicts achievement on tasks invented only within the past 5,000 years, such as reading and writing, according to Tooby.

Distinguishing between evolved aptitudes and the skills that have been contrived from them for modern purposes has important implications for understanding how children think and how schools should teach them, contends David C. Geary, a psychologist at the University of Missouri in Columbia. Geary refers to evolved problem-solving mechanisms as biologically primary abilities, which apply to all people or, in some instances, only to members of one sex. Biologically secondary abilities emerge in specific cultures as people exploit primary thinking systems to perform tasks unrelated to their original functions.

"IQ tests and *g* may to some extent pick up on the ability to co-opt biologically primary skills for the acquisition of secondary skills in school or elsewhere," Geary contends.

Consider mathematics. Psychological research points to several biologically primary mathematical abilities that children everywhere display, Geary writes in the January American Psychologist. Numerosity (sometimes called subitizing) is the most basic of these abilities; it involves quickly determining the quantity of up to about four items or events without counting. Different investigators find that infants show a sensitivity to the numerosity of up to three, and sometimes four, items as early as the first week of life, Geary notes.

Next comes ordinality, or a basic understanding of when a quantity is more than or less than another quantity. For instance, by 18 months of age, youngsters recognize that three items exceed two items and that two items outnumber one.

A preverbal counting system for up to perhaps four items at a time also develops in children across cultures, Geary proposes. An increasing number of studies finds that infants as young as 5 months tot up objects in simple ways (SN: 8/29/92, p.132).

These primary mathematical abilities buttress an early awareness of simple arithmetic, especially basic adding and subtracting. As a result, preschool-age children in all cultures engage in number-related activities and games, the Missouri psychologist maintains.

Biologically secondary mathematical skills assume prominence later in childhood, thanks to parental instruction (such as being taught number names), experience with peers (noting that counted objects get tagged in order from left to right), or teaching at school (learning the base 10 number system, for starters). Algebra, calculus, and most aspects of geometry also represent secondary abilities, Geary asserts.

In contrast to the natural blossoming of biologically primary math skills, secondary math abilities can be tough to acquire. Mathematically precocious youths, who provide a striking exception to this rule, often report that they use an inherent flair for mentally representing information in a spatial array and tracking relevant information in their memory — biologically primary abilities — to solve word problems in algebra and other complex mathematical challenges, Geary notes.

Sustained practice of such techniques may give other students their best chance at acquiring and hanging onto secondary math skills, in Geary's view.

This suggestion conflicts with much educational practice in the United States. Many educators endorse the theory that, given appropriate materials, children discover mathematical knowledge on their own without having to endure drill-and-practice lessons. A comparable assumption animates whole language reading theory, which holds that reading skills develop naturally with exposure to reading and writing, not by memorizing sounds associated with letters that make up words (SN: 2/29/92, p.138).

This currently popular school of thought mistakenly treats biologically primary and secondary skills as equally natural and attainable, Geary argues. Children run into far more problems with reading, writing, and mathematics when they lack hard-won knowledge of the procedures that make those biologically secondary skills possible, in his view.

"We cannot expect that the acquisition of secondary abilities in school will be particularly enjoyable for children," Geary says. "The motivation to acquire these abilities comes from the requirements of the wider and increasingly complex society and not from the inherent interests of children."

However, psychological research offers clues to how teachers can best inspire children to learn, he maintains. For example, short doses of practice over several months or years of schooling result in algebra or Spanish learning that lasts for decades (SN: 1/11/92, p.21). This approach can also engage students' interest more effectively than having them solve algebraic equations or conjugate Spanish verbs on worksheets, the Missouri psychologist notes.

The distinction between biologically primary and biologically secondary abilities also highlights the importance of cultural forces, rather than innate group differences in intelligence, in producing the much-noted mathematical superiority of Asian youngsters to their U.S. counterparts, Geary contends.

At age 4 to 5 years, Asian and U.S. children show no differences in math abilities or on tests of general knowledge, an important component of IQ scores, he says. However, once formal schooling begins, advantages in math achievement appear and expand rapidly among children in China, Japan, and Korea, Geary asserts.

A stronger emphasis on classroom practice of various procedures for solving math problems, greater reliance on homework, and firmer family and teacher expectations that youngsters make academic progress contribute significantly to the Asian math advantage, Geary concludes in his 1994 book *Children's Mathematical Development* (American Psychological Association, Washington, D.C.).

"Geary's arguments will stimulate a lot of debate," says Robert S. Siegler, a psychologist at Carnegie Mellon University in Pittsburgh. "I'm not yet sure if I agree with him."

If Geary's theory holds, biologically secondary abilities probably encompass many of the cognitive skills tapped by *g*, Siegler asserts. However, secondary abilities such as reading and algebra may not be as inherently dull for children to learn as Geary implies, the Pittsburgh psychologist adds.

David Bjorklund, a psychologist at Florida Atlantic University in Boca Raton, welcomes Geary's evolutionary approach to education and intelligence.

"An evolutionary perspective is catching on in the behavioral sciences," Bjorklund contends. "It's making us ask about the many specific cognitive abilities that make up intelligence."

Still, it appears that rancorous debate over the nature of intelligence will continue to focus on the tools of the psychometrists' trade — IQ and *g*. Evolutionary psychologists eye the fray with an exasperation reminiscent of Professor Henry Higgins trying to coax the Cockney out of Eliza Doolittle in "My Fair Lady." Repeat after me, they intone in unison: "The reign of brains lies mainly in domains." □

Next week: Criminal Intellects