FEATURE ARTICLES

EDITOR'S COMMENT: *In this series of articles Dr. Keith E. Stanovich, of the Ontario Institute for Studies in Education, proposes that we more carefully consider the role of intelligence in definitions of learning disabilities. Dr. Robert J. Sternberg, Yale University, and Dr. Kenneth A. Kavale, University of Iowa, give their reactions to his suggestions. Dr. Stanovich then responds to these professionals and expands upon his original suggestions. Readers' comments are encouraged, in the form of Letters to the Editor or Forum articles, and will be printed as space permits.*—**JLW**

Dysrationalia: A New Specific Learning Disability

Keith E. Stanovich

The concept of selective deficit is the foundation of most conceptual definitions of learning disability. Such definitions have tended to implicate the construct of intelligence in the conceptualization of learning disability and have led to the use of IQ test scores to operationalize the notion of aptitude–achievement discrepancy. The learning disabilities field is only beginning to grapple with the implications of its reliance on the concept of psychometrically defined intelligence. For example, discrepancy-based definitions of learning disabilities guarantee that such disabilities will become more or less prevalent depending on the comprehensiveness of the set of skills assessed on IQ tests. Unlike the vernacular concept of intelligence—which is quite broad—psychometric operationalizations reflect only a thin slice of the mental domain that might be considered cognitive. Thus, it is possible that we have not exhausted the potential set of discrepancy-based disabilities. As a demonstration proof, a new discrepancy-based disability category is proposed and defended in this paper. The disability is one that may force more careful consideration of the role that intelligence plays in conceptual and operational definitions of learning disabilities.

The central assumption that underlies the concept of a learning disability is the idea of selective cognitive deficit: that individuals can display deficits only in a restricted domain of cognitive functioning, and, therefore, educational interventions in Domain A should be different for children who have deficits only in that domain, as opposed to children who have deficits in Domain A that are accompanied by a variety of other cognitive dysfunctions. In educational practice, the concept of selective deficit became tied to the construct of intelligence and was operationalized by the use of IQ tests. However, the learning disabilities field has only recently begun to come to grips with the fact that linking the concept of a learning disability to the construct of intelligence automatically transfers all of the empirical and theoretical controversies surrounding the latter to the former (Lyon, 1987; Siegel, 1989, in press; Stanovich, 1989, 1991; Torgesen, 1986, 1991). In this article I wish to illustrate how the somewhat arbitrary composition of IQ tests, as well as changing assumptions about what the concept of intelligence is, could spawn new disability categories that perhaps have not been thought of before.

The Centrality of IQ

It is easy to illustrate that intelligence plays a leading role in both conceptual and operational definitions of learning disabilities (Hammill, 1990). The landmark Education for All Handicapped Children Act (P.L. 94-142), passed in 1975, contained a conceptual definition stating that

> specific learning disability means a disorder in one or more of the basic psychological processes involved in understanding or in using language spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations. The term includes such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. The term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage. (Hammill, 1990, p. 77)

This definition highlighted the well-known "exclusionary criteria" that caused much controversy (e.g., Applebee, 1971; Ceci, 1986; Doehring, 1978; Eisenberg, 1978; Rutter, 1978). In particular, the definition excluded children of low intelligence from the learning disability classification, along with those who suffered from inadequate environments and those who under-

achieved due to lack of educational opportunity.

The conceptual definition of learning disability that is currently most widely accepted is that of the National Joint Committee on Learning Disabilities (NJCLD) (see Hammill, 1990). It reads, in part:

> Learning disabilities is a general term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquistion and use of listening, speaking, reading, writing, reasoning, or mathematical abilities. These disorders are intrinsic to the individual, presumed to be due to central nervous dysfunction, and may occur across the life span. . . . Although learning disabilities may occur concomitantly with other handicapping conditions (for example, sensory impairment, mental retardation, serious emotional disturbance) or with extrinsic influences (such as cultural differences, insufficient or inappropriate instruction), they are not the result of those conditions or influences. (Hammill, 1990, p. 77)

Various learning disabilities are defined in a similar way in the DSM-III-R (American Psychiatric Association, 1987). For example, the key diagnositic criterion for developmental reading disorder in DSM-III-R is as follows: "Reading achievement, as measured by a standardized, individually administered test, is markedly below the expected level, given the person's schooling and intellectual capacity (as determined by an individually administered IQ test)" (p. 44). As Shepard (1980) noted, "All LD definitions, either by connotation or denotation, rest on this discrepancy between achievement and ability. LD children are thereby distinguished from slow learners, who have low achievement but are presumably learning as fast as they are able" (p. 80). For example, one purpose of the so-called exclusionary criteria (which rule out mental retardation, socioenvironmental influences, etc. as causes; see Rutter, 1978) is to screen out generically poor cognitive functioning.

Operationally, researchers and practitioners have turned to the IQ test to screen out generically poor cognitive functioning and positively identify selective impairment. Thus, in the area of reading disability, the idea of measuring aptitude-achievement discrepancies gained popularity among school personnel—with IQ test performance representing general aptitude. Formulas based on IQ test and achievement test performance have been (and continue to be) the main criteria schools have used in defining this reading disability (Frankenberger & Fronzaglio, 1991; Frankenberger & Harper, 1987; Kavale & Nye, 1981; Reynolds, 1985). Despite repeated admonitions that disability classification should be multidimensional (Johnson, 1988), the formal or informal assessment of IQ-achievement discrepancy has dominated both educational practice and research in the area of reading disability (Frankenberger & Fronzaglio, 1991; Stanovich, 1991).

The way that reading disability has been operationalized invites, by analogy, the recognition of other disabilities when certain behavioral domains are found to be out of kilter with intelligence test performance. For example, in the report to the Interagency Committee on Learning Disabilities, established by the U.S. Health Research Extension Act of 1985 (Kavanagh & Truss, 1988), the analogy was extended to social skills, which, according to the Interagency definition, is a domain in which a learning disability can occur. Similarly, the diagnostic criterion for developmental arithmetic disorder (sometimes termed *dyscalculia*) in DSM-III-R is that "arithmetic skills, as measured by a standardized, individually administered test, are markedly below the expected level, given the person's schooling and intellectual capacity (as determined by an individually administered IQ test)" (American Psychiatric Association, 1987, p. 42).

Clearly, intelligence test performance has become a benchmark for measuring the aptitude-achievement discrepancy that has become the quintessence of the concept of learning disability (see Note). However, the learning disabilities field is only beginning to display some awareness that empirical evidence supporting some of the assumptions that have led to our reliance on IQ is lacking. For example, one problem that is beginning to be recognized is that the foundational assumption that poor behavior in a domain is different whether or not it is accompanied by intelligence deficits has been inadequately investigated. It is still unclear, for instance, whether poor readers with and without IQ discrepancy respond differently to educational treatments, whether they have different prognoses, and whether they have different cognitive profiles of reading-related cognitive subskills (McKinney, 1987; Rispens, van Yeren, & van Duijn, 1991; Share, McGee, McKenzie, Williams, & Silva, 1987; Share, McGee, & Silva, 1989; Siegel, 1989, in press; Stanovich, 1991; van der Wissel, 1987). However, rather than dwelling on the inadequacy of current evidence, which I have discussed elsewhere (see Stanovich, 1991), in the remainder of this article I would like to focus attention on how the reliance on the construct of intelligence (and IQ tests) in the learning disabilities field threatens to create further conceptual and practical problems for the field if current trends continue.

Have We Found All the Disabilities Yet?

The logic of discrepancy-based classification based on IQ test performance has created a clear precedent whereby we are almost obligated to create a new disability category when an important skill domain is found to be somewhat dissociated from intelligence. Dyscalculia provides one clear example, and the debate about the status of learning disabilities in the domain of social skills provides another (Hammill, 1990; Hazel & Schumaker, 1988). One logical corollary of this past practice is that the less comprehensive IQ tests are, the more such domains there will be; or, conversely, the more comprehensive

and exhaustive the set of skills tapped by IQ tests, the fewer candidates for additional discrepancy-based disability categories there will be. Unfortunately, there seems every reason to believe that we are in the former situation.

Almost all critics of IQ tests make the argument that these instruments ignore many important domains of cognitive/behavioral functioning (e.g., Block & Dworkin, 1976; Ceci, 1990; Davidson, 1990; Evans & Waites, 1981; Gardner, 1983, 1986; Gould, 1981; Hilliard, 1984; Neisser, 1976; Owen, 1985). Such critics often point out that the cognitive domains that these instruments actually assess are only a small subset of the larger set of skills that are folded into the vernacular concept of intelligence. For example, studies of the layperson's concept of intelligence consistently demonstrate that it encompasses practical problem solving, creativity, and social skills (Sternberg, Conway, Ketron, & Bernstein, 1981)—none of which are tapped by the conventional IQ tests that are used for learning disability classification. Finally, the literature on practical intelligence and recent research on the domain-specificity of performance differences both serve to focus attention on the narrowness of the psychometrically defined intelligence concept (see Ceci, 1990; de Bono, 1991; Gardner, 1983; Resnick, Levine, & Teasley, 1991; Rogoff & Lave, 1984; Sternberg & Wagner, 1986; Voss, Perkins, & Segal, 1991).

Thus, criticisms of IQ tests are often motivated by the impression that IQ tests are leaving something out. Naturally, the something that is left out is logically more likely to be discrepant from IQ than is a domain that is represented on the tests. When a discrepancy occurs in an area that is deemed important, we have the makings of a situation in which we may feel pressure to create a disability category. Given the standard way of operationalizing learning disabilities, the field will always be hard-pressed—from a legal or a conceptual point of view—to deny such a request for a new disability category. It is mere hubris to think that our current jury-rigged definitions cover all of the potential domains that a concerned public might view as candidates for educational intervention.

A New Disability

In short, the very narrowness of the cognitive domains tapped by IQ tests could potentially spawn a plethora of disability categories as yet unrecognized, if the logic of current discrepancy-based classification continues to be a key feature of the learning disabilities construct in research and in practice. I wish to demonstrate this point by proposing a new disability category. The new psychological disability arises from the possibility of deficits in a set of thought processes, behaviors, and dispositions that are not the same as the capacities tapped on current IQ tests and that, therefore, can become severely dissociated from IQ test performance. These behavioral dispositions and thought processes are often folded into the vernacular concept of intelligence and thus are deemed important by the general public.

The new disability is called *dysrationalia*. The proposed definition of the disability is as follows:

> Dysrationalia is the inability to think and behave rationally despite adequate intelligence. It is a general term that refers to a heterogeneous group of disorders manifested by significant difficulties in belief formation, in the assessment of belief consistency, and/or in the determination of action to achieve one's goals. Although dysrationalia may occur concomitantly with other handicapping conditions (e.g., sensory impairment), it is not the result of those conditions. The key diagnostic criterion for dysrationalia is a level of rationality, as demonstrated in thinking and behavior, that is significantly below the level of the individual's intellectual capacity (as determined by an individually administered IQ test).

Examples of Dysrationalia

As is the case with all learning disabilities that are currently recognized, borderline cases of dysrationalia may be difficult to classify; however, extreme instances of dysrationalia are very easy to identify. Consider, for example, the two former schoolteachers in Illinois who, convinced that the Holocaust was a myth, withdrew their child from a local school that included discussion of the Holocaust in its history curriculum ("The Holocaust's," 1990). Presumably their previous college education and careers as schoolteachers are indications of at least adequate intelligence; yet, they have sent 6,000 letters to local parents and teachers, and a letter to every member of Congress, because they feel that "we can't let Western civilization live forever with these myths" (p. 52). Here is a clear case of a severe problem in belief formation despite adequate intelligence.

As a further example, consider a survey on paranormal beliefs taken of members of a Mensa club in Canada (Chatillon, 1989). Mensa is a club restricted to high-IQ individuals and one must pass IQ-type tests to be admitted. Yet, 44% of the members of this club believed in astrology, 51% believed in biorhythms, and 56% believed in the existence of extraterrestrial visitors—all beliefs for which there is no valid evidence (Frazier, 1981; Hines, 1988; Klass, 1983).

Further anecdotal evidence is not hard to generate. There are numerous examples of famous individuals, noted for their intelligence, who displayed persistently irrational behavior. Philosopher Martin Heidegger, a conceptual thinker of world renown, was a Nazi apologist and used the most specious of arguments to justify his beliefs (Farias, 1989). He organized paramilitary camps for his students and often signed correspondence "*Heil Hitler*" (Farias, 1989). Famed scientist William Crookes, discoverer of the element thallium and a Fellow of the Royal Society, was repeatedly duped by spiritualist "mediums" but never gave up his belief in spiritualism (Brandon, 1983). Arthur Conan Doyle, creator of Sherlock Holmes, was likewise a no-

torious dupe for mediums (Brandon, 1983; Randi, 1980). The renowned poet Ezra Pound spent most of World War II ranting Fascist propaganda on Italian radio broadcasts (Torrey, 1984). These examples could be extended almost indefinitely (see Brandon, 1983; Bulgatz, 1992; Dawes, 1988; Lehman, 1991; Moore, 1977; Muller, 1991; Randi, 1980; Stenger, 1990). Of course, we must distinguish isolated instances of dysrationalia from enduring dispositions. Additionally, we must differentiate dysrationalic thinking that occurs only in highly specific domains from suboptimal processes of belief formation that operate more universally. However, many of the examples listed above do seem to represent enduring styles of evidence evaluation that generalized across several domains of thinking (e.g., Farias, 1989; Torrey, 1984). Clearly, then, there can be striking dissociations between intelligence and rational thinking.

As is the case with most learning disabilities, early identification of dysrationalia may be difficult. Nevertheless, some psychological research on the development of cognitive styles and critical thinking has focused on the childhood precursors of adult dysrationalia: premature closure, belief perseverance, lack of motivation for generating alternative explanations, an absolutist orientation toward knowledge, resistance to new ideas, dogmatism about beliefs, and lack of reflectiveness (Baron, Badgio, & Gaskins, 1986; Baron, Granato, Spranca, & Teubal, 1993; Baron & Sternberg, 1987; Chandler, Boyes, & Ball, 1990; Graumlich & Baron, 1991; Harrington, Block, & Block, 1978; Kitchener & Brenner, 1990; Kuhn, 1989; Perry, 1970; Shafrir & Pascual-Leone, 1990).

A Model of Rational Thinking

Let us now flesh out some of the details in the proposal to recognize a new psychological disability known as dysrationalia. Clearly, the proposal necessitates recognition of a distinction between intelligence and rationality. It forces us to acknowledge that our commonly employed measures of intelligence—IQ tests—do not assess something important: rationality. Obviously, to more fully understand the disability of dysrationalia we need a model of rationality and rational thinking. Because of space constraints I will be able to present only the most simplified of models. We know much more about rational thinking than I can illustrate here. For more extensive theoretical discussions and empirical research on rational thinking processes, the reader is referred to Arkes (1991); Baron (1985, 1988); Brown (1988); Cherniak (1986); Cook and Levi (1990); Dawes (1988); Evans (1989); Fischhoff and Beyth-Marom (1983); Goldman (1986); Kuhn (1991); and Nisbett and Ross (1980).

We must begin by distinguishing between cognitive capacities and rational thinking dispositions in the manner suggested by Baron (1985, 1988). *Capacities* refers to the cognitive processes studied by information-processing researchers seeking the underlying bases of performance on IQ tests. Perceptual speed, discrimination accuracy, working-memory capacity, and the efficiency of the retrieval of codes stored in long-term memory are examples of cognitive capacities that underlie traditional psychometric intelligence (Cooper & Regan, 1982; Estes, 1982; Hunt, 1978, 1987; Jensen, 1982; Vernon, 1987). *Rational thinking dispositions,* in contrast, are better viewed as cognitive styles (see Baron, 1985) that relate to the adequacy of belief formation and decision making, for example, "the disposition to weigh new evidence against a favored belief heavily (or lightly), the disposition to spend a great deal of time (or very little) on a problem before giving up, or the disposition to weigh heavily the opinions of others in forming one's own" (Baron, 1985, p. 15).

A simplified model of the components of rational thinking is presented in Figure 1 (see Elster, 1989, p. 4, for a related scheme). The figure distinguishes three components of rational thinking: belief formation, belief/desire consistency, and action determination. The connections labeled *A* refer to the process of belief formation: how information about the external world serves to fix beliefs. Modeling of the external world by beliefs can range from good to poor and, in the extreme, it may become so poor that we want to call it irrational (presumably, some problem in belief formation characterizes the Illinois ex-teachers).

In Figure 1, the double-headed arrows labeled *B* refer to relations among beliefs and relations among desires and represent the process of consistency assessment. Belief inconsistency detection is an important determinant of rationality for a variety of reasons. Belief inconsistency might be a sign that belief formation processes have operated suboptimally. Also, belief inconsistency signals that the beliefs and desires that are used in the processes of action determination might be expected to result in a less-than-satisfactory outcome. Finally, the box labeled *C* refers to the processes of action determination: the processes that use beliefs about the world to determine which actions will lead to desire satisfaction.

The general model of rationality presented in Figure 1 begs one very important issue in the study of thinking and decision making: the issue of the potential domain specificity of the three general mechanisms identified. It is possible, for example, that processes of belief formation (covariation detection, etc.) vary in efficiency depending on the particular domain in which the individual is currently operating. Although the literature is not without some hints of domain generality (e.g., Alcock & Otis, 1980; Blackmore & Troscianko, 1985; Campbell & Tesser, 1983; Fong, Krantz, & Nisbett, 1986; Fong & Nisbett, 1991; Lehman & Nisbett, 1990; Wierzbicki, 1985), this issue remains largely uninvestigated and is a contentious one in discussions of critical thinking and rationality (Adams, 1989; Ennis, 1989; Lipman, 1991; McPeck, 1990a, 1990b; Nisbett, Fong, Lehman,

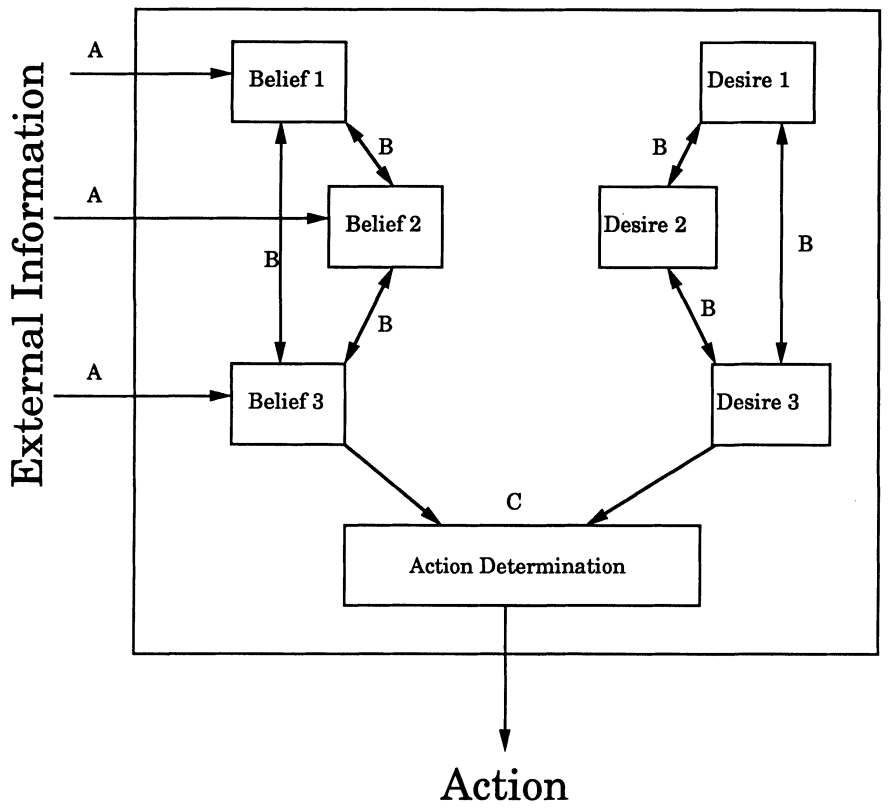

FIGURE 1. A model of the components of rational thinking. Label A represents the process of belief formation, label B represents the process of belief/desire consistency assessment, and label C represents the process of action determination.

& Cheng, 1987; Siegel, 1988; Swartz, 1987). However, it should not be surprising that the issue of domain specificity is unresolved in the area of rational thinking, because it is still debated vigorously in the literature on cognitive capacities (e.g., Ceci, 1989, 1990; Ennis, 1989; Glaser, 1984; Perkins & Salomon, 1989; Sternberg, 1989), even after decades of intense investigation into the nature of intelligence.

Finally, the tripartite differentiation of the components of rational thought and behavior in Figure 1 is overly simplified, because it ignores several critical processes, such as the formation of desires, and how beliefs modify desires and vice versa (Elster, 1983). An important complication that should be noted is the possibility that desires modify processes of belief formation and inconsistency detection (Kunda, 1990). This notion is pictured in Figure 2, where it is clear that one of the things affecting belief formation and consistency assessment may well be information (or interference) from desires themselves (see arrows labeled *D*).

Although research is in its infancy, we have made some clear progress in studying the subcomponents of the model of rational thinking identified in Figures 1 and 2. For example, tasks have been developed to assess important components of belief formation, such as the ability to properly infer causation (Kuhn, Amsel, & O'Loughlin, 1988; Nisbett & Ross, 1980); isolate variables (Kuhn et al., 1988); detect covariation (Kunda & Nisbett, 1986); utilize falsification strategies (Beattie & Baron, 1988; Evans, 1989); and coordinate theory and evidence (Holland, Holyoak, Nisbett, & Thagard, 1986; Kuhn, 1989, 1991, 1993). Some seminal work on the ability to detect inconsistency in beliefs has been carried out (Evans & Wason, 1976; Wason, 1977). Finally, investigations have been carried out on factors that affect the determination of action, such as the ability to utilize probabilistic information (Arkes & Hammond, 1986; Dawes, 1988; Fong et al., 1986; Kahneman, Slovic, & Tversky, 1982); the tendency to honor sunk costs (Arkes & Blumer, 1985; Baron et al., 1993); the tendency to ignore opportunity costs (Larrick, Morgan, & Nisbett, 1990); and being overly sensitive to the framing of questions (Kahneman, 1992; Kahneman & Tversky, 1984). Additionally, research on rational thinking skills does appear to generalize to nonlaboratory situations (Dawes, 1988; Earl, 1990; Gilovich, 1991; Saks & Kidd, 1980; Stanovich, 1992; Thaler, 1992).

Dissociations Between Rational Thinking Dispositions and Cognitive Capacities

Although, as previously noted, the model presented here is clearly oversimplified, it does provide a context sufficient for illustrating how the information-processing capacities that underlie IQ test performance might relate to these three components of rationality. The strongest relationship would appear to occur in the domain of belief/desire inconsistency detection. There must be some computational limits on consistency assessment in a network of beliefs and desires (see Cherniak, 1986), and there may well be individual differences in these computational limits. These limitations may also be related to the capacity limits studied in traditional intelligence research. It is conceivable that processes such as working memory capacity and long-term memory retrieval efficiency might enter into the assessment of the consistency in a belief network. Because the effectiveness with which these processes operated would set

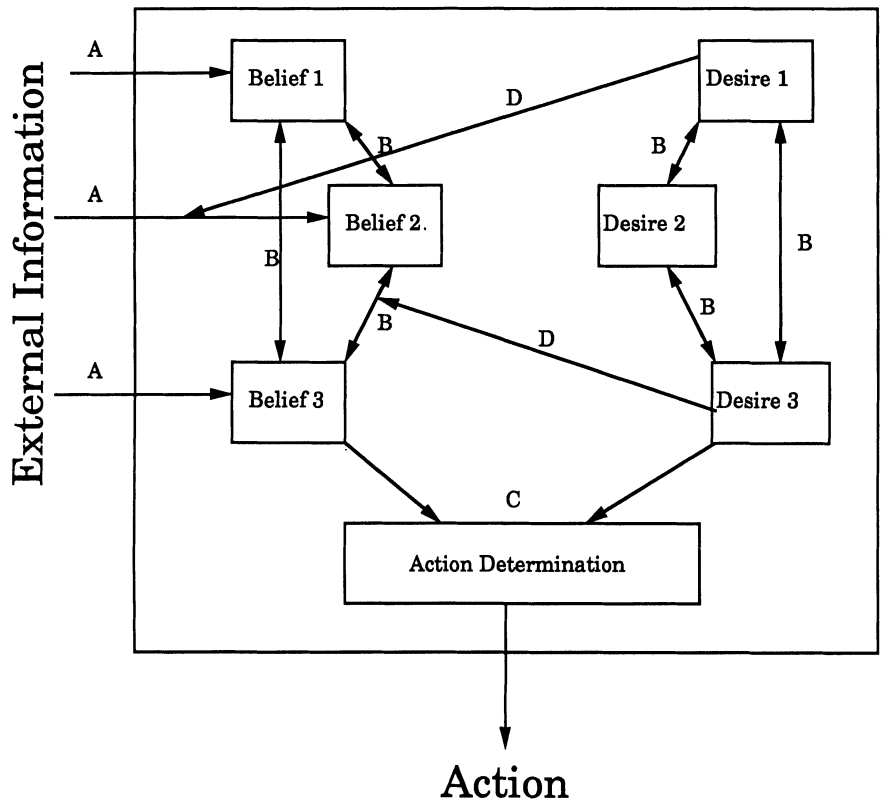

FIGURE 2. A model of the components of rational thinking indicating the possibility of desires influencing the processes of belief formation and belief consistency assessment.

limits on the adequacy of consistency determination, cognitive capacities—that is, intelligence, traditionally conceived—would bear some relation to rational thought and action. Nevertheless, even here, the disposition to *search* for inconsistencies (Baron, 1985, 1988)—surely a major determinant of belief-network consistency—might well be virtually unrelated to any subcomponents of intelligence or capacity limitations. Certainly there is no logical relation between the disposition to search for inconsistency and basic information-processing capacities.

This is even more true in the domain of action determination. Here again, it is possible to see how memory capacities and retrieval speed might help in recruiting the right information to enable action to satisfy desires. On the other hand, tendencies to search widely for beliefs relevant to action determination (Baron, 1985, 1988) could be largely dissociated from cognitive capacities.

Finally, it would seem that the processes of belief formation might be most dissociated from cognitive capacities. There is, for example, some empirical evidence indicating that processes of evidence evaluation can sometimes be strikingly independent of IQ (Ceci & Liker, 1986; King, Kitchener, Davison, Parker, & Wood, 1983; Kitchener & Brenner, 1990; Kitchener & King, 1981; Lesser & Paisner, 1985). Apparently, cognitive capacities are no insurance against beliefs being distorted by desires. This is important, because problems in belief formation appear to be the most prominent cause of dysrationalia. For example, research on belief in so-called "paranormal" phenomena has repeatedly uncovered persistent, and sometimes intractable, problems in belief formation (Alcock, 1981, 1990; Hines, 1988; Randi, 1987). The main mechanism (see Alcock, 1981, 1987; Brandon, 1983; Moore, 1977) appears to be one of wish fulfillment: Desires are interfering with processes of belief formation to an unusual extent (the process labeled *D* in Figure 2).

Clearly, then, the cognitive processes that determine rationality are not the same as those assessed by standard IQ measures developed within the psychometric tradition. Thus, the theoretical conditions allowing dissociations between cognitive capacities and rational thinking dispositions are present. There is, as well, some empirical evidence demonstrating such dissociations (e.g., Kitchener & Brenner, 1990; Lesser & Paisner, 1985; Perkins, Farady, & Bushey, 1991), to go along with many striking individual examples, such as those previously discussed. In fact, if we were to emphasize *only* some startling cases of dissociation as justification for considering a syndrome of dysrationalia, we would be following in the well-worn footsteps of other disabilities, such as dyslexia—the interest in which continues to be fueled by startling case studies of dissociation (Doris, 1986; Monaghan, 1980; Patterson, Marshall, & Coltheart, 1985).

Objections to Dysrationalia

In this section, I will address some possible objections to the idea of defining the new disability of dysrationalia, and I will give rejoinders to these objections. However, I will preface the discussion of the objections by calling attention to the general form that will characterize many of the rejoinders: that the conceptual problems involved in admitting the concept of dysrationalia are no more formidable than those inherent in other discrepancy-based categories that have become reified in current professional, legal, and research practice. The choice is to accept dysrationalia as a viable concept, or else the rationale for currently accepted learning disabilities will be undermined.

Let us now consider some objections to dysrationalia.

1. Objection: Rationality cannot be measured.

Reply: The dispositions toward rational thought and behavior are, in principle, no less measurable than the capacities traditionally viewed as underlying intelligence. The latter have simply been the subject of much more intense investigation. This is not to deny the difficult problems presented by the concept of rationality (Cohen, 1981; Goldman, 1986; Stich, 1990). It must be stressed, however, that most of the purely philosophical arguments against the possibility of assessing individual differences in rationality (see Cohen, 1981; Davidson, 1984; Dennett, 1978; Stich, 1990) could be turned against the traditional concept of intelligence. This is particularly so when intelligence is taken to encompass abilities relevant to adapting to the environment or to attaining the individual's goals (Baron, 1985; Stich, 1990).

In fact, the "impossibility of measurement" argument has repeatedly been put forth by critics of the intelligence concept. Because the concept of learning disability, as traditionally conceived, is crucially dependent on some notion of intelligence (Siegel, 1989; Stanovich, 1991), it would behoove those who are supporters of our traditional categories of learning disability not to put intelligence in jeopardy by attacking the idea of operationalizing rationality.

2. Objection: But we have no standardized tests of rational thinking.

Reply: This is true enough, but it is hardly a reason to reject the concept of dysrationalia. In fact, given the myriad criticisms of tody's standardized IQ tests—which, for the most part, congealed into their present form decades ago—it is questionable that we should view the lack of established tests of rationality as a drawback. The fact that IQ tests took form *before* the cognitive revolution, and the concomitant explosion in information-processing assessment methods, has been a constant source of grief for the intelligence field. Actually, if we do ever decide to construct standardized devices to assess processes of rational thinking, we will benefit from the extended discussion of the mistakes that have been made in constructing standardized instruments for assessing cognitive capacities.

Indeed, rationality measures will benefit from not having the "cart before the horse" history that characterizes IQ tests. With the exception of a few "critical thinking" tests (Ennis & Millman, 1985; Watson & Glaser, 1980), we lack any history of measuring individual differences in rational thinking via standardized instruments. This means that we will have a chance to get a more conceptually coherent foundation of methods and theory laid down before the construction of standardized instruments begins to limit conceptual development. Preliminary work has been done on many individual components of rational thought, and some of this work was cited previously. We know a considerable amount about the ability to properly infer causation, to utilize probabilistic information, to detect covariation, to isolate variables, to detect inconsistency in beliefs, to utilize falsification strategies, and to coordinate theory and evidence (see Arkes & Hammond, 1986; Baron, 1985; Dawes, 1988; Evans, 1989; Kahneman et al., 1982; Kuhn, 1991; Nisbett & Ross, 1980). Relatively reliable operational methods of assessing rational thinking components have been developed, such as covariation detection (Arkes & Harkness, 1983; Kunda & Nisbett, 1986; Shaklee & Paszek, 1985; Wasserman, Dorner, & Kao, 1990); the ability to isolate variables (Farris & Revlin, 1989; Tschirgi, 1980); and the ability to calibrate knowledge (Arkes, Christensen, Lai, & Blumer, 1987; Fischhoff, 1988). This work will provide the foundation for future assessment devices, if such devices are deemed desirable.

3. Objection: Learning disabilities concern difficulties in school. Rationality is not an academic subject.

Reply: Neither are social skills, but they are included in the definition of the Interagency Committee on Learning Disabilities (Kavanagh & Truss, 1988). For that matter, neither are "reasoning" or "listening," but they are likewise included in the Interagency definition and in the definition of the National Joint Committee on Learning Disabilities (Hammill, 1990).

4. Objection: But social skills, reasoning, and listening are critical to functioning in a variety of domains, including functioning in academic settings.

Reply: So is rationality, to some extent. But an important point is being made here. Perhaps it *is* easier for a person with dysrationalia to successfully negotiate his or her way through our current educational institutions than it is for a person who has some other learning disability. But is this a good thing? Perhaps defining a disability of dysrationalia would focus our schools on areas of thinking that are currently neglected. There is little question that the social consequences of dysrationalia are profound. A U.S. Committee of Congress (House Select Committee on Aging, 1984) estimated that, in 1984, $10 billion was spent on medical quackery. Pyramid sales schemes exist in virtually every community in the United States, and not a year goes by in a community of any size without one going bust and causing financial distress to its participants. Wishful thinking, a key diagnostic indicator of dysrationalia (Baron, 1988; Svenson, 1981; Weinstein, 1980, 1987), was a contributor to the huge savings and loan scandal in the United States in the late 1980s (Pizzo, Fricker, & Muolo, 1991; White, 1991), the economic effects of which will be felt for years to come. It is thus clear that the collective effects of dysrationalia are considerable. Its cost to society is high—probably at least as high as that of dyslexia, the most prevalent learning disability and the one that has received the most research effort and educational attention.

Focusing schools on teaching rational thinking and decision-making skills would be in the spirit of calls for prac-

tical education with real-world relevance. Probably nowhere in the curriculum, outside of literacy itself, would there be so many direct real-world consequences linked to what is taught. Because of faulty decision making and suboptimal rational thinking skills, physicians choose less effective medical treatments (McNeil, Pauker, Sox, & Tversky, 1982); people fail to accurately assess risks in their environments (Stanovich, 1992, pp. 61–62); information is misused in legal proceedings (Saks & Kidd, 1980); millions of dollars are spent on unneeded projects by government and private industry (Dawes, 1988, pp. 23–24); animals are hunted to extinction (Gilovich, 1991, p. 5); billions of dollars are wasted on quack medical remedies (Gilovich, 1991; House Select Committee on Aging, 1984); unnecessary surgery is performed (Dawes, 1988, pp. 73–75); and costly financial misjudgments are made (Thaler, 1992; Willis, 1990). Finally, certain decision-making domains, such as contraceptive use, drug use, and driving habits, are particularly relevant for adolescents (Furby & Beyth-Marom, 1992).

Finally, a consideration of dysrationalia might help to provoke some needed discussion about why the selection mechanisms used by society and schools tap only cognitive capacities and ignore rationality. Given the social consequences of rational versus irrational thinking outlined previously, the practical relevance of this domain of skills cannot be questioned. Furthermore, the issue of the differential privileging of some thinking skills over others deserves some discussion. For example, Ivy League colleges or selective flagship state universities in the United States are selecting society's future elite (selection mechanisms in other countries have a similar logic despite surface dissimilarities). What societal goals are served by the selection mechanisms (e.g., SAT tests) that they use? Social critics have argued that it is the goal of maintaining an economic and social elite (Aronowitz & Giroux, 1985; Bowles & Gintis, 1976; Oakes, 1985). But the social critics seem to have generally neglected to ask another type of question: "Why select for capacities and ignore rationality? Whose interests are served by our almost exclusive focus on cognitive capacities, and who is disadvantaged by our doing so?" For example, it is an interestingly open question as to whether race and social class differences on measures of rational thinking would be found to be as large as those displayed on tasks tapping cognitive capacities.

Is society well served by this bias in our valuation of thinking skills? As de Bono (1991) argued,

> Many people with a high intelligence actually turn out to be poor thinkers. . . . For example, a highly intelligent person may take up a view on a subject and then defend that view (through choice of premises and perception) very ably. The better someone is able to defend a view the less inclined is that person actually to explore the subject. (p. 159)

In a telling thought experiment, Baron (1985) hypothesized that if we were to give everyone a harmless drug that would increase their cognitive capacities (discrimination speed, STM capacity, etc.), it is likely that people would simply go about their usual business more efficiently—that they would carry on using the same ineffective medical treatments, keep making the same poor financial decisions, keep voting against their interests, keep misassessing environmental risks, and continue making other suboptimal decisions. In contrast, increasing the rational thinking skills previously defined—processes of accurate belief formation, belief consistency assessment, and action determination—might really improve our own lives and those of others.

5. Objection: The cognitive capacities of intelligence and the components of rationality might be more intertwined than has been suggested. For example, it was hypothesized that short-term memory processes, memory retrieval mechanisms, and so forth might be implicated in the assessment of belief consistency. If these and other cognitive capacities could be implicated in the processes of belief formation and action determination, then intelligence and rationality may be more coextensive than has been implied.

Reply: Of course, the magnitude of the correlations between cognitive capacities and rational thinking processes is an empirical question. Nevertheless, even a substantial relationship would leave enough room for dissociations of the type that would define dysrationalia. Scores on reading comprehension tests and IQ tests can be correlated as high as .60 to .70 in samples of adults (Harris & Sipay, 1985; Stanovich, Cunningham, & Feeman, 1984), yet this still leaves enough room for the dissociations that define dyslexia to occur. It is unlikely that cognitive capacities and rational thinking skills correlate any higher than this.

6. Objection: The definition of dysrationalia presented herein does not contain parallels to the stipulations of the NJCLD definition that a learning disability be (a) "intrinsic to the individual," (b) "due to central nervous system dysfunction," and (c) not the result of "extrinsic influences," such as cultural differences or inappropriate instruction. Likewise, the Interagency definition rules out "socioenvironmental influences" as causes of learning disabilities.

Reply: These parts of the NJCLD definition are remnants of the old "exclusionary criteria" that were once used to define learning disabilities and that have received voluminous criticism (Ceci, 1986; Doehring, 1978; Rutter, 1978). These particular aspects of the NJCLD definition are problematic because they assume a causal model of learning disability that we simply do not have (Coles, 1987; Senf, 1986; Siegel, 1989; Stanovich, 1991). In fact, they create a conceptual muddle that will continue to bedevil the learning disabilities field for some time. For example, it is not clear just what "intrinsic to the individual" means, if anything, other than a redundant reference to a later part of the definition: that the disability not be the direct result of "extrinsic influences." "Due to central nervous system dysfunction"

by itself does not rule out "extrinsic influences," because such influences would ultimately manifest their effects in changing the central nervous system (both genetic and environmental causes will have their proximal influences by way of the nervous system). Without the elaboration that only future research can provide (i.e., what kind of central nervous system dysfunction), the phrasing in the NJCLD definition is little more than a tautology. In contrast, "extrinsic influences" are ruled out seemingly by fiat—the earlier parts of the definition do not provide a principled rationale for eliminating such causes. There is simply not a shred of empirical evidence indicating that children with aptitude-achievement discrepancies caused by "extrinsic" influences differ from children with "intrinsically" caused learning disabilities in their response to treatment, educational prognosis, or cognitive profile.

In short, "intrinsic to the individual" and "due to central nervous system dysfunction" do no conceptual work at all, and "extrinsic influences" are ruled out in the absence of principled reasons. To put it bluntly, these parts of the traditional definition of learning disabilities are pure hash, and thus it seemed wise not to similarly burden the concept of dysrationalia. These parts of the traditional definition simply give critics hostile to the learning disability concept (e.g., Klatt, 1991) ammunition to attack the entire field. To the extent that dysrationalia is free of the conceptual confusion surrounding these elements of the traditional definitions, it is actually on *firmer* ground than disabilities deriving their conceptual support from the traditional definitions.

However, one might still address the issue of what type of evidence it is that makes learning disability seem a "harder" and more well-grounded concept than dysrationalia. I will focus on reading disability, where the "hardest" evidence exists (that is, I will charitably ignore the fact that hard evidence for specific psychological disabilities of "reasoning" or "social skills" is as sparse as for dysrationalia). Here it might be said that we are beginning to validate the idea of a disability "intrinsic to the individual" through twin and familial relationship studies that have shown a moderate heritability for reading disability (DeFries & Fulker, 1985; Olson, Wise, Conners, Rack, & Fulker, 1989). However, if significant heritability is to be one criterion for operationalizing "intrinsic to the individual," it is not at all clear that dysrationalia could not pass the test. The dispositions to think rationally could well be heritable, in part (heritability, of course, does not imply lack of malleability—see below). Recent reports of heritable personality variables and behavioral dispositions might even be said to make this outcome the expected one. Plomin, Corley, DeFries, and Fulker (1990) found television watching to be significantly heritable, and Waller, Kojetin, Bouchard, Lykken, and Tellegen (1990) found that religious attitudes and worldviews are partially heritable. The latter could well be related to dysrationalia.

However, the potential for sample instability in heritability estimates—and the possibility of malleability—may be much greater for dispositions toward rationality than for cognitive capacities, narrowly defined (see Baron, 1985). Heritability estimates are, of course, dependent on the range of environmental variance in the sample. In a typical North American sample of children, the range of environmental variance relevant to the development of rational thinking dispositions might be quite low. Parents, friends, relatives, and neighbors almost always reinforce children for exhibiting unjustified beliefs. Indeed, the culture almost demands it. Children are encouraged to believe—without justification—that their country is best, that their religion is best, that their state is best, that their high school is best, and so on, ad infinitum. Beyond family and friends, no other infuence in a child's environment serves to inculcate skills of critical rationality. Commercial television programming, which occupies more than 3 hours of the average eighth grader's day (Hafner, Ingels, Schneider, & Stevenson, 1990), tends, if anything, to suppress critical thinking skills (Iyengar & Kinder, 1987; Postman, 1985; Pratkanis & Aronson, 1992). The one place where children might have found an atmosphere that fostered critical judgment—school—has failed miserably at providing models of comprehensive critical thinking (Bartley, 1990; Paul, 1984, 1987, 1990; Siegel, 1988). If I am right and reflective, skeptical judgment is not something that is encouraged in any of the social settings in which children develop, then our population might well be exposed to a fairly uniform (e.g., low-variability) environment relevant to the development of dispositions toward rationality. Thus, a more varied set of environments for teaching children principles of belief formation might well drastically lower heritability estimates for components of rational thought and behavior. Research indicates that rational thinking processes *are* teachable (Agnoli, 1991; Baron & Brown, 1991; Fong et al., 1986; Fong, Lurigio, & Stalins, 1990; Fong & Nisbett, 1991; Lehman & Nisbett, 1990; Nisbett, Krantz, Jepson, & Kunda, 1983).

7. Objection: Why focus on discrepancy from IQ? Should not the absolute level of rationality be important?

Reply: This is a good point. Actually, a version of this question continues to be debated in the literature on reading disability. Even after decades of research and clinical practice, it still has not been unequivocally demonstrated that defining reading disability by reference to discrepancy from intelligence makes practical or theoretical sense (McKinney, 1987; Rispens et al., 1991; Share et al., 1987; Share et al., 1989; Siegel, 1989, in press; Stanovich, 1991; van der Wissel, 1987). Intelligence crept into the definition of dyslexia via the mistaken assumption that IQ tests were measures of a child's "potential" educability. Not only is this an incorrect interpretation of an IQ test score, but also even the *empirical* utility of IQ discrepancy measurement in the area of reading disability is still

in doubt. That is, it has yet to be reliably demonstrated that the way that poor readers with IQ discrepancy read is functionally different from the way that poor readers without IQ discrepancy read—or that these two groups respond differently to treatment, or that their educational prognosis is different (Siegel, 1989; Stanovich, 1991).

Dysrationalia was defined by reference to discrepancy only to highlight its conceptual similarity to other learning disabilities; no general endorsement of discrepancy measurement is to be inferred. Discrepancy measurement was proposed only to establish the analogy with learning disability: that one could start out with the same "common sense" assumption that the "potential" for rational behavior is higher among those higher in intelligence. But as we have seen, "common sense" in the domain of reading disability has been harder to verify than we might have thought. The same might be true for rationality–intelligence discrepancies. Whether discrepancy measurement in the domain of rationality makes sense is an empirical question.

Note that the "common sense" or "folk concept" (Greenwood, 1991) of learning disability probably also involves the vernacular concept of intelligence and the assumption that the IQ test is a comprehensive assessment of the nature of cognitive functioning. That is, the folk model leads us to view discrepancies from IQ in some domain as "surprising," because it is assumed that intelligence reflects something comprehensive and pervasive about cognitive functioning. If, in fact, IQ tests are nothing of the sort—if they reflect only a thin slice of the thinking domain (a small collection of cognitive microcapacities)—then the fact that individuals show up with discrepancies from IQ (in reading or in rational thinking or whatever) becomes much less surprising. This is the point raised at the beginning of this article. The interpretation of any particular discrepancy from a score on an IQ test rests on a comprehensive theory of what mental components are assessed by the test.

8. Objection: We would not need to talk about dysrationalia if we conceived of intelligence differently. Folk terms like "dumb" are as often used to characterize irrational behaviors as unintelligent ones. If the scientific conception of intelligence conflated rationality and intelligence in the same way as the vernacular, we would not need the concept of "dysrationalia."

Reply: This objection represents another take on the issue raised by the previous question. The point raised in this objection is precisely correct. It points up the choices facing psychologists who use the term *learning disabilities*. The choice is that we either reform our use of the term *intelligence* or we lose any principled argument against recognizing dysrationalia as a disability on par with many others that are essentially defined by IQ discrepancy. Both of these alternatives have educational consequences.

Intelligence as a Concept in the Learning Disabilities Field: Two Alternatives

Baron's (1985) use of the distinction between cognitive capacities and rational thinking dispositions is somewhat different from that exemplified in the concept of dysrationalia. He proposes that these dispositions be folded into our view of intelligence—that intelligence be made to encompass rationality (see also Perkins et al., 1991; Perkins, Jay, & Tishman, 1993). This proposal would bring the scientific concept of intelligence into greater congruence with vernacular usage, because research evidence suggests that intelligence and rationality are often conflated in ordinary discourse. When Neisser (1979) asked a sample of Cornell University undergraduates to list the characteristics of intelligent people, they mentioned numerous characteristics that might be related to rationality, such as "realizes there is a lot he doesn't know," "lack of bias," "openness to experience," and "independence."

In the more systematic study of nonstudent adults conducted by Sternberg et al. (1981; see also Sternberg, 1985, 1987; and Cornelius, Kenny, & Caspi, 1989), three factors emerged when subjects rated the relevance of 250 subject-generated behaviors to intelligence. The factors were labeled practical problem solving, verbal ability, and social competence. Many of the behaviors that loaded most highly (factor loadings greater than .60) on the practical problem-solving and social competence factors resemble dispositions toward rationality rather than cognitive capacities, such as "keeps an open mind," "responds thoughtfully to others' ideas," "interprets information accurately," "goes to original sources for basic information," "listens to all sides of an argument," "admits mistakes," "does not make snap judgments," and "makes fair judgments." Sternberg et al. concluded that laypersons "perceived intelligence as comprising quite a bit more than is presumably measured by IQ tests" (p. 46; see also McCrae & Costa, 1985). Likewise, investigations of so-called "practical intelligence" (e.g., de Bono, 1991; Sternberg & Wagner, 1986; Voss et al., 1991) highlight the broader view of intelligence shared by virtually everyone outside of the psychometric community.

Thus, there is a course of action that might be preferred by those not enamored with the concept of dysrationalia. The alternative is simply to accept the conflation of intelligence and rationality in folk usage and carry it over into the scientific conceptualization (see Baron, 1985, for a full and detailed exposition on this possibility; see also Baron, 1988, pp. 105–122; and Goldman, 1986, pp. 22–27, 122–125). The theoretical characterization of intelligent behavior as that which helps us achieve our goals or that which helps us to adapt to the environment (Sternberg & Detterman, 1986) is already conceptualizing intelligence as something that overlaps with rationality, even if operationalizations of the concept do not reflect this.

The proposal to conflate rationality and cognitive capacities into the concept of intelligence prevents us—almost by legal precedent—from having to define a disability of dysrationalia. (Dysrationalia disappears under this proposal because subjects low in rationality dispositions are simply less intelligent—there is no longer a discrepancy between rationality and intelligence because rationality is *part* of intelligence.) Nevertheless, the proposal does entail reforms in the treatment of the concept of intelligence and in the measurement of this construct.

First, allowing intelligence to subsume rationality highlights the fact that we *cannot* identify currrent IQ tests—which are tests of capacities—with the concept intelligence, a point repeatedly made in the past by critics of IQ tests. This criticism, however, has been singularly ineffective in changing practice, because the proposals for what is in intelligence but not in the tests have never been clear, or, when clear, have been insufficiently compelling. The proposal to fold rationality into the concept of intelligence provides a more compelling argument for changing assessment instruments than past criticisms, first, because rationality is already embedded in folk "intelligence" and, second, because it is more patently clear that this component is not already in the tests. Thus, this proposal would create more pressure for change in IQ tests as well as all their "aptitude" relatives, such as the Scholastic Aptitude Test (SAT).

Second, "intelligence" in the vernacular is already loaded with positive valence. To the extent that IQ tests bathe in the aura of this positive valence, and to the extent that these instruments serve a selective function in society, then it could be argued that the *sources* of the positive valence *should* really be represented in the tests. Because a major source of the positive valence comes from appropriation of connotations of rationality by the folk concept of intelligence and, sometimes, by psychometricians themselves (see Block & Dworkin, 1976), it could be argued that current IQ instruments should be revised to include indicators of dispositions toward rationality.

Alternatively, if a notion of intelligence as cognitive capacity is to be retained—despite lack of accord with the vernacular—then dysrationalia is a concept that might help discipline the overextension of the term *intelligence*. I have outlined how the idea of a discrepancy between dispositions toward rationality and assessed cognitive capacity could serve as a defining feature of such a disability, and how such a definition would fall squarely within an already established tradition of disability identification.

Whichever course of action the field takes—either incorporating rational thinking into intelligence or recognizing dysrationalia—two positive outcomes will result. First, the learning disabilities field will have to deal seriously with the conceptual paradoxes that result from discrepancy definitions. Second, we will have to think more extensively about what has been left out of education due to our excessive focus on cognitive capacities. In this way, the learning disabilities field might provide a service to the rest of education by spurring a more explicit debate about the societal consequences of what the educational system values and what it neglects.

ABOUT THE AUTHOR

***Keith E. Stanovich** is a professor at the Ontario Institute for Studies in Education. His research interests are in the psychology of reading, reading disabilities, the cognitive consequences of literacy, critical thinking, and decision making. He has twice received the Albert J. Harris Award from the International Reading Association. He currently serves as the associate editor of the journal Merrill-Palmer Quarterly. Address: Keith E. Stanovich, Ontario Institute for Studies in Education, 252 Bloor St. West, Toronto, Ontario, Canada M5S 1V6.*

AUTHOR'S NOTE

This article was written while the author was a visiting scholar in the Department of Experimental Psychology, University of Cambridge. The author wishes to thank Usha Goswami and the faculty and staff of that department for their support and hospitality. Preparation of the article was assisted by a grant from the Social Sciences and Humanities Research Council of Canada.

NOTE

Arguing that learning disabilities are defined by reference to intraindividual ability differences rather than strict aptitude-achievement discrepancies (see Hammill, 1990, for a discussion) does not mitigate the paradoxes created by IQ-based discrepancy definitions that I will discuss. Intraindividual deficits become interesting to those in the learning disability field only if the deficits do not extend across the cognitive profile. That is, learning disabilities are defined by a "spike" downward in the performance profile, indicating a specific deficit. The spike stands out only in the context of a general profile that displays largely normal performance. Thus, the remainder of the cognitive profile that is the context for the spike becomes analogous to an intelligence-like construct (see Detterman, 1982).

REFERENCES

Adams, M.J. (1989). Thinking skills curricula: Their promise and progress. *Educational Psychologist, 24,* 25-27.

Agnoli, F. (1991). Development of judgmental heuristics and logical reasoning: Training counteracts the representativeness heuristic. *Cognitive Development, 6,* 195-217.

Alcock, J.E. (1981). *Parapsychology: Science or magic?* Oxford: Pergamon Press.

Alcock, J.E. (1987). Parapsychology: Science of the anomalous or search for the soul? *Behavioral and Brain Sciences, 10,* 553-643.

Alcock, J.E. (1990). *Science and supernature: An appraisal of parapsychology.* Buffalo, NY: Prometheus Books.

Alcock, J.E., & Otis, L.P. (1980). Critical thinking and belief in the paranormal. *Psychological Reports, 46,* 479-482.

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed., rev.). Washington, DC: Author.

Applebee, A.N. (1971). Research in reading retardation: Two critical problems. *Journal of Child Psychology & Psychiatry, 12,* 91-113.

Arkes, H.R. (1991). Costs and benefits of judgment errors: Implications for debiasing. *Psychological Bulletin, 110,* 486-498.

Arkes, H., & Blumer, C. (1985). The psychology of sunk cost. *Organizational Behavior and Human Decision Processes, 35,* 124–140.

Arkes, H.R., Christensen, C., Lai, C., & Blumer, C. (1987). Two methods of reducing overconfidence. *Organizational Behavior and Human Decision Processes, 39,* 133–144.

Arkes, H., & Hammond, K. (Eds.). (1986). *Judgment and decision making.* Cambridge, England: Cambridge University Press.

Arkes, H.R., & Harkness, A.R. (1983). Estimates of contingency between two dichotomous variables. *Journal of Experimental Psychology: General, 112,* 117–135.

Aronowitz, S., & Giroux, H.A. (1985). *Education under siege.* South Hadley, MA: Bergin & Garvey.

Baron, J. (1985). *Rationality and intelligence.* Cambridge, England: Cambridge University Press.

Baron, J. (1988). *Thinking and deciding.* Cambridge, England: Cambridge University Press.

Baron, J., Badgio, P.C., & Gaskins, I.W. (1986). Cognitive style and its improvement: A normative approach. In R.J. Sternberg (Ed.), *Advances in the psychology of human intelligence* (Vol. 3, pp. 173–220). Hillsdale, NJ: Erlbaum.

Baron, J., & Brown, R.V. (1991). Toward improved instruction in decision making to adolescents: A conceptual framework and pilot program. In J. Baron & R.V. Brown (Eds.), *Teaching decision making to adolescents* (pp. 95–122). Hillsdale, NJ: Erlbaum.

Baron, J., Granato, L., Spranca, M., & Teubal, E. (1993). Decision making biases in children and early adolescents: Exploratory studies. *Merrill-Palmer Quarterly, 39,* 22–46.

Baron, J.B., & Sternberg, R.J. (Eds.). (1987). *Teaching thinking skills: Theory and practice.* New York: W.H. Freeman.

Bartley, W.W. (1990). *Unfathomed knowledge, unmeasured wealth.* La Salle, IL: Open Court.

Beattie, J., & Baron, J. (1988). Confirmation and matching biases in hypothesis testing. *Quarterly Journal of Experimental Psychology, 40A,* 269–297.

Blackmore, S., & Troscianko, T. (1985). Belief in the paranormal: Probability judgments, illusory control, and the 'chance baseline shift.' *British Journal of Psychology, 76,* 459–468.

Block, N.J., & Dworkin, G. (1976). IQ, heritability, and inequality. In N.J. Block & G. Dworkin (Eds.), *The IQ controversy* (pp. 410–540). New York: Pantheon.

Bowles, S., & Gintis, H. (1976). *Schooling in capitalist America.* New York: Basic Books.

Brandon, R. (1983). *The spiritualists.* London: Weidenfeld & Nicolson.

Brown, H.I. (1988). *Rationality.* London: Routledge.

Bulgatz, J. (1992). *Ponzi schemes, invaders from Mars, and more extraordinary popular delusions and the madness of crowds.* New York: Harmony Books.

Campbell, J.D., & Tesser, A. (1983). Motivational interpretation of hindsight bias: An individual difference analysis. *Journal of Personality, 51,* 605–640.

Ceci, S.J. (1986). *Handbook of cognitive, social, and neuropsychological aspects of learning disabilities* (Vol. 1). Hillsdale, NJ: Erlbaum.

Ceci, S.J. (1989). On domain specificity . . . more or less: General and specific constraints on cognitive development. *Merrill-Palmer Quarterly, 35,* 131–142.

Ceci, S.J. (1990). *On intelligence . . . more or less: A bio-ecological treatise on intellectual development.* Englewood Cliffs, NJ: Prentice-Hall.

Ceci, S.J., & Liker, J.K. (1986). A day at the races: A study of IQ, expertise, and cognitive complexity. *Journal of Experimental Psychology: General, 115,* 255–266.

Chandler, M., Boyes, M., & Ball, L. (1990). Relativism and stations of epistemic doubt. *Journal of Experimental Child Psychology, 50,* 370–395.

Chatillon, G. (1989). Acceptance of paranormal among two special groups. *Skeptical Inquirer, 13*(2), 216–217.

Cherniak, C. (1986). *Minimal rationality.* Cambridge, MA: MIT Press.

Cohen, L.J. (1981). Can human irrationality be experimentally demonstrated? *Behavioral and Brain Sciences, 4,* 317–331.

Coles, G.S. (1987). *The learning mystique.* New York: Pantheon.

Cook, K.S., & Levi, M. (Eds.). (1990). *The limits of rationality.* Chicago: University of Chicago Press.

Cooper, L.A., & Regan, D.T. (1982). Attention, perception, and intelligence. In R.J. Sternberg (Ed.), *Handbook of human intelligence* (pp. 123–169). Cambridge, England: Cambridge University Press.

Cornelius, S.W., Kenny, S., & Caspi, A. (1989). Academic and everyday intelligence in adulthood: Conceptions of self and ability tests. In J.D. Sinnott (Ed.), *Everyday problem solving* (pp. 191–210). New York: Praeger.

Davidson, D. (1984). On the very idea of a conceptual scheme. In D. Davidson (Ed.), *Truth and interpretation* (pp. 183–198). Oxford: Oxford University Press.

Davidson, J.E. (1990). Intelligence recreated. *Educational Psychologist, 25,* 337–354.

Dawes, R.M. (1988). *Rational choice in an uncertain world.* San Diego, CA: Harcourt Brace Jovanovich.

de Bono, E. (1991). *I am right—you are wrong: From rock logic to water logic.* New York: Viking.

DeFries, J.C., & Fulker, D. (1985). Multiple regression analyses of twin data. *Behavior Genetics, 15,* 467–473.

Dennett, D. (1978). Intentional systems. In D. Dennett (Ed.), *Brainstorms* (pp. 3–22). Cambridge, MA: MIT Press.

Detterman, D. (1982). Does "g" exist? *Intelligence, 6,* 99–108.

Doehring, D.G. (1978). The tangled web of behavioral research on developmental dyslexia. In A.L. Benton & D. Pearl (Eds.), *Dyslexia* (pp. 123–135). New York: Oxford University Press.

Doris, J. (1986). Learning disabilities. In S.J. Ceci (Ed.), *Handbook of cognitive, social, and neuropsychological aspects of learning disabilities* (Vol. 1, pp. 3–53). Hillsdale, NJ: Erlbaum.

Earl, P.E. (1990). Economics and psychology: A survey. *The Economic Journal, 100,* 718–755.

Eisenberg, L. (1978). Definitions of dyslexia: Their consequences for research and policy. In A.L. Benton & D. Pearl (Eds.), *Dyslexia* (pp. 29–42). New York: Oxford University Press.

Elster, J. (1983). *Sour grapes: Studies in the subversion of rationality.* Cambridge, England: Cambridge University Press.

Elster, J. (1989). *Solomonic judgments: Studies in the limitations of rationality.* Cambridge, England: Cambridge University Press.

Ennis, R. (1989). Critical thinking and subject specificity. *Educational Researcher, 18(3),* 4–10.

Ennis, R.H., & Millman, J. (1985). *Cornell critical thinking test.* Pacific Grove, CA: Midwest.

Estes, W.K. (1982). Learning, memory, and intelligence. In R.J. Sternberg (Ed.), *Handbook of human intelligence* (pp. 170–224). Cambridge, England: Cambridge University Press.

Evans, B., & Waites, B. (1981). *IQ and mental testing: An unnatural science and its social history.* London: Macmillan.

Evans, J.B.T. (1989). *Bias in human reasoning: Causes and consequences.* London: Erlbaum.

Evans, J.B.T., & Wason, P.C. (1976). Rationalization in a reasoning task. *British Journal of Psychology, 67,* 479–486.

Farias, V. (1989). *Heidegger and Nazism.* Philadelphia: Temple University Press.

Farris, H., & Revlin, R. (1989). Sensible reasoning in two tasks: Rule discovery and hypothesis evaluation. *Memory & Cognition, 17,* 221–232.

Fischhoff, B. (1988). Judgment and decision making. In R.J. Sternberg & E.E. Smith (Eds.), *The psychology of human thought* (pp. 153–187). Cambridge, England: Cambridge University Press.

Fischhoff, B., & Beyth-Marom, R. (1983). Hypothesis evaluation from a Bayesian perspective. *Psychological Review, 90,* 239–260.

Fong, G.T., Krantz, D.H., & Nisbett, R.E. (1986). The effects of statistical training on thinking about everyday problems. *Cognitive Psychology, 18,* 253–292.

Fong, G.T., Lurigio, A.J., & Stalins, L.J. (1990). Improving probation decisions through statistical training. *Criminal Justice and Behavior, 17,* 370–388.

Fong, G.T., & Nisbett, R.E. (1991). Immediate and delayed transfer of training effects in statistical reasoning. *Journal of Experimental Psychology: General, 120,* 34–45.

Frankenberger, W., & Fronzaglio, K. (1991). A review of states' criteria and procedures for identifying children with learning disabilities. *Journal of Learning Disabilities, 24,* 495–500.

Frankenberger, W., & Harper, J. (1987). States' criteria and procedures for identifying learning disabled children: A comparison of 1981/82 and 1985/86 guidelines. *Journal of Learning Disabilities, 20,* 118–121.

Frazier, K. (Ed.). (1981). *Paranormal borderlands of science.* Buffalo, NY: Prometheus.

Furby, L., & Beyth-Marom, R. (1992). Risk taking in adolescence: A decision-making perspective. *Developmental Review, 12,* 1–44.

Gardner, H. (1983). *Frames of mind.* New York: Basic Books.

Gardner, H. (1986). The waning of intelligence tests. In R.J. Sternberg & D.K. Detterman (Eds.), *What is intelligence?* (pp. 73–76). Norwood, NJ: Ablex.

Gilovich, T. (1991). *How we know what isn't so.* New York: Free Press.

Glaser, R. (1984). Education and thinking: The role of knowledge. *American Psychologist, 39,* 93–104.

Goldman, A.I. (1986). *Epistemology and cognition.* Cambridge, MA: Harvard University Press.

Gould, S.J. (1981). *The mismeasure of man.* New York: Norton.

Graumlich, G., & Baron, J. (1991). Teaching decision making in the city: Two experiences. In J. Baron & R.V. Brown (Eds.), *Teaching decision making to adolescents* (pp. 147–159). Hillsdale, NJ: Erlbaum.

Greenwood, J.D. (Ed.). (1991). *The future of folk psychology.* Cambridge, MA: MIT Press.

Hafner, A., Ingels, S., Schneider, B., & Stevenson, D. (1990). *A profile of the American eighth grader: NELS:88 student descriptive summary.* Washington, DC: National Center for Educational Statistics.

Hammill, D.D. (1990). On defining learning disabilities: An emerging consensus. *Journal of Learning Disabilities, 23,* 74–84.

Harrington, D.M., Block, J.H., & Block, J. (1978). Intolerance of ambiguity in preschool children: Psychometric considerations, behavioral manifestations, and parental correlates. *Developmental Psychology, 14,* 242–256.

Harris, A.J., & Sipay, E.R. (1985). *How to increase reading ability* (8th ed.). White Plains, NY: Longman.

Hazel, J.S., & Schumaker, J.B. (1988). Social skills and learning disabilities: Current issues and recommendations for future research. In J.F. Kavanagh & T.J. Truss (Eds.), *Learning disabilities: Proceedings of the national conference* (pp. 293–344). Parkton, MD: York Press.

Hilliard, A. (1984). IQ testing and the emperor's new clothes. In C.R. Reynolds & R.T. Brown (Eds.), *Perspectives on bias in mental testing* (pp. 189–220). New York: Plenum Press.

Hines, T. (1988). *Pseudoscience and the paranormal.* Buffalo, NY: Prometheus.

Holland, J.H., Holyoak, K.J., Nisbett, R.E., & Thagard, P.R. (1986). *Induction: Processes of inference, learning, and discovery.* Cambridge, MA: MIT Press.

House Select Committee on Aging. (1984, May 31). *Quackery: A $10 billion scandal* (98th Cong. Comm. Pub. No. 98-435). Washington, DC: U.S. Government Printing Office.

Hunt, E. (1978). Mechanics of verbal ability. *Psychological Review, 85,* 109–130.

Hunt, E. (1987). The next word on verbal ability. In P.A. Vernon (Ed.), *Speed of information-processing and intelligence* (pp. 347–392). Norwood, NJ: Ablex.

Iyengar, S., & Kinder, D.R. (1987). *News that matters: Television and American opinion.* Chicago: University of Chicago Press.

Jensen, A.R. (1982). The chronometry of intelligence. In R.J. Sternberg (Ed.), *Advances in the psychology of human intelligence* (Vol. 1, pp. 255–310). Hillsdale, NJ: Erlbaum.

Johnson, D.J. (1988). Review of research on specific reading, writing, and mathematics disorders. In J.F. Kavanagh & T.J. Truss (Eds.), *Learning disabilities: Proceedings of the national conference* (pp. 79–163). Parkton, MD: York Press.

Kahneman, D. (1992). Reference points, anchors, norms, and mixed feelings. *Organizational Behavior and Human Decision Processes, 51,* 296–312.

Kahneman, D., Slovic, P., & Tversky, A. (1982). *Judgment under uncertainty: Heuristics and biases.* Cambridge, England: Cambridge University Press.

Kahneman, D., & Tversky, A. (1984). Choices, values, and frames. *American Psychologist, 39,* 341–350.

Kavale, K.A., & Nye, C. (1981). Identification criteria for learning disabilities: A survey of the research literature. *Learning Disability Quarterly, 4,* 363–388.

Kavanagh, J.F., & Truss, T.J. (Eds.). (1988). *Learning disabilities: Proceedings of the national conference.* Parkton, MD: York Press.

King, P.M., Kitchener, K.S., Davison, M.L., Parker, C.A., & Wood, P.K. (1983). The justification of beliefs in young adults: A longitudinal study. *Human Development, 26,* 106–116.

Kitchener, K.S., & Brenner, H.G. (1990). Wisdom and reflective judgment: Knowing in the face of uncertainty. In R.J. Sternberg (Ed.), *Wisdom: Its nature, origins, and development* (pp. 212–229). Cambridge, England: Cambridge University Press.

Kitchener, K.S., & King, P.M. (1981). Reflective judgment: Concepts of justification and their relationship to age and education. *Journal of Applied Developmental Psychology, 2,* 89–116.

Klass, P. (1983). *UFOs explained.* New York: Random House.

Klatt, H. (1991). Learning disabilities: A questionable construct. *Educational Theory, 41,* 48–60.

Kuhn, D. (1989). Children and adults as intuitive scientists. *Psychological Review, 96,* 674–689.

Kuhn, D. (1991). *The skills of argument.* Cambridge, England: Cambridge University Press.

Kuhn, D. (1993). Connecting scientific and informal reasoning. *Merrill-Palmer Quarterly, 39,* 74–103.

Kuhn, D., Amsel, E., & O'Loughlin, M. (1988). *The development of scientific thinking skills.* San Diego: Academic Press.

Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin, 108,* 480–498.

Kunda, Z., & Nisbett, R.E. (1986). The psychometrics of everyday life. *Cognitive Psychology, 18,* 195–224.

Larrick, R.P., Morgan, J.N., & Nisbett, R.E. (1990). Teaching the use of cost-benefit reasoning in everyday life. *Psychological Science, 1,* 362–370.

Lehman, D. (1991). *Signs of the times: Deconstruction and the fall of Paul de Man.* New York: Poseidon Press.

Lehman, D.R., & Nisbett, R.E. (1990). A longitudinal study of the effects of undergraduate training on reasoning. *Developmental Psychology, 26,* 952–960.

Lesser, R., & Paisner, M. (1985). Magical thinking in formal operational adults. *Human Development, 28,* 57–70.

Lipman, M. (1991). *Thinking in education.* Cambridge, England: Cambridge University Press.

Lyon, G.R. (1987). Learning disabilities research: False starts and broken promises. In S. Vaughn & C.S. Bos (Eds.), *Research in learning disabilities* (pp. 69–85). Austin, TX: PRO-ED.

McCrae, R.R., & Costa, P.T. (1985). Updating Norman's "adequate taxonomy": Intelligence and personality dimensions in natural language and in questionnaires. *Journal of Personality and Social Psychology, 49,* 710–721.

McKinney, J.D. (1987). Research on the identification of learning-disabled children: Perspectives on changes in educational policy. In S. Vaughn & C.S. Bos (Eds.), *Research in learning disabilities* (pp. 215–233). Austin, TX: PRO-ED.

McNeil, B., Pauker, S., Sox, H., & Tversky, A. (1982). On the elicitation of preferences for alternative therapies. *New England Journal of Medicine, 306,* 1259–1262.

McPeck, J.E. (1990a). Critical thinking and subject specificity: A reply to Ennis. *Educational Researcher, 19*(4), 10–12.

McPeck, J.E. (1990b). *Teaching critical thinking.* New York: Routledge.

Monaghan, E.J. (1980). A history of the syndrome of dyslexia with implications for its treatment. In C. McCullough (Ed.), *Inchworm, inchworm: Persistent problems in reading education* (pp. 87–101). Newark, DE: IRA.

Moore, R.L. (1977). *In search of white crows.* New York: Oxford University Press.

Muller, I. (1991). *Hitler's justice: The courts of the Third Reich.* Cambridge, MA: Harvard University Press.

Neisser, U. (1976). General, academic, and artificial intelligence. In L.B. Resnick (Ed.), *The nature of intelligence* (pp. 135–144). Hillsdale, NJ: Erlbaum.

Neisser, U. (1979). The concept of intelligence. In R.J. Sternberg & D.K. Detterman (Eds.), *Human intelligence* (pp. 179–189). Norwood, NJ: Ablex.

Nisbett, R.E., Fong, G.T., Lehman, D.R., & Cheng, P.W. (1987). Teaching reasoning. *Science, 238,* 625–631.

Nisbett, R.E., Krantz, D.H., Jepson, C., & Kunda, Z. (1983). The use of statistical heuristics in everyday inductive reasoning. *Psychological Review, 90,* 339–363.

Nisbett, R., & Ross, L. (1980). *Human inference: Strategies and shortcomings of social judgment.* Englewood Cliffs, NJ: Prentice-Hall.

Oakes, J. (1985). *Keeping track: How schools structure inequality.* New Haven, CT: Yale University Press.

Olson, R.K., Wise, B., Conners, F., Rack, J., & Fulker, D. (1989). Specific deficits in component reading and language skills: Genetic and environmental influences. *Journal of Learning Disabilities, 22,* 339–348.

Owen, D. (1985). *None of the above: Behind the myth of scholastic aptitude.* Boston: Houghton Mifflin.

Patterson, K., Marshall, J., & Coltheart, M. (1985). *Surface dyslexia.* London: Erlbaum.

Paul, R.W. (1984). Critical thinking: Fundamental to education for the free society. *Educational Leadership, 42*(1), 4–14.

Paul, R.W. (1987). Critical thinking and the critical person. In D.N. Perkins, J. Lockhead, & J. Bishop (Eds.), *Thinking: The second international conference* (pp. 373–403). Hillsdale, NJ: Erlbaum.

Paul, R. (1990). *Critical thinking.* Rohnert Park, CA: Sonoma State University.

Perkins, D.N., Farady, M., & Bushey, B. (1991). Everyday reasoning and the roots of intelligence. In J. Voss, D. Perkins, & J. Segal (Eds.), *Informal reasoning and education* (pp. 83–105). Hillsdale, NJ: Erlbaum.

Perkins, D.N., Jay, E., & Tishman, S. (1993). Beyond abilities: A dispositional theory of thinking. *Merrill-Palmer Quarterly, 39,* 1–21.

Perkins, D.N., & Salomon, G. (1989). Are cognitive skills context-bound? *Educational Researcher, 18*(1), 16–25.

Perry, W.G. (1970). *Forms of intellectual and ethical development in the college years: A scheme.* New York: Holt, Rinehart & Winston.

Pizzo, S., Fricker, M., & Muolo, P. (1991). *Inside job: The looting of America's savings and loans.* New York: HarperCollins.

Plomin, R., Corley, R., DeFries, J.C., & Fulker, D.W. (1990). Individual differences in television viewing in early childhood: Nature as well as nurture. *Psychological Science, 1,* 371–377.

Postman, N. (1985). *Amusing ourselves to death.* New York: Viking Penguin.

Pratkanis, A., & Aronson, E. (1992). *Age of propaganda.* New York: W.H. Freeman.

Randi, J. (1980). *Flim-flam.* Buffalo, NY: Prometheus.

Randi, J. (1987). *The faith healers.* Buffalo, NY: Prometheus.

Resnick, L.B., Levine, J., & Teasley, S. (Eds.). (1991). *Pespectives on socially shared cognition.* Washington, DC: American Psychological Association.

Reynolds, C.R. (1985). Measuring the aptitude-achievement discrepancy in learning disability diagnosis. *Remedial and Special Education, 6*(5), 37–55.

Rispens, J., van Yeren, T., & van Duijn, G. (1991). The irrelevance of IQ to the definition of learning disabilities: Some empirical evidence. *Journal of Learning Disabilities, 24,* 434–438.

Rogoff, B., & Lave, J. (Eds.). (1984). *Everyday cognition.* Cambridge, MA: Harvard University Press.

Rutter, M. (1978). Prevalence and types of dyslexia. In A. Benton & D. Pearl (Eds.), *Dyslexia: An appraisal of current knowledge* (pp. 5–28). New York: Oxford University Press.

Saks, M.J., & Kidd, R.F. (1980). Human information processing and adjudication: Trial by heuristics. *Law and Society, 15,* 123–160.

Senf, G.F. (1986). LD research in sociological and scientific perspective. In J.K. Torgesen & B.Y.L. Wong (Eds.), *Psychological*

and educational perspectives on learning disabilities (pp. 27–53). Orlando, FL: Academic Press.

Shafrir, U., & Pascual-Leone, J. (1990). Postfailure reflectively/impulsivity and spontaneous attention to errors. *Journal of Educational Psychology, 82,* 378–387.

Shaklee, H., & Paszek, D. (1985). Covariation judgment: Systematic rule use in middle childhood. *Child Development, 56,* 1229–1240.

Share, D.L., McGee, R., McKenzie, D., Williams, S., & Silva, P.A. (1987). Further evidence relating to the distinction between specific reading retardation and general reading backwardness. *British Journal of Developmental Psychology, 5,* 35–44.

Share, D.L., McGee, R., & Silva, P. (1989). IQ and reading progress: A test of the capacity notion of IQ. *Journal of the American Academy of Child and Adolescent Psychiatry, 28,* 97–100.

Shepard, L. (1980). An evaluation of the regression discrepancy method for identifying children with learning disabilities. *The Journal of Special Education, 14,* 79–91.

Siegel, H. (1988). *Educating reason.* New York: Routledge.

Siegel, L.S. (1989). IQ is irrelevant to the definition of learning disabilities. *Journal of Learning Disabilities, 22,* 469–479.

Siegel, L.S. (in press). Alice in IQ land or why IQ is still irrelevant to learning disabilities. In M. Joshi & C.K. Leong (Eds.), *Reading disabilities: Diagnosis and component processes.* Dordrecht, The Netherlands: Kluwer Academic.

Stanovich, K.E. (1989). Has the learning disabilities field lost its intelligence? *Journal of Learning Disabilities, 22,* 487–492.

Stanovich, K.E. (1991). Discrepancy definitions of reading disability: Has intelligence led us astray? *Reading Research Quarterly, 26,* 7–29.

Stanovich, K.E. (1992). *How to think straight about psychology* (3rd ed.). New York: HarperCollins.

Stanovich, K.E., Cunningham, A.E., & Feeman, D.J. (1984). Intelligence, cognitive skills, and early reading progress. *Reading Research Quarterly, 19,* 278–303.

Stenger, V.J. (1990). *Physics and psychics.* Buffalo, NY: Prometheus.

Sternberg, R.J. (1985). Implicit theories of intelligence, creativity, and wisdom. *Journal of Personality and Social Psychology, 49,* 607–627.

Sternberg, R.J. (1987). Implicit theories: An alternative to modeling cognition and its development. In J. Bisanz, C. Brainerd, & R. Kail (Eds.), *Formal models in developmental psychology* (pp. 155–192). New York: Springer-Verlag.

Sternberg, R.J. (1989). Domain-generality versus domain-specificity: The life and impending death of a false dichotomy. *Merrill-Palmer Quarterly, 5,* 115–130.

Sternberg, R.J., Conway, B., Ketron, J., & Bernstein, M. (1981). People's conceptions of intelligence. *Journal of Personality and Social Psychology, 41,* 37–55.

Sternberg, R.J., & Detterman, D.K. (1986). *What is intelligence?* Norwood, NJ: Ablex.

Sternberg, R.J., & Wagner, R.K. (1986). *Practical intelligence.* Cambridge, England: Cambridge University Press.

Stich, S. (1990). *The fragmentation of reason.* Cambridge, MA: MIT Press.

Svenson, O. (1981). Are we all less risky and more skillful than our fellow drivers? *Acta Psychologica, 47,* 143–148.

Swartz, R.J. (1987). Critical thinking, the curriculum, and the problem of transfer. In D.N. Perkins, J. Lockhead, & J.C. Bishop (Eds.), *Thinking: The second international conference* (pp. 261–284). Hillsdale, NJ: Erlbaum.

Thaler, R.H. (1992). *The winner's curse: Paradoxes and anomalies of economic life.* New York: Free Press.

The Holocaust's new lessons. (1990, December 3). *Newsweek,* p. 52.

Torgesen, J.K. (1986). Controlling for IQ. *Journal of Learning Disabilities, 19,* 452.

Torgesen, J.K. (1991). Learning disabilities: Historical and conceptual issues. In B.L. Wong (Ed.), *Learning about learning disabilities* (pp. 3–37). San Diego, CA: Academic Press.

Torrey, E.F. (1984). *The roots of treason.* San Diego: Harcourt Brace Jovanovich.

Tschirgi, J.E. (1980). Sensible reasoning: A hypothesis about hypotheses. *Child Development, 51,* 1–10.

van der Wissel, A. (1987). IQ profiles of learning disabled and mildly mentally retarded children: A psychometric selection effect. *British Journal of Developmental Psychology, 5,* 45–51.

Vernon, P.A. (1987). New developments in reaction time research. In P.A. Vernon (Ed.), *Speed of information-processing and intelligence* (pp. 1–20). Norwood, NJ: Ablex.

Voss, J., Perkins, D., & Segal, J. (Eds.). (1991). *Informal reasoning and education.* Hillsdale, NJ: Erlbaum.

Waller, N.G., Kojetin, B.A., Bouchard, T.J., Lykken, D.T., & Tellegen, A. (1990). Genetic and environmental influences on religious interests, attitudes, and values: A study of twins reared apart and together. *Psychological Science, 1,* 138–142.

Wason, P.C. (1977). Self-contradictions. In P.N. Johnson-Laird & P.C. Wason (Eds.), *Thinking: Readings in cognitive science* (pp. 114–128). Cambridge, England: Cambridge University Press.

Wasserman, E.A., Dorner, W.W., & Kao, S.F. (1990). Contributions of specific cell information to judgments of interevent contingency. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 16,* 509–521.

Watson, G., & Glaser, E.M. (1980). *Watson-Glaser critical thinking appraisal.* San Antonio, TX: Psychological Corp.

Weinstein, N. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology, 39,* 806–820.

Weinstein, N. (1987). Unrealistic optimism about susceptibility to health problems: Conclusions from a community-wide sample. *Journal of Behavioral Medicine, 10,* 481–500.

White, L.J. (1991). *The S & L debacle: Public policy lessons for bank and thrift regulation.* New York: Oxford University Press.

Wierzbicki, M. (1985). Reasoning errors and belief in the paranormal. *Journal of Social Psychology, 125,* 489–494.

Willis, C. (1990, June). The ten mistakes to avoid with your money. *Money Magazine,* pp. 84–94.