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THE MYTH OF INTELLIGENCE

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Since the beginning of the 20th century, intelligence has been conceptualized as a qualitatively unique faculty (or faculties) with a relatively fixed quantity that individuals possess and that can be tested by conventional intelligence tests. Despite the logical errors of reification and circular reasoning involved in this essentialistic conceptualization, this view of intelligence has persisted until the present, with psychologists still debating how many and what types of intelligence there are. This paper argues that a concept of intelligence as anything more than a label for various behaviors in their contexts is a myth and that a truly scientific understanding of the behaviors said to reflect intelligence can come only from a functional analysis of those behaviors in the contexts in which they are observed. A functional approach can lead to more productive methods for measuring and teaching intelligent behavior.

Few topics have sparked such heated debate within the academic community and society at large as that of intelligence and intelligence testing. Some of the contentious issues in the debate include the very definition of intelligence, the controversy concerning IQ and race, the ever present nature-nurture problem (Weinberg, 1989), and even the question of whether intelligence exists (Howe, 1990). The debate was reignited most recently by the publication in 1994 of *The Bell Curve: Intelligence and Class Structure in American Life* by Richard J. Herrnstein and Charles Murray. The *sturm und drang* created by the publication of this book was, among other things, the motivation behind the creation of a task force in 1995 by the Board of Scientific Affairs of the American Psychological Association to prepare an authoritative report on the current status of research on intelligence and intelligence testing. The flurry of response generated by *The Bell Curve,* both in the academic

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community and in the media, also prompted a letter to the Wall Street Journal in December, 1994, in which 50 professors "all experts in intelligence and allied fields" signed a statement, titled "Mainstream Science on Intelligence."[1] The purpose of this statement was to respond to the public outcry over the suggestions and social implications of *The Bell Curve* by outlining "conclusions regarded as mainstream among researchers on intelligence, in particular, on the nature, origins, and practical consequences of individual and group differences in intelligence" ("Mainstream Science on Intelligence," 1994).

One of the reasons for the persistent concern about intelligence is that intelligence tests have been used to support nativistic theories in which intelligence is viewed as a qualitatively unique faculty with a relatively fixed quantity. Historically, proponents of nativistic theories have succeeded in persuading those with political power that standardized tests reliably measure intelligence; and these tests have been used to make important decisions about vast numbers of individuals including immigrants, U.S. soldiers during the first World War, normal school children, and the developmentally disabled. Not surprisingly, there exists a substantial literature documenting the history of the intelligence testing movement (e.g., Bolles, 1993; Fancher, 1985; Gould, 1981; Herrnstein & Murray, 1994; Kamin, 1974).

Background: General Intelligence

Although many people have contributed to the conception of intelligence as a unitary, qualitatively unique trait, we may trace its origin in the history of the intelligence testing movement to the British psychologist and statistician Charles Spearman. When Spearman factor analyzed scores on different tests of intelligence, including his own Galtonian-inspired sensory acuity tests, as well as those designed by Binet and Simon, he discovered that not only were the correlations positive, but they fell into a roughly hierarchical pattern with the highest correlations on tests that Spearman believed required higher level skills, such as abstract thinking. For Spearman, these positive intercorrelations provided evidence of a common underlying factor that tied them all together; he called this factor *g* for *general intelligence* (Spearman, 1904, 1927). Crinella and Yu (2000) explain:

[1]With some exceptions, the list of cosigners reads like a Who's Who of those theorists (e.g., Thomas J. Bouchard, Jr., John B. Carroll, Raymond B. Cattell, Hans Eysenck, Linda S. Gottfredsen, Seymour W. Itzkoff, Arthur R. Jensen, Robert Plomin, J. Philippe Rushton, and Vincent Sarich) who have continued Spearman's tradition of factor analyzing intelligence test scores to generate a theory of general intelligence - *g* - and some of whom (e.g., Thomas J. Bouchard, Robert Plomin) claim that behavior genetic research supports the conclusion that *g* is highly heritable, and others of whom (e.g., Arthur Jensen, J. Philippe Rushton, Seymour Itzkoff) have written highly emotionally charged articles arguing that the research supports the conclusion that group differences on intelligence tests reflect genetic differences.

> People who are proficient at solving a given problem tend to be proficient at solving others; those less capable of solving that problem tend to be less capable of solving others. The psychometric representation of this phenomenon is the general intelligence or g factor, obtained whenever scores on a battery of diverse problem solving tests are factor analyzed. (p. 299)

Thus *g factor*, or simply *g* as it is called, is a numerical outcome—an algebraic factor—resulting from a complex series of statistical manipulations, called factor analysis. Although Spearman believed that different types of skills required their own type of intelligence, which he called *s* for *specific factors*, he still viewed *g* as the most important factor. Spearman further believed that a person's general intelligence was inherited and, thus, was somehow represented in the physiology of the brain (Fancher, 1985).

As Fancher (1985) notes, Spearman saw what he wanted to see in his data. Despite problems with his original calculations, however, Spearman's conclusions regarding the positive intercorrelations between individual tests and their hierarchical arrangement have been generally accepted. In addition to problems with Spearman's research design and statistical analyses, there are several logical problems with his theory of *general intelligence* that would not concern us as much today had the core of his theory not been adopted by many who followed him. For one, as critics such as Gould (1981), among others, have pointed out, Spearman committed the logical error of reification. He took an abstract mathematical correlation and reified it as the *general intelligence* that someone possesses. Although Spearman was probably not the first person to commit this error regarding intelligence, his use of mathematics and statistics lent the appearance of scientific credibility to this practice. Once the error of reification is committed, it is easy to commit another logical error, circular reasoning, in which the only evidence for an explanation of some phenomenon is simply the phenomenon itself. In Spearman's case, the only evidence for *g*, or *general intelligence*, were the positive correlations, even though it was those positive correlations he was trying to explain in the first place. Had no positive correlations been obtained, Spearman would not have posited *g*. As some authors have correctly noted, *g* is a "statistical extraction" (Gottfredson, 1998) or "a construct . . . representing individual differences in performance on multiple cognitive measures" (Crinella & Yu, 2000, p. 300); it is not a thing being measured. What is measured is the behavior of large numbers of people on various tests. The positive intercorrelations that result from factor analysis of their test scores are themselves far removed from the behavior of any individual in the test-taking situation or, for that matter, in any other context.

If we do not accept prima facie the claims by Spearman and his intellectual descendants that the positive intercorrelations obtained on intelligence tests are a reflection of innate intelligence possessed by the individual test takers, then the positive correlations need to be explained some other way as do the performances of subjects on individual tests. As scientists know, correlation does not mean causation, although we apparently need to be reminded of this dictum fairly regularly (e.g., Gould, 1981; Howe, 1988a; Kamin. 1995; Layzer, 1972; Schlinger, 1996). In fact, variables may correlate for a number of possible reasons, only one of which is that they may be causally related. However, correlations based on different intelligence tests in large populations cannot be explained in the traditional sense of the term; they can only be accounted for statistically. The performance of individuals on a test or while engaging in behavior we call "intelligent" can be explained scientifically but this has not been the interest or strategy of intelligence researchers.

Because *g* is a statistical construct, theorists can see in it what they want and, consequently, the interpretation of *g* has changed over time. It initially represented a factor resulting from factor analysis but it has evolved semantically into *general intelligence* as a mental capacity and, more recently, into *general cognitive ability* (Plomin, 1999). The value, if any, of *g* is the same as that of any factor derived from factor analysis, namely it is a useful tool for detecting covariation in a set of complex data. Unfortunately because of the potential problems with external validity, a factor could emerge that is just an artifact of the way intelligence tests are designed; it might not represent anything fundamental about the test takers.

The concept of the inheritance of intelligence has also undergone some revision. Galton and Spearman believed that intelligence was inherited. Modern behavior geneticists claim that the heritability of IQ scores lies somewhere between .30 and .70 (Plomin, 1990), with some claiming an outright .80 heritability quotient (Jensen, 1969). What must be remembered is that behavior genetic research can only estimate to what extent the variance of one measurement, such as intelligence test scores, is correlated with the variance of another measurement, such as genetic differences, in a population of individuals. The heritability of a trait, for example, intelligence (as reflected by IQ), refers to the proportion of that variation that is associated with genetic differences among the individuals. Although behavior genetic researchers make strong claims for the validity of the (separated twin and adoption) research that they have used to estimate the heritability of intelligence, some of the core assumptions underlying such research have been seriously called into question. For example, according to some authors (e.g., Beckwith, 1999; Joseph, 1998), the equal environment assumption—namely that the environments of identical and fraternal twins are equal or even similar—is demonstrably false, whereas other critics (e.g., Layzer, 1972, 1999) seriously question the assumption that the variation of genetic and nongenetic factors contribute additively and independently to intelligence and, even if they do, that the heritability of IQ can be estimated from the extant data.

All of these concerns raise the issue as to just exactly what is being measured by intelligence tests. These and other problems occasioned by Spearman's theory would not demand our attention at the present time had the theory died with him. But Spearman's concept of *g* still plays a central role in intelligence research and theory, especially among those psychologists and social scientists who champion standardized tests and factor analysis as methods to discover what intelligence is and how to measure it, and who either conduct or support behavior genetic research (e.g., Carroll, 1993; Gottfredson, 1998; Jensen, 1998). Dissatisfaction with this strong (or restricted) view of *g* by other intelligence theorists, however, has led to different, but related concepts of intelligence which are alive and well in contemporary psychology.

Recent Conceptions of Intelligence

Until fairly recently, Spearman's concept of *g* had been the accepted view of human intelligence among intelligence theorists. In recent years, however, other theories have been proffered in which intelligence is seen not as a single general trait, but rather as a number of different traits or capacities, a trend that has not gone uncriticized by hard-line *g-factor* theorists (e.g., Gottfredson, 1998). For example, Sternberg's (1984) triarchic theory includes three types of intelligence—analytical, creative, and practical—all of which combine to make up what we call "intelligence." Gardner (1983) has postulated no fewer than six intelligences, including linguistic and musical intelligence, both of which are aural-auditory; logical-mathematical and spatial intelligence, which are visual; and bodily kinesthetic and personal intelligence. Although Gardner explicitly warns against the trap of reification when discussing intelligence, he offers the following general rule: "Intelligences should be thought of as *entities* at a certain level of generality, broader than highly specific computational mechanisms (like line detection) while narrower than the most general capacities like analysis, synthesis, or a sense of self (if any of these can be shown to exist apart from combinations of specific intelligences)" (p. 68, emphasis added). This statement notwithstanding, Gardner states that his intelligences are not "physically verifiable entities" but, rather, "potentially useful scientific constructs" (p. 70).

One of the notable differences in both Sternberg's and Gardner's subdivision of intelligence into multiple forms is their inclusion of intelligences not specifically related to academic success. In fact, a relatively recent trend in the intelligence literature has been to expand the concept to include capabilities or skills explicitly not related to success in school and, thus, not assessable by conventional tests. Toward that end, some psychologists (e.g., Neisser, 1976; Sternberg, Wagner, Williams, & Horvath, 1995) have distinguished between academic and practical intelligence. Academic intelligence enables one to perform well on school-related tasks and can be assessed by conventional standardized intelligence tests. Practical intelligence, known by the ordinary term, "common sense," enables one to perform well in the real world but cannot be fairly assessed through standardized intelligence tests.

Consider the following example of practical intelligence offered by

Sternberg et al. (1995). Apparently, garbage collectors in Tallahassee, Florida used to have to manually lift each huge city-issued trash container, empty it into the truck, and then carry the empty container back into the resident's yard. One day a new man on the job came up with the idea, the authors called it an insight, of wheeling each empty container into the yard of the next resident and so on, rather than returning each container to the yard from which it came. This meant that the garbage collectors only had to make one trip to each yard instead of two. Instituting this practice cut the work almost in half. In an attempt to understand such intelligent behavior, Sternberg et al. (1995) asked the following question: "What kind of intelligence enables a person to come up with this kind of strategy for reducing effort by half, a strategy that had eluded well-educated observers such as the present authors, other garbage collectors, and the managers who trained them" (p. 912)? By assuming that a "kind of intelligence" must be responsible for such an insight, however, Sternberg et al. commit the error of reification and, by extension, circular reasoning. They simply observed a particular behavior in its context, and because the actual proximate and ultimate causes of the behavior were not easily identifiable, they inferred a "kind of intelligence" as the cause of the behavior. In most, if not all, instances the only evidence for the inferred intelligence is the very behavior said to reflect it. If others do not exhibit the behavior of interest, then theorists are likely to assume, as Sternberg et al. did, that they do not possess that particular "kind of intelligence." Once again, the actual behaviors said to reflect intelligence, in this example, the idea (i.e., the verbal statement) of wheeling trash containers into the yard of the next resident, remain unexplained and scientists may be distracted from studying the variables, for example, the particular experiences, which determine such behavior.

More recently, psychologists have moved even farther away from the conventional and narrow conception of intelligence as a "genetic given that cannot be changed by life experience" (Goleman, 1995, p. xi) and toward a conception that includes "emotional intelligence" (see Mayer & Geher, 1996; Mayer & Salovey, 1993). For Mayer and his colleagues, emotional intelligence is "defined as the capacity to reason with emotion in four areas: to perceive emotion, to integrate it in thought, to understand it and to manage it" (Mayer, 1999). Of course, such a definition is predicated on a definition of emotions, which, according to Mayer, Caruso, and Salovey (2000), "are internal events that coordinate many psychological subsystems including physiological responses, cognitions, and conscious awareness (p. 267). Notwithstanding the authors' assertion that emotional intelligence meets the criteria required for scientific legitimacy, one of which is its ability to be operationalized as a set of abilities, their definition of emotion is inherently subjective — how can one observe and measure the internal events?

Psychologists, such as Goleman (1995), who have popularized the concept of emotional intelligence[2] believe a challenging question needs to be answered: "What *can* we change that will help our children fare better in life" (pp. xi-xii)? For Goleman the answer lies in the abilities he calls "emotional intelligence," which include, among other capabilities, "self-control, zeal and persistence, and the ability to motivate oneself" (p. xii). For Goleman, addressing emotional intelligence is not only a practical issue but a moral one as well. Moreover, he suggests that parents and the culture at large should better prepare children for life by placing more emphasis on their emotional education relative to their intellectual education. The behaviors involved when we speak of "self-control, zeal and persistence, and the ability to motivate oneself" are no doubt important in some social contexts, but by adding the term "intelligence" Goleman opens up a Pandora's box of difficulties, including the above-mentioned problems of reification and circular reasoning. For example, it might be said that some people have more emotional intelligence than others and that this causes them to behave with more zeal and persistence, or to be more self-motivated. Meanwhile, and most importantly, the behaviors said to reflect emotional intelligence, remain unexplained. Although labeling behavior as "emotional intelligence" may have some value, it does nothing to explain the behavior. Except for the common sense appeal of terms such as "emotional intelligence," they bring with them numerous logical and scientific pitfalls.

Even this very cursory review of recent trends regarding human intelligence compels us to ask just exactly what intelligence is and how many types there are. Such questions have the appearance of being scientific, although they are really semantic (or philosophical) questions that may distract behavior scientists from the more important questions about the variables responsible for the actual behavior we call "intelligent." There are obviously many different ways of being smart. In fact, one implication of the position offered in this article goes even further to suggest that the intelligence of an individual be determined on a case-by-case or, more specifically, a behavior-by-behavior basis. Thus, the question of whether intelligence is one general, qualitatively distinct trait, or several specific categorical types seems moot. Rather than debating how intelligence should be defined or how many forms of intelligence there are, perhaps behavior scientists should instead take a more Darwinian view and look at the specific behaviors in their contexts that we label "intelligent," and then analyze them according to their function in those contexts.

Essentialistic Versus Functional Approaches To Intelligence

The logical problems of reification and circular reasoning described

[2]Mayer (1999) and Mayer, Caruso, and Salovey (2000) contend that the concept of emotional intelligence popularized by others and by the media, stretches the meaning of their term—usually as a list of personality characteristics, which they call a "mixed conception," and overestimates the predictions about important life outcomes or about people who are said to be highly emotionally intelligent.

above are often found in essentialistic approaches to behavior. The concept of "essentialism" [the term was coined by the philosopher Karl Popper (1957)] has a long history in Western thinking. As Mayr (1982) points out, we may trace the concept back to Plato who likened phenomena in the natural world to geometric forms. For example, just as a triangle always has the same unchanging form and is thus discontinuous, that is, different from any other form, so are phenomena in the natural world reflections of a limited number of fixed and changeless forms, or *essences* as they came to be called. For example, any one cat, although different to varying degrees from other cats, is an example of a fixed unchanging form that defines all cats. According to an essentialistic view, genuine change can occur only through the sudden and abrupt origin of new essences or forms, a view at odds with a selectionist view of change. According to Mayr (1982), the philosophy of essentialism dominated biological thinking for almost two millennia until selectionism, first formally introduced by Charles Darwin, replaced it. More recently, Palmer and Donahoe (1992) extended Mayr's distinction between essentialism and selectionism to psychology as well. They argued that, with perhaps the single exception of the selectionist program articulated by B. F. Skinner, theorizing about human behavior, in particular by many cognitive psychologists, has been dominated by essentialistic thinking.

A clue to essentialistic thinking can often be found in the practice of formally defining terms before any functional analysis occurs. Palmer and Donahoe (1992) state that a priori formal definitions of terms can be said to have essential properties to the extent that they "precede any example of the category." For example, they point out that Noam Chomsky's concepts of *abstract structures* and *language faculty* are essentialistic in that they are wholly abstract constructs which have been posited without reference to physical mechanisms explained by scientific principles of selection. Interestingly, Chomsky viewed such constructs in the same way that Spearman viewed *general intelligence*—as inborn, fixed properties of human beings.

Many of the ways the concept of intelligence has been historically discussed reflect essentialistic thinking. For example, simply asking the question, What is intelligence? implicitly assumes that there is a quality, or essence, of human nature with essential, immutable qualities. Asking this question begins the process of reifying intelligence because it suggests that intelligence is an entity possessed by individuals that determines their behavior. Once intelligence as an essence or quality is assumed, the next logical step is to provide a formal definition. The futility of this tactic was demonstrated by Sternberg and Detterman (1986) who asked two dozen prominent theorists to define intelligence and got two dozen different definitions. After a formal definition is offered, researchers then typically construct hypotheses regarding how the essence should manifest itself in behavior, or how it can be tested or studied. All of this information may then be used to construct a research program into the nature of the essence and the processes through which it works to generate behavior. Researchers observe the actual behavior usually only as a way of understanding the underlying essence which, itself, can never be observed directly—a practice that has not gone without criticism (e.g., Schlinger, 1993).

A functional, selectionist approach follows a different path. Rather than constructing formal definitions a priori and then looking for instances of them, scientists must *discover* the definition (see Palmer & Donahoe, 1992). This is done by experimentally analyzing behavior and looking for order therein. Consider, for example, the behaviors involved in solving a particular mathematical problem. A conventional, essentialistic approach would assume that children possess mathematical abilities (i.e., intelligence) to varying degrees. It follows, then, that although we may attempt to teach all children how to solve the mathematical problem, some will learn to solve it with greater ease than others. Those who learn to solve the problem easily are said to possess more mathematical ability than those who do not. Using a functional approach, researchers might first try to determine through experimental analysis what constituent behaviors are involved in solving such problems in general and in what order those behaviors must occur. Teaching methods based on such an analysis can then be constructed to increase the chances that as many children as possible learn the behaviors. A functional approach cannot only provide better and more elegant explanations of the behavior by pointing to the variables of which the behavior of interest is a function, but it also can ensure through the application of the scientific principles that a greater proportion of children will be able to perform the behaviors under the appropriate circumstances whether it is solving mathematical problems, thinking and reasoning, or writing poetry.

Some psychologists will object to an approach that discounts questions about the nature or definition of intelligence and focuses only on the behaviors said to reflect it. Therefore, it is not unreasonable to ask whether there is really any advantage in positing the existence of intelligence separate from behavior. The answer, I believe, is no. Returning to the example above, if the only evidence for mathematical ability is the very behaviors necessary to solve the mathematical problem and from which we infer mathematical ability (or the lack thereof), then a more productive approach is to analyze the variables responsible for those behaviors. By focusing on mathematical ability, we might be distracted from understanding the function of the very behaviors that lead us to talk about that ability in the first place. Once scientists are able to produce the mathematical behaviors by arranging the variables responsible for them, talking about some construct called "intelligence" seems superfluous except perhaps, as Howe (1990) suggests, as a broad summary term or as a descriptive term in applied psychology to refer to how well someone might perform in a given context.

In contrast to an essentialistic approach, a functional approach suggests at least two different questions with respect to intelligence or any other construct. First, what behaviors in what contexts cause us to use the term *intelligence*, and second, what accounts for the behaviors? The second question is about the actual behaviors we call *intelligent*, but the first question is largely about the verbal behavior of psychologists and social theorists. We may shed some light on the answer to this question by looking at the derivation of the term *intelligence*. The word *intelligence* comes from the Latin *intellegere*, meaning to perceive or understand, from the roots *inter* meaning between or among, and *legere*, meaning to gather, pick or choose. It is interesting to note that these roots do not refer to inferred essences or qualities, but rather to behaviors, in this case, gathering, picking, and choosing. Thus, intelligence, or, more aptly, intelligent behavior, is what we observe when we say that an individual perceives (i.e., reacts to) relationships between or differences among situations.

With the emphasis shifted from intelligence as a unique quality or qualities to the actual behavior we call *intelligent*, it may be useful to revisit the logical errors made by Spearman and his intellectual descendants regarding the concept of intelligence with an eye toward correcting similar errors we make in our everyday language. First, when we speak of intelligence, we are not speaking of a thing or an entity that individuals possess and that determines their behavior. *Intelligence* is simply a descriptive term for an instance of behavior in a particular context or for a group of related behaviors (e.g., those called verbal, spatial, mathematical, etc.). We are fooled into believing that the term refers to a tangible entity because other words in our language, such as *cat* or *table*, have tangible referents. *Intelligence*, however, does not have a referent per se. *Intelligence* is like other terms such as *mind* or *personality* in that the only objective referents are the behaviors that occasion the terms. And such behaviors and their contexts are as varied as the number of different types of cats that cause us to say "*cat*," although they obviously have some common features that enable one summary term to apply to them.[3]

This simple locution has significant and radical implications for the way we talk about intelligence. Alfred Binet, the originator of the modern intelligence test, seemed to know this intuitively. Rather than referring to *intelligence*, and defining it a priori, which would have tempted him to search for the referent, Binet used an adjectival form, *intellectual skill*, where *skill* was synonymous with behavior. Once it is understood that what we speak of as *intelligence* is more appropriately spoken of as *intelligent behavior*, then we can begin to examine the variables of which the behavior is a function. Once the functional determinants of intelligent behavior are discovered, they can be altered, as Binet believed, through teaching. This optimistic view is not just wishful thinking; scientifically based teaching techniques have for years demonstrated how intelligent behavior can be effectively taught (e.g., Johnson & Layng, 1992).

[3]Howe (1990) makes a similar argument about the error of reification in which the assumption is made that just because the noun *intelligence* exists, that it refers to some underlying thing or entity.

Another significant implication of this simple change in language is that instead of the endless debate about whether there are different types of intelligence, or the differences between academic, practical, and emotional intelligence, behavior scientists can experimentally analyze the behavior in which they are interested. Moreover, they can no longer say that intelligence tests measure intelligence; rather, they measure the correctness or appropriateness of certain behaviors in contrived contexts (Schlinger, 1992). Finally, it is erroneous to say that some observed behavior occurred *because* the person was *intelligent* or *because* they possessed *intelligence*. These types of explanations simply take the name or label given to a behavior and convert it into the explanation of that very same behavior; in other words, they are circular explanations. Understanding behavior in the scientific sense means being able to specify the historical and contemporary conditions or variables necessary for its occurrence, and this is accomplished only through systematic experimentation.

From General Intelligence to Specific Skills: Toward a Functional Environmental Approach to Intelligent Behavior

Recall that even though Spearman argued for a general intelligence underlying all skills, he did posit specific factors, or *s*, that influenced specific skills or abilities. As I outlined previously, in the last two decades, some psychologists have gone beyond the concept of a unitary general intelligence and have suggested many different types of intelligence, some operating autonomously, from three (Sternberg, 1984) to seven (Gardner, 1983). Despite their apparent break from traditional intelligence theorists who accept *g* as a unitary general capacity (neither Sternberg nor Gardner signed the statement, "Mainstream Science on Intelligence," that appeared in the Wall Street Journal after the publication of *The Bell Curve*), both Sternberg and Gardner accept *g* in a restricted sense. What is important for the present argument, however, is that psychologists are gradually coming to the realization that in contrast to the approach that there is one general intelligence, measurable by standardized tests, and reflecting considerable heritability, it may be more scientifically productive to investigate individual skills in an effort to determine their causes. As a group, behavioral psychologists, like Alfred Binet before them, are already ahead of the game. Behaviorists have known for some time that *intelligence* is simply a term that refers loosely to numerous behaviors the performance of which cannot be separated from their specific contexts. Cognitive psychologists, (e.g., Howe 1989, 1996) are moving toward a more behavioral view by concentrating on a person's abilities or skills, not as reflective of any general ability or intelligence, but rather as autonomous behaviors that may be learned independently (although any two or more may share common features), and are under the control of the stimuli that define their specific context.

If psychologists really want to understand the behaviors that we call *intelligent* and that are often tested on intelligence tests, perhaps they should look at more objective variables that do not reify intelligence or posit any hypothetical constructs. A major step in that direction was taken by Hart and Risley (1995) in their longitudinal study of 40 American children from birth until 2 1/2 years of age. In this study, language interactions between children and their families were observed in the home 1 hour a month for 2 1/2 years. Of several family characteristics, including child gender and race, and whether both parents were employed, the only one that made a difference in the amount of talk a child heard was socioeconomic status. For example, 11- to 18-month-old children of professional parents heard an average of 642 utterances per hour of which 482 were addressed to the children, whereas children of welfare parents heard an average of 394 utterances of which only 197 were addressed to the children. A closer look at the data revealed strong correlations between what the parents were actually doing during interactions with their language-learning children and the children's language development. Specifically, the researchers found strong correlations between the children's cumulative vocabulary growth rate and several derived variables of family experience, in particular, language diversity (the sum of different nouns plus modifiers) and feedback tone (approval plus repetition of children's utterances divided by approval plus prohibitions). These correlations, unlike those with the families' socioeconomic status, held up at age 3, and with performance on standardized achievement and intelligence tests (i.e., IQ scores) when the children were 9 years old and in the 3rd grade. In addition, negative correlations were found between the richness of parent initiations, imperatives, and prohibitions and their children's vocabulary growth and use. In particular, children in lower SES families heard proportionally more imperatives and prohibitions from parents and siblings and they initiated verbal interactions less often.

This major study by Hart and Risley, unlike the research conducted by Spearman's intellectual descendants that relies on factor analysis, correlates the actual behaviors of parents and children in the home during the critical years of language learning and intellectual development. The results support the assertion that what the parents do at home is strongly related to the child's intellectual behaviors both at home and later in life and offers a more productive approach to understanding the genesis of some of the behaviors we call "intelligent." Such data set the stage for behavior theorists to interpret the interactions between parents and children according to the principles of operant and social learning. As a result, the ultimate causes of the children's behaviors and the importance of the first three years of life may come into sharper focus.

Counterpoint

Many psychologists may contest the assertion that intelligence is still reified in modern psychology and that it is only a label for behaviors in certain contexts. Their argument is that intelligence (or any other similar construct) is at the very least a hypothesis to be tested. If no evidence can be found for intelligence other than behaviors in certain contexts, then its value as a scientific concept is diminished. So what other evidence for intelligence is there? Intelligence theorists assert that general intelligence as measured on a variety of standardized tests correlates with a number of other educational, occupational, economic, and social variables (Jensen, 1994), as well as various CNS measures such as brain size, speed of nerve conduction, and EEG pattern (Jensen & Sinha, 1993). In assessing the potential explanatory power of the concept of intelligence, Howe (1988b) looked at 10 potential conditions, any one of which, if confirmed, could warrant using the term "intelligence" in an explanatory fashion. These conditions included the relationship between measured intelligence to observable physiological correlates, variability in basic mental processing mechanisms such as reaction time, the ability to learn and remember, and the complexity of a person's cognitive functioning, among others. Howe concluded that any observed correlations were either insupportable scientifically or there were alternative and more parsimonious explanations. Howe (1988b) explained:

> Although the possibility that an indication of a person's measured intelligence can be explanatory or informative . . . cannot be ruled out absolutely, there are no strong grounds for believing that identification of someone's measured intelligence justifies any meaningful statement about the individual's qualities, achievements, attributes, or even detailed predictions except in narrowly circumscribed circumstances. (p. 358)

Of course, intelligence theorists and behavior geneticists interested in intelligence have argued for decades that the factor analysis of scores on standardized intelligence tests provides substantial evidence for the existence of intelligence as a mental or cognitive capacity as well as for its heritability. Their claims have always rested on the legitimacy of their use of factor analysis. However, the use of factor analysis on standardized intelligence test scores has been seriously called into question by a number of authors, but none more convincing than the Harvard astrophysicist David Layzer. In 1972, just 3 years after Arthur Jensen's article, "How Much Can We Boost IQ and Scholastic Achievement?" appeared in the *Harvard Educational Review*, and just 1 year after Richard Herrnstein's article, "IQ," appeared in the *Atlantic Monthly*, Layzer, in his article "Science and Superstition: A Physical Scientist Looks at the IQ Controversy" (1972, 1995) (which has been reprinted in two edited books since) provided a comprehensive and scientific critique not only of the statistical approach taken by Spearman's intellectual descendants, but also the underlying assumptions and rationale for their research. Layzer concluded that all estimates of the heritability of IQ are "unscientific and indeed meaningless" in part because (a) the research violates the equal environment assumption mentioned previously, which in population genetic terms means that the range of relevant environmental variations is assumed to be small; (b) intelligence theorists mistakenly assume that intelligence represents a metric character like height or weight, and that IQ tests measure that character, and, relatedly, because (c) IQ tests do not measure what they purport to. Layzer (1995) explains:

> IQ does not measure an individual phenotypic character like height or weight; it is a measure of the rank order or relative standing of test scores in a given population. (p. 666)

Finally, it could be argued that "intelligence" as an unobservable hypothetical construct that determines behavior is a hypothesis to be tested and not to be rejected out of hand. This argument is based on the fact that in other scientific fields hypothesized unobservable constructs, such as extrasolar planets or genes, were subsequently confirmed after refinements in observational technology. However, as I have pointed out elsewhere (Schlinger, 1998), inferring unobserved constructs in other sciences is predicated on an already established factual base of experimentally derived relationships. The field of intelligence research has no such base and, in fact, is built solely on a correlational foundation which renders conclusions about an internal construct that we may call "intelligence" premature at best and completely misdirected at worst. Among other things, this means that any significant correlations between IQ scores and variables such as brain size or function do not necessarily confer additional meaning on *g* or intelligence. At best they represent possible neurophysiological underpinnings of behaviors, some of which might be assessed with intelligence tests. They do not, however, represent causes in any scientific sense of the term.

Why Has The Myth of Intelligence Persisted?

Given the logical problems with the concept of intelligence as it has evolved in modern psychology and problems with many of the research methods used to study it, one might ask why most psychologists persist in mythologizing it. One simple answer is that as psychology students are trained, the myth is passed on through the literature, only a small sample of which I have referenced in this article. The myth of intelligence as a distinct quality possessed by individuals, however, is not unlike the myth of personality, memory, or the myriad other distinct faculties human beings are said to possess. Thus, conceptualizing intelligence in essentialistic ways is part of a broader approach to human behavior that has persisted for centuries. It may have had its roots in primitive animistic philosophies of human behavior, but it has become the standard vocabulary of ordinary citizens. Whereas the other sciences have developed technical vocabularies distinct from the primitive ones used by early philosophers, the vocabulary of psychology, with some exceptions, is still mired in early animistic-like philosophies that place many of the causes of human behavior inside the individual in terms of mind, will, and so forth. Howe (1990) explains:

> Psychology is a difficult scientific discipline for the unusual reason that we come to it already furnished with firm habits of thought that have been acquired from daily exposure to folklore and the unscientific (and sometimes illogical) "commonsense" psychological thinking that permeates everyday life. (p. 490)

Another reason that some psychologists persist in believing in intelligence is that they have a significant personal and professional investment in it. For example, those of Spearman's intellectual descendants who continue to assert the heritability of general intelligence do so, at least in part, because of a strong bias in favor of heritability and against environmental determinants of intelligence. Beckwith (1999) writes:

> What the history of IQ research shows is that fundamental assumptions or mind-sets that permeate the field reflect *ab initio* attitudes toward the relative importance of environment in the development of human behaviors and aptitudes. (p.168)

And contrary to claims by some intelligence theorists that their conclusions about general intelligence and its heritability have no *ab initio* implications for social policy, ever since Galton first posited the heritability explanation of individual differences and eugenics as a solution to a general decrease in intelligence, the initial assumptions of those who conduct intelligence research have repeatedly been used to promote social policy (Beckwith, 1999). Beckwith notes:

> What is most striking about this state of affairs is that the simplifying assumptions practically dictate the conclusions. The research field appears to have been imbued with a social perspective from its outset to its presentation to the public. (1999, p. 168)

Coda

Intelligence, then, as an essence or quality, is a myth. *Intelligence* is first and foremost a word that psychologists and others use to refer to various behaviors in varying contexts. It may be useful for social reasons to distinguish between behaviors that are more relevant to academic, practical, or emotional contexts, or to subdivide and categorize behaviors according to other socially relevant criteria. However, we should remember that these are not scientific distinctions, at least not yet. At best they are arbitrary social distinctions (verbal discriminations), regardless of whether they turn out to be useful or not. Even the recent report on intelligence issued by the Task Force established by the American Psychological Association concluded: "Because there are many ways to be intelligent, there are also many conceptualizations of intelligence" (Neisser et al., 1996, p. 95). Taken to its extreme, we could potentially postulate a different kind of intelligence for each instance of intelligent behavior observed. Palmer and Donahoe (1992) remind us, however, that although we are free to define such categories as we please, they may not reflect distinctions in nature. It is for scientists to determine the natural lines of fracture of the particular phenomenon under study, and they will do so by finding order in the subject matter through experimentation.

Psychologists who take a more functional approach will necessarily follow a different path than traditional intelligence researchers have. A functional route will have Alfred Binet, E. L. Thorndike, and B. F. Skinner as the progenitors rather than Francis Galton and Charles Spearman and it will emphasize behaviors that we call intelligent rather than statistical constructs. It will consist of experimental (rather than correlational) methods for determining the controlling variables of the behavior and will emphasize teaching methods based on discovered functional units of behavior. Rather than debating the unresolvable question of whether some statistical factor, *g*, is heritable, those interested in intelligent behavior will recognize that although nature and nurture interact to produce human behavior, the hallmark of human beings is a flexible central nervous system which is especially sensitive to environmental input early in life. Overall, this more functional approach will lead to new ways of thinking about how the environments of human beings can be structured to generate more intelligent behavior.

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