ABSTRACT—In this article, I describe chronologically my attempts over a 40-year career to understand the nature of human intelligence. I explain how later attempts built on earlier ones, with each attempt revealing the earlier one to be too limited and narrow in the questions it asked. In my early work, I envisioned intelligence in terms of components of information processing. Later, I viewed these components as contributing to three distinct but related aspects of intelligence: analytical, creative, and practical. I came to realize the importance of contextual factors in determining what constitutes adaptive behavior. Still later, I viewed wisdom as part of the mix. The search has been rewarding, except for the fact that I have not yet completed it and never will.

KEYWORDS—intelligence; analytical skills; creative skills; practical skills; wisdom-based skills

STAGE 0: THE PREHISTORY

I have long believed that IQ is not the whole story of intelligence. Like McClelland (3), Gardner (4), and Ceci (5), among others, I believe that IQ tests are narrow in what they assess as intelligence (see also (6)). But if a score on an IQ test is not the whole story, what is?

As a result of my dismal scores on the group IQ tests that were all the rage in the 1950s, I became interested in intelligence in elementary school (see Ref. 7). When I was in the seventh grade, in 1963, as part of a science project, I created my own IQ test: the Sternberg Test of Mental Abilities (STOMA—no doubt you have heard of it!). I thought that was wrong with IQ tests is that they insufficiently sampled the skills involved in intelligence. So I put into my test just about every subtest I could find that was used in existing intelligence tests. I
did not know statistics, but I knew enough to discover, through testing, that after a certain point, it did not seem to matter how many subtests I gave: The results were about the same. I had rediscovered Spearman’s (8) g. No Zipperump-a-Zoo there!

STAGE 1: THE COMPONENTIAL THEORY OF INTELLIGENCE

By the time I was in graduate school at Stanford and then an assistant professor at Yale, I concluded that I finally had figured out what was wrong with IQ in particular and the whole psychometric approach to intelligence in general. The problem was focusing on individual differences—person variation—instead of on information processing, as assessed by stimulus variation (9). So my colleagues and I started giving mental-test problems in different forms, recording reaction times and error rates, and mathematically modeling the cognitive processes involved in solving inductive (e.g., analogies) as well as deductive reasoning problems (e.g., categorical syllogisms) as well as verbal-comprehension problems (where test takers had to figure out the meanings of unknown words). We also gave psychometric ability tests so we could relate components of information processing to psychometrically determined abilities. Using these techniques, we ascertained the components of information processing people used, the strategies into which these components were combined, the mental representations upon which the processes acted, and the latencies and error rates associated with the components (10, 11).

For example, we found that most people solve linear syllogisms (e.g., John is taller than Mary. Mary is taller than Bill. Who is shortest?) using a combination of linguistic and spatial strategies, that encoding the terms of the sentences was time-consuming, and that we could distinguish components of information processing that were linguistically based from those that were spatially based. We also could account for the development of component processes in linear syllogisms, analogies, and other types of problems over different age spans (12–14).

I came to believe that components are of three kinds: meta- components, which plan, monitor, and evaluate problem solving (e.g., recognizing the existence of a problem, defining the nature of the problem); performance components, which execute the problem solving (e.g., encoding items, inferring relations between items); and knowledge-acquisition components, which learn how to solve the problems in the first place (e.g., selectively encoding what information is relevant, selectively comparing new information to old information stored in long-term memory). Some kinds of componential processes (e.g., inference) continued to develop monotonically, but other kinds of componential processes (e.g., encoding) did not. Children first became faster in encoding and then, when they learned that strong encoding could speed up their reasoning and problem solving, actually became slower. So we learned that development was not a matter of continuity versus discontinuity, but a matter of both (15). I thought I had found the Zipperump-a-Zoo! I was wrong.

The componential approach was elegant—if I must say so myself—but had three problems. First, in regression equations, the component latency that correlated most strongly with g was the regression constant. That was clearly not what I had hoped for, as that was the unanalyzed component. Second, the approach worked for problems whose information processing could be decomposed relatively easily, but it was not clear how it would work for more complex problems, such as the crypt-arithmetic problems studied by Newell and Simon (16): For example, given DONALD + GERALD = ROBERT, D = 5; test takers would have to figure out what numerals to put in place of the remaining letters. Third, I concluded that all I was doing was reanalyzing IQ test data: Psychometricians analyzed subject variance; I analyzed stimulus variance. But the underlying assumption was still that IQ is all there is.

STAGE 2: THE TRIARCHIC THEORY OF INTELLIGENCE

By the early 1980s, I was convinced that the componential approach to intelligence was inadequate. Partly through the literature and partly through my experiences as director of graduate studies in psychology at Yale, I became convinced that intelligence comprised more than just the kinds of analytical skills measured by intelligence tests, including the ones I had been using. In particular, I believed that intelligence involved creative and practical skills (17, 18), not just analytical intelligence or what is commonly called general intelligence, or g. General intelligence is a modestly to moderately good predictor of many forms of behavior (19), but much unexplained variance remains in its prediction of various criteria, such as academic success, job success, and health. When I was tackling the concept of g in the early 1980s, it was a time of some ferment in the field of intelligence, with Howard Gardner (20) proposing his theory of multiple intelligences at about the same time. My colleagues and I did empirical work on practical intelligence (21) and creative intelligence (22, 23).

I called the theory triarchic because it had three parts: a part specifying the information-processing components of intelligence; a part specifying what constituted creative and automatized use of those components, depending on one’s level of experience in given tasks and situations; and a part dealing with how the components could be used practically by adapting to, shaping, and selecting environments. However, some scholars came to see the theory as triarchic because of its distinction among analytical, creative, and practical aspects of intelligence—and I eventually adopted that view, too. Unlike in Gardner’s (20) theory, which specified independent intelligences, the three aspects of intelligence were not viewed as independent. Rather, components of intelligence were used analytically when applied to relatively familiar and abstract problems; used creatively
when applied to relatively novel tasks and situations; and used practically when applied to everyday situations in which people needed to adapt to, shape, and select environments.

I thought I had found the Zippermump-a-Zoo at last. I had not. I was viewing intelligence as some kind of weighted combination of its analytical, creative, and practical aspects, and that was wrong.

STAGE 3: THE THEORY OF SUCCESSFUL INTELLIGENCE

In the triarchic theory, I noted something about human intelligence, but at the time, did not realize its full significance. That something was that people are intelligent, in large part, by virtue of recognizing their strengths and weaknesses, and of finding ways to capitalize on their strengths and compensating for or correcting their weaknesses. No single weighted combination of skills characterized a person's intelligence because people succeed in large part not just because of their abilities, but also because of their patterns of capitalization, on one hand, and compensation and correction, on the other (24). It was as important to leverage one's abilities effectively as to have the abilities in various degrees in the first place.

We studied validating the theory of successful intelligence, particularly with regard to whether the theory could improve instruction. We found that teaching for successful intelligence improved school achievement (25); however, when we tried to upscale the work some years later, we were less successful (26). We lacked the resources to ensure fidelity of treatment, but the weak findings may have been the result of many possible causes. We also found that students who were taught at least some of the time in a way that capitalized on their strengths performed more optimally than students who were not taught in a way that considered their abilities (27).

This is about where I was when I wrote the first article for The Psychologist on my search for the Zippermump-a-Zoo (2). But I knew I had not found the Zippermump-a-Zoo, for at least two reasons. First, I had no well-validated measures of the elements of the theory of successful intelligence. Second, my experience suggested that although I acknowledged context effects on intelligence, I was underestimating them.

My first goal was to develop validated measures and show that they could be useful. A team of collaborators and I constructed an assessment for an enterprise we called the Rainbow Project (28). The assessment was administered to roughly 1,000 high school seniors and college freshmen. The students varied widely in their geographic region as well as in the level of prestige of the institution they attended.

By using tests of analytical, creative, and practical skills, we could about double the prediction of how the SAT or the ACT alone influenced freshman GPA, and we could reduce substantially ethnic-group differences on our measures in comparison with the SAT and ACT. We also found separable creative and practical factors, although the analytical factor we anticipated instead was characterized by the multiple-choice format. That is, no matter what we intended to measure, if we measured it by multiple-choice testing, we ended up with an analytical test. In a separate study (29), we showed that we could improve prediction of success in a graduate business school over and above the prediction obtained from the Graduate Management Admission Test (GMAT). In particular, our test predicted success in a creative independent project, whereas the GMAT did not. My collaborators and I also showed that ethnic-group differences could be reduced in our augmented versions of various Advanced Placement (AP) examinations, in particular, in psychology, statistics, and physics (30, 31).

The Rainbow Project succeeded, at least in a predictive way, but our funders, the College Board, refused to renew our funding, claiming that the assessment could not be upscaled. I disagreed. I saw all my research plans going up in smoke. So I decided to enter administration, which would give me a chance to use measures like the ones we developed in the undergraduate admissions process. We did so when I was Dean of Arts and Sciences at Tufts University and Provost at Oklahoma State University. Through a project called Kaleidoscope, we increased prediction not only of college academic performance but also of extracurricular and leadership performance, and we continued to reduce ethnic-group differences (32). These admissions procedures are still used at Tufts (Kaleidoscope) and Oklahoma State (Panorama).

Of course, all of these studies were conducted in U.S. mainstream culture and did not look beyond it. So they could address some questions about performance of U.S. college-bound students, but not about students in other countries. By the turn of the 20th century, I was looking at cultural and other contextual factors not only in what it meant to think and perform intelligently, but also on what people meant by intelligence. Although as psychological scientists, we may discount people’s implicit theories (folk conceptions) of intelligence, these implicit theories determine largely both their judgments of the intelligence of others and how they raise their children to be intelligent. I had been studying implicit theories for a while (33, 34), but I had studied them in the continental United States. I now found that people’s conceptions of intelligence differed widely across cultures (35). Moreover, what they needed to do to adapt to their environment varied wildly across cultures (36).

For example, rural Kenyan school children needed to learn the names of natural herbal medicines to combat frequent parasitic illnesses (37), and rural Yup’ik children in Alaska needed to learn spatial navigation, hunting, and ice-fishing skills (38). Some of the children who excelled in these indigenous skills did not fare well on conventional intelligence tests, and some of the children who did well on standardized tests did not do well on the indigenous tasks. People in different cultures had very different metaphors of mind (39, 40) and as a result, raised their children to be smart in terms of their own implicit theories of
intelligence. When these implicit theories matched those of the school, the children tended to look smart; but when the implicit theories were a poor match, the children tended not to look so smart (41).

I still did not have my Zipperump-a-Zoo and I knew it: I now realized that even people who were successfully intelligent could be plenty smart but remarkably foolish (42).

STAGE 4: THE AUGMENTED THEORY OF SUCCESSFUL INTELLIGENCE

By the early 2000s, I was convinced the theory of successful intelligence lacked one crucial feature: It did not consider wisdom (43, 44). I came to view wisdom as the application of the analytical, creative, and practical aspects of successful intelligence for a common good, over the long as well as the short terms, through the infusion of positive values (44). People could be smart, both in terms of IQ and of successful intelligence, and yet commit egregious cognitive fallacies in their thinking, in particular, egocentrism (“It’s all about me”), unrealistic optimism (“It’s my idea so it has to work out”), false omniscience (“I’m so smart, I know all there is to know”), false omnipotence (“I’m so smart, I’m all-powerful”), false invulnerability (“I’m so smart, no one ever will be able to touch me”), and ethical disengagement (“Ethics are important for other people, but I’m too smart for that.”). Recently, I have become interested in why so many people’s ethical reasoning goes astray (45). Stanovich (46) made a related point: People can be smart but highly irrational. Unfortunately, they do not realize how irrational they are because they cloak themselves in their not-always-useful IQs.

THAT STILL-HIDDEN ZIPPERUMP-A-ZOO

No, I still have not found the Zipperump-a-Zoo. I know it, and others are convinced that I am not even close. For one thing, although I have been studying intelligence as modifiable (47), I know that intelligence has state-like properties that even a view of intelligence as modifiable does not capture (48). In universities today, students take drugs that boost test scores to capitalize on these state-like properties, raising a new question of what it means for a test, administered in a brief period of time, to be fair. Moreover, although I have argued that general intelligence (g) is part of the whole package of intelligence, many psychologists and especially psychometricians believe that, when it comes to intelligence, g is pretty much the whole thing, and they question much or all of my research (19, 49–51). Personally, I accept a hierarchical model of g, such as Carroll’s (52): I just do not believe that g, by itself or in a hierarchical arrangement, is all there is to intelligence.

In the end, you never find the Zipperump-a-Zoo, though it may lurk in your office, living room, or anywhere else. You pass the torch to your students in the hope they may find it, and the best they can do is pass on their torch when the time comes. The search has been fun, though, and I have had the pleasure to see plenty of other animals in Professor Wormberg’s menagerie along the way, even though the Zipperump-a-Zoo has eluded me, no matter where I have looked. Should you encounter anyone who believes he or she has found it—and there are plenty of those in the field of intelligence—my advice is: “Caveat emptor: Buyer beware!”

REFERENCES