using one dimension or criterion, a kind of a crypto-IQ assessment. Clearly, everything I have described today stands in direct opposition to that particular view of the world. Indeed that is my intent—to provide a ringing indictment of such one-track thinking.

I believe that in our society we suffer from three biases, which I have nicknamed "Westist," "Testist," and "Bestist." "Westist" involves putting certain Western cultural values, which date back to Socrates, on a pedestal. Logical thinking, for example, is important; rationality is important; but they are not the only virtues. "Testist" suggests a bias towards focusing upon those human abilities or approaches that are readily testable. If it can't be tested, it sometimes seems, it is not worth paying attention to. My feeling is that assessment can be much broader, much more humane than it is now, and that psychologists should spend less time ranking people and more time trying to help them.

"Bestist" is a not very veiled reference to a book by David Halberstam called *The best and the brightest.* Halberstam referred ironically to figures such as Harvard faculty members who were brought to Washington to help President John F. Kennedy and in the process launched the Vietnam War. I think that any belief that all the answers to a given problem lie in one certain approach, such as logical-mathematical thinking, can be very dangerous. Current views of intellect need to be leavened with other more comprehensive points of view.

It is of the utmost importance that we recognize and nurture all of the varied human intelligences, and all of the combinations of intelligences. We are all so different largely because we all have different combinations of intelligences. If we recognize this, I think we will have at least a better chance of dealing appropriately with the many problems that we face in the world. If we can mobilize the spectrum of human abilities, not only will people feel better about themselves and more competent; it is even possible that they will also feel more engaged and better able to join the rest of the world community in working for the broader good. Perhaps if we can mobilize the full range of human intelligences and ally them to an ethical sense, we can help to increase the likelihood of our survival on this planet, and perhaps even contribute to our thriving.

Chapter 2

A Rounded Version

Coauthored by Joseph Walters

Gardner, H. & Walters, J. (1993). A Rounded Version. Multiple Intelligences (pp. 13-34). NY: Basic Books.

Two eleven-year-old children are taking a test of "intelligence." They sit at their desks laboring over the meanings of different words, the interpretation of graphs, and the solutions to arithmetic problems. They record their answers by filling in small circles on a single piece of paper. Later these completed answer sheets are scored objectively: the number of right answers is converted into a standardized score that compares the individual child with a population of children of similar age.

The teachers of these children review the different scores. They notice that one of the children has performed at a superior level; on all sections of the test, she answered more questions correctly than did her peers. In fact, her score is similar to that of children three to four years older. The other child's performance is average—his scores reflect those of other children his age.

A subtle change in expectations surrounds the review of these test scores. Teachers begin to expect the first child to do quite well during her formal schooling, whereas the second should have only moderate success. Indeed these predictions come true. In other words, the test taken by the eleven-year-olds serves as a reliable predictor of their later performance in school.

How does this happen? One explanation involves our free use of the word "intelligence": the child with the greater "intelligence" has the ability to solve problems, to find the answers to specific questions, and to learn new material quickly and efficiently. These skills in turn play a central role in school success. In this view, "intelligence" is a singular faculty that is brought to bear in any problem-solving situation. Since schooling deals largely with solving problems of various sorts, predicting this capacity in young children predicts their future success in school.

"Intelligence," from this point of view, is a general ability that is found in varying degrees in all individuals. It is the key to success in solving problems. This ability can be measured reliably with standardized pencil-and-paper tests that, in turn, predict future success in school.

What happens after school is completed? Consider the two individuals in the example. Looking further down the road, we find that the "average" student has become a highly successful mechanical engineer who has risen to a position of prominence in both the professional community of engineers as well as in civic groups in his community. His success is no fluke—he is considered by all to be a talented individual. The "superior" student, on the other hand, has had little success in her chosen career as a writer; after repeated rejections by publishers, she has taken up a middle management position in a bank. While certainly not a "failure," she is considered by her peers to be quite "ordinary" in her adult accomplishments. So what happened?

This fabricated example is based on the facts of intelligence testing. IQ tests predict school performance with considerable accuracy, but they are only an indifferent predictor of performance in a profession after formal schooling (Jencks, 1972). Furthermore, even as IQ tests measure only logical or logical-linguistic capacities, in this society we are nearly "brain-washed" to restrict the notion of intelligence to the capacities used in solving logical and linguistic problems.

To introduce an alternative point of view, undertake the following "thought experiment." Suspend the usual judgment of what constitutes intelligence and let your thoughts run freely over the capabilities of humans—perhaps those that would be picked out by the proverbial Martian visitor. In this exercise, you are drawn to the brilliant chess player, the world-class violinist, and the champion athlete; such outstanding performers deserve special consideration. Under this experiment, a quite different view of *intelligence* emerges. Are the chess player, violinist, and athlete "intelligent" in these pursuits? If they are, then why do our tests of "intelligence" fail to identify them? If they are not "intelligent," what allows them to achieve such astounding feats? In

general, why does the contemporary construct "intelligence" fail to explain large areas of human endeavor?

In this chapter we approach these problems through the theory of multiple intelligences (MI). As the name indicates, we believe that human cognitive competence is better described in terms of a set of abilities, talents, or mental skills, which we call "intelligences." All normal individuals possess each of these skills to some extent; individuals differ in the degree of skill and in the nature of their combination. We believe this theory of intelligence may be more humane and more veridical than alternative views of intelligence and that it more adequately reflects the data of human "intelligent" behavior. Such a theory has important educational implications, including ones for curriculum development.

What Constitutes an Intelligence?

The question of the optimal definition of intelligence looms large in our inquiry. Indeed, it is at the level of this definition that the theory of multiple intelligences diverges from traditional points of view. In a traditional view, intelligence is defined operationally as the ability to answer items on tests of intelligence. The inference from the test scores to some underlying ability is supported by statistical techniques that compare responses of subjects at different ages; the apparent correlation of these test scores across ages and across different tests corroborates the notion that the general faculty of intelligence, *g*, does not change much with age or with training or experience. It is an inborn attribute or faculty of the individual.

Multiple intelligences theory, on the other hand, pluralizes the traditional concept. An intelligence entails the ability to solve problems or fashion products that are of consequence in a particular cultural setting or community. The problem-solving skill allows one to approach a situation in which a goal is to be obtained and to locate the appropriate route to that goal. The creation of a *cultural* product is crucial to such functions as capturing and transmitting knowledge or expressing one's views or feelings. The problems to be solved range from creating an end for a story to anticipating a mating move in chess to repairing a quilt. Products range from scientific theories to musical compositions to successful political campaigns.

MI theory is framed in light of the biological origins of each problem-solving skill. Only those skills that are universal to the human species are treated. Even so, the biological proclivity to participate in a particular form of problem solving must also be coupled with the cultural nurturing of that domain. For example, language, a universal skill, may manifest itself particularly as writing in one culture, as oratory in another culture, and as the secret language of anagrams in a third.

Given the desire of selecting intelligences that are rooted in biology, and that are valued in one or more cultural settings, how does one actually identify an "intelligence"? In coming up with our list, we consulted evidence from several different sources: knowledge about normal development and development in gifted individuals; information about the breakdown of cognitive skills under conditions of brain damage; studies of exceptional populations, including prodigies, idiots savants, and autistic children; data about the evolution of cognition over the millenia; cross-cultural accounts of cognition; psychometric studies, including examinations of correlations among tests; and psychological training studies, particularly measures of transfer and generalization across tasks. Only those candidate intelligences that satisfied all or a majority of the criteria were selected as bona fide intelligences. A more complete discussion of each of these criteria for an "intelligence" and the seven intelligences that have been proposed so far, is found in *Frames of mind* (1983). This book also considers how the theory might be disproven and compares it to competing theories of intelligence.

In addition to satisfying the aforementioned criteria, each intelligence must have an identifiable core operation or set of operations. As a neurally based computational system, each intelligence is activated or "triggered" by certain kinds of internally or externally presented information. For example, one core of musical intelligence is the sensitivity to pitch relations, whereas one core of linguistic intelligence is the sensitivity to phonological features.

An intelligence must also be susceptible to encoding in a symbol system—a culturally contrived system of meaning, which captures and conveys important forms of information. Language, picturing, and mathematics are but three nearly worldwide symbol systems that are necessary for human survival and productivity. The relationship of a candidate intelligence to a human symbol system is no accident. In fact, the existence of a core computational capacity anticipates the existence of a symbol system that exploits that capacity. While it may be possible for an intelligence to proceed without an accompanying symbol system, a primary characteristic of human intelligence may well be its gravitation toward such an embodiment.

The Seven Intelligences

Having sketched the characteristics and criteria of an intelligence, we turn now to a brief consideration of each of the seven intelligences. We begin each sketch with a thumbnail biography of a person who demonstrates an unusual facility with that intelligence. These biographies illustrate some of the abilities that are central to the fluent operation of a given intelligence. Although each biography illustrates a particular intelligence, we do not wish to imply that in adulthood intelligences operate in isolation. Indeed, except for abnormal individuals, intelligences always work in concert, and any sophisticated adult role will involve a melding of several of them. Following each biography we survey the various sources of data that support each candidate as an "intelligence."

MUSICAL INTELLIGENCE

> When he was three years old, Yehudi Menuhin was smuggled into the San Francisco Orchestra concerts by his parents. The sound of Louis Persinger's violin so entranced the youngster that he insisted on a violin for his birthday and Louis Persinger as his teacher. He got both. By the time he was ten years old, Menuhin was an international performer (Menuhin, 1977).

Violinist Yehudi Menuhin's musical intelligence manifested itself even before he had touched a violin or received any musical training. His powerful reaction to that particular sound and his rapid progress on the instrument suggest that he was biologically prepared in some way for that endeavor. In this way evidence from child prodigies supports our claim that there is a biological link to a particular intelligence. Other special populations, such as autistic children who can play a musical instrument beautifully but who cannot speak, underscore the independence of musical intelligence.

A brief consideration of the evidence suggests that musical skill passes the other tests for an intelligence. For example, certain parts of the brain play important roles in perception and production of music. These areas are characteristically located in the right hemisphere, although musical skill is not as clearly "localized," or located in a specifiable area, as language. Although the particular susceptibility of musical ability to brain damage depends on the degree of training and other individual differences, there is clear evidence for "amusia" or loss of musical ability.

Music apparently played an important unifying role in Stone Age (Paleolithic) societies. Birdsong provides a link to other species. Evidence from various cultures supports the notion that music is a universal faculty. Studies of infant development suggest that there is a "raw" computational ability in early childhood. Finally, musical notation provides an accessible and lucid symbol system.

In short, evidence to support the interpretation of musical ability as an "intelligence" comes from many different sources. Even though musical skill is not typically considered an intellectual skill like mathematics, it qualifies under our criteria. By definition it deserves consideration; and in view of the data, its inclusion is empirically justified.

BODILY-KINESTHETIC INTELLIGENCE

> Fifteen-year-old Babe Ruth played third base. During one game his team's pitcher was doing very poorly and Babe loudly criticized him from third base. Brother Mathias, the coach, called out, "Ruth, if you know so much about it, YOU pitch!" Babe was surprised and embarrassed because he had never pitched before, but Brother Mathias insisted. Ruth said later that at the very moment he took the pitcher's mound, he KNEW he was supposed to be a pitcher and that it was "natural" for him to strike people out. Indeed, he went on to become a great major league pitcher (and, of course, attained legendary status as a hitter) (Connor, 1982).

Like Menuhin, Babe Ruth was a child prodigy who recognized his "instrument" immediately upon his first exposure to it. This recognition occurred in advance of formal training.

Control of bodily movement is, of course, localized in the motor cortex, with each hemisphere dominant or controlling bodily movements on the contra-lateral side. In right-handers, the dominance for such movement is ordinarily found in the left hemisphere. The ability to perform movements when directed to do so can be impaired even in individuals who can perform the same movements reflexively or on a nonvoluntary basis. The existence of specific *apraxia* constitutes one line of evidence for a bodily-kinesthetic intelligence.

The evolution of specialized body movements is of obvious advan-

tage to the species, and in humans this adaptation is extended through the use of tools. Body movement undergoes a clearly defined developmental schedule in children. And there is little question of its universality across cultures. Thus it appears that bodily-kinesthetic "knowledge" satisfies many of the criteria for an intelligence.

The consideration of bodily-kinesthetic knowledge as "problem solving" may be less intuitive. Certainly carrying out a mime sequence or hitting a tennis ball is not solving a mathematical equation. And yet, the ability to use one's body to express an emotion (as in a dance), to play a game (as in a sport), or to create a new product (as in devising an invention) is evidence of the cognitive features of body usage. The specific computations required to solve a particular bodily-kinesthetic *problem,* hitting a tennis ball, are summarized by Tim Gallwey:

> At the moment the ball leaves the server's racket, the brain calculates approximately where it will land and where the racket will intercept it. This calculation includes the initial velocity of the ball, combined with an input for the progressive decrease in velocity and the effect of wind and after the bounce of the ball. Simultaneously, muscle orders are given: not just once, but constantly with refined and updated information. The muscles must cooperate. A movement of the feet occurs, the racket is taken back, the face of the racket kept at a constant angle. Contact is made at a precise point that depends on whether the order was given to hit down the line or cross-court, an order not given until after a split-second analysis of the movement and balance of the opponent.
>
> To return an average serve, you have about one second to do this. To hit the ball at all is remarkable and yet not uncommon. The truth is that everyone who inhabits a human body possesses a remarkable creation (Gallwey, 1976).

LOGICAL-MATHEMATICAL INTELLIGENCE

In 1983 Barbara McClintock won the Nobel Prize in medicine or physiology for her work in microbiology. Her intellectual powers of deduction and observation illustrate one form of logical-mathematical intelligence that is often labeled "scientific thinking." One incident is particularly illuminating. While a researcher at Cornell in the 1920s McClintock was faced one day with a problem: while *theory* predicted 50 percent pollen sterility in corn, her research assistant (in the "field") was finding plants that were only 25 to 30 percent sterile. Disturbed by this discrepancy, McClintock left the cornfield and returned to her office where she sat for half an hour, thinking:

> Suddenly I jumped up and ran back to the (corn) field. At the top of the field (the others were still at the bottom) I shouted "Eureka, I have it! I know what the 30% sterility is!" . . . They asked me to prove it. I sat down with a paper bag and a pencil and I started from scratch, which I had not done at all in my laboratory. It had all been done so fast; the answer came and I ran. Now I worked it out step by step—it was an intricate series of steps—and I came out with [the same result]. [They] looked at the material and it was exactly as I'd said it was; it worked out exactly as I had diagrammed it. Now, why did I know, without having done it on paper? Why was I so sure? (Keller, 1983, p. 104).

This anecdote illustrates two essential facts of the logical-mathematical intelligence. First, in the gifted individual, the process of problem solving is often remarkably rapid—the successful scientist copes with many variables at once and creates numerous hypotheses that are each evaluated and then accepted or rejected in turn.

The anecdote also underscores the *nonverbal* nature of the intelligence. A solution to a problem can be constructed *before* it is articulated. In fact, the solution process may be totally invisible, even to the problem solver. This need not imply, however, that discoveries of this sort—the familiar "Aha!" phenomenon—are mysterious, intuitive, or unpredictable. The fact that it happens more frequently to some people (perhaps Nobel Prize winners) suggests the opposite. We interpret this as the work of the logical-mathematical intelligence.

Along with the companion skill of language, logical-mathematical reasoning provides the principal basis for IQ tests. This form of intelligence has been heavily investigated by traditional psychologists, and it is the archetype of "raw intelligence" or the problem-solving faculty that purportedly cuts across domains. It is perhaps ironic, then, that the actual mechanism by which one arrives at a solution to a logical-mathematical problem is not as yet properly understood.

This intelligence is supported by our empirical criteria as well. Certain areas of the brain are more prominent in mathematical calculation than others. There are idiots savants who perform great feats of calculation even though they remain tragically deficient in most other areas. Child prodigies in mathematics abound. The development of this intelligence in children has been carefully documented by Jean Piaget and other psychologists.

LINGUISTIC INTELLIGENCE

> At the age of ten, T. S. Eliot created a magazine called "Fireside" to which he was the sole contributor. In a three-day period during his winter vacation, he created eight complete issues. Each one included poems, adventure stories, a gossip column, and humor. Some of this material survives and it displays the talent of the poet (see Soldo, 1982).

As with the logical intelligence, calling linguistic skill an "intelligence" is consistent with the stance of traditional psychology. Linguistic intelligence also passes our empirical tests. For instance, a specific area of the brain, called "Broca's Area," is responsible for the production of grammatical sentences. A person with damage to this area can understand words and sentences quite well but has difficulty putting words together in anything other than the simplest of sentences. At the same time, other thought processes may be entirely unaffected.

The gift of language is universal, and its development in children is strikingly constant across cultures. Even in deaf populations where a manual sign language is not explicitly taught, children will often "invent" their own manual language and use it surreptitiously! We thus see how an intelligence may operate independently of a specific input modality or output channel.

SPATIAL INTELLIGENCE

> Navigation around the Caroline Islands in the South Seas is accomplished without instruments. The position of the stars, as viewed from various islands, the weather patterns, and water color are the only sign posts. Each journey is broken into a series of segments; and the navigator learns the position of the stars within each of these segments. During the actual trip the navigator must envision mentally a reference island as it passes under a particular star and from that he computes the number of segments completed, the proportion of the trip remaining, and any corrections in heading that are required. The navigator cannot *see* the islands as he sails along; instead he maps their locations in his mental "picture" of the journey (Gardner, 1983).

Spatial problem solving is required for navigation and in the use of the notational system of maps. Other kinds of spatial problem solving are brought to bear in visualizing an object seen from a different angle and in playing chess. The visual arts also employ this intelligence in the use of space.

Evidence from brain research is clear and persuasive. Just as the left hemisphere has, over the course of evolution, been selected as the site of linguistic processing in right-handed persons, the right hemisphere proves to be the site most crucial for spatial processing. Damage to the right posterior regions causes impairment of the ability to find one's way around a site, to recognize faces or scenes, or to notice fine details.

Patients with damage specific to regions of the right hemisphere will attempt to compensate for their spacial deficits with linguistic strategies. They will try to reason aloud, to challenge the task, or even make up answers. But such nonspatial strategies are rarely successful.

Blind populations provide an illustration of the distinction between the spatial intelligence and visual perception. A blind person can recognize shapes by an indirect method: running a hand along the object translates into length of time of movement, which in turn is translated into the size of the object. For the blind person, the perceptual system of the tactile modality parallels the visual modality in the seeing person. The analogy between the spatial reasoning of the blind and the linguistic reasoning of the deaf is notable.

There are few child prodigies among visual artists, but there are idiots savants such as Nadia (Selfe, 1977). Despite a condition of severe autism, this preschool child made drawings of the most remarkable representational accuracy and finesse.

INTERPERSONAL INTELLIGENCE

With little formal training in special education and nearly blind herself, Anne Sullivan began the intimidating task of instructing a blind and deaf seven-year-old Helen Keller. Sullivan's efforts at communication were complicated by the child's emotional struggle with the world around her. At their first meal together, this scene occurred:

> Annie did not allow Helen to put her hand into Annie's plate and take what she wanted, as she had been accustomed to do with her family. It became a test of wills—hand thrust into plate, hand firmly put aside. The family, much upset, left the dining room. Annie locked the door and proceeded to eat her breakfast while Helen lay on the floor kicking and screaming, pushing and pulling at Annie's chair. [After half an hour] Helen went around the table looking for her family. She discovered no one else was there and that bewildered her. Finally, she sat down and began to eat her breakfast, but with her hands. Annie gave her a spoon. Down on the floor it clattered, and the contest of wills began anew (Lash, 1980, p. 52).

Anne Sullivan sensitively responded to the child's behavior. She wrote home: "The greatest problem I shall have to solve is how to discipline and control her without breaking her spirit. I shall go rather slowly at first and try to win her love."

In fact, the first "miracle" occurred two weeks later, well before the famous incident at the pumphouse. Annie had taken Helen to a small cottage near the family's house, where they could live alone. After seven days together, Helen's personality suddenly underwent a profound change—the therapy had worked:

> My heart is singing with joy this morning. A miracle has happened! The wild little creature of two weeks ago has been transformed into a gentle child (p. 54).

It was just two weeks after this that the first breakthrough in Helen's grasp of language occurred; and from that point on, she progressed with incredible speed. The key to the miracle of language was Anne Sullivan's insight into the *person* of Helen Keller.

Interpersonal intelligence builds on a core capacity to notice distinctions among others; in particular, contrasts in their moods, temperaments, motivations, and intentions. In more advanced forms, this intelligence permits a skilled adult to read the intentions and desires of others, even when these have been hidden. This skill appears in a highly sophisticated form in religious or political leaders, teachers, therapists, and parents. The Helen Keller–Anne Sullivan story suggests that this interpersonal intelligence does not depend on language.

All indices in brain research suggest that the frontal lobes play a prominent role in interpersonal knowledge. Damage in this area can cause profound personality changes while leaving other forms of problem solving unharmed—a person is often "not the same person" after such an injury.

Alzheimer's disease, a form of presenile dementia, appears to attack posterior brain zones with a special ferocity, leaving spatial, logical, and linguistic computations severly impaired. Yet, Alzheimer's patients will often remain well groomed, socially proper, and continually apologetic for their errors. In contrast, Pick's disease, another variety of presenile dementia that is more frontally oriented, entails a rapid loss of social graces.

Biological evidence for interpersonal intelligence encompasses two additional factors often cited as unique to humans. One factor is the prolonged childhood of primates, including the close attachment to the mother. In those cases where the mother is removed from early development, normal interpersonal development is in serious jeopardy. The second factor is the relative importance in humans of social interaction. Skills such as hunting, tracking, and killing in prehistoric societies required participation and cooperation of large numbers of people. The need for group cohesion, leadership, organization, and solidarity follows naturally from this.

INTRAPERSONAL INTELLIGENCE

In an essay called "A Sketch of the Past," written almost as a diary entry, Virginia Woolf discusses the "cotton wool of existence"—the various mundane events of life. She contrasts this "cotton wool" with three specific and poignant memories from her childhood: a fight with her brother, seeing a particular flower in the garden, and hearing of the suicide of a past visitor:

> These are three instances of exceptional moments. I often tell them over, or rather they come to the surface unexpectedly. But now for the first time I have written them down, and I realize something that I have never realized before. Two of these moments ended in a state of despair. The other ended, on the contrary, in a state of satisfaction.
>
> The sense of horror (in hearing of the suicide) held me powerless. But in the case of the flower, I found a reason; and was thus able to deal with the sensation. I was not powerless.
>
> Though I still have the peculiarity that I receive these sudden shocks, they are now always welcome; after the first surprise, I always feel instantly that they are particularly valuable. And so I go on to suppose that the shock-receiving capacity is what makes me a writer. I hazard the explanation that a shock is at once in my case followed by the desire to explain it. I feel that I have had a blow; but it is not, as I thought as a child, simply a blow from an enemy hidden behind the cotton wool of daily life; it is or will become a revelation of some order; it is a token of some real thing behind appearances; and I make it real by putting it into words (Woolf, 1976, pp. 69–70).

This quotation vividly illustrates the intrapersonal intelligence—knowledge of the internal aspects of a person: access to one's own

feeling life, one's range of emotions, the capacity to effect discriminations among these emotions and eventually to label them and to draw upon them as a means of understanding and guiding one's own behavior. A person with good intrapersonal intelligence has a viable and effective model of himself or herself. Since this intelligence is the most private, it requires evidence from language, music, or some other more expressive form of intelligence if the observer is to detect it at work. In the above quotation, for example, linguistic intelligence is drawn upon to convey intrapersonal knowledge; it embodies the interaction of intelligences, a common phenomenon to which we will return later.

We see the familiar criteria at work in the intrapersonal intelligence. As with the interpersonal intelligence, the frontal lobes play a central role in personality change. Injury to the lower area of the frontal lobes is likely to produce irritability or euphoria; while injury to the higher regions is more likely to produce indifference, listlessness, slowness, and apathy—a kind of depressive personality. In such "frontal-lobe" individuals, the other cognitive functions often remain preserved. In contrast, among aphasics who have recovered sufficiently to describe their experiences, we find consistent testimony: while there may have been a diminution of general altertness and considerable depression about the condition, the individual in no way felt himself to be a different person. He recognized his own needs, wants, and desires and tried as best he could to achieve them.

The autistic child is a prototypical example of an individual with impaired intrapersonal intelligence; indeed, the child may not even be able to refer to himself. At the same time, such children often exhibit remarkable abilities in the musical, computational, spatial, or mechanical realms.

Evolutionary evidence for an intrapersonal faculty is more difficult to come by, but we might speculate that the capacity to transcend the satisfaction of instinctual drives is relevant. This becomes increasingly important in a species not perennially involved in the struggle for survival.

In sum, then, both interpersonal and intrapersonal faculties pass the tests of an intelligence. They both feature problem-solving endeavors with significance for the individual and the species. Interpersonal intelligence allows one to understand and work with others; intrapersonal intelligence allows one to understand and work with oneself. In the individual's sense of self, one encounters a melding of inter- and intrapersonal components. Indeed, the sense of self emerges as one of the most marvelous of human inventions—a symbol that represents all kinds of information about a person and that is at the same time an invention that all individuals construct for themselves.

Summary: The Unique Contributions of the Theory

As human beings, we all have a repertoire of skills for solving different kinds of problems. Our investigation has begun, therefore, with a consideration of these problems, the contexts they are found in, and the culturally significant products that are the outcome. We have not approached "intelligence" as a reified human faculty that is brought to bear in literally any problem setting; rather, we have begun with the problems that humans *solve* and worked back to the "intelligences" that must be responsible.

Evidence from brain research, human development, evolution, and cross-cultural comparisons was brought to bear in our search for the relevant human intelligences: a candidate was included only if reasonable evidence to support its membership was found across these diverse fields. Again, this tack differs from the traditional one: since no candidate faculty is *necessarily* an intelligence, we could choose on a motivated basis. In the traditional approach to "intelligence," there is no opportunity for this type of empirical decision.

We have also determined that these multiple human faculties, the intelligences, are to a significant extent *independent*. For example, research with brain-damaged adults repeatedly demonstrates that particular faculties can be lost while others are spared. This independence of intelligences implies that a particularly high level of ability in one intelligence, say mathematics, does not require a similarly high level in another intelligence, like language or music. This independence of intelligences contrasts sharply with traditional measures of IQ that find high correlations among test scores. We speculate that the usual correlations among subtests of IQ tests come about because all of these tasks in fact measure the ability to respond rapidly to items of a logical-mathematical or linguistic sort; we believe that these correlations would be substantially reduced if one were to survey in a contextually appropriate way the full range of human problem-solving skills.

Until now, we have supported the fiction that adult roles depend largely on the flowering of a single intelligence. In fact, however, nearly every cultural role of any degree of sophistication requires a combination of intelligences. Thus, even an apparently straightforward role, like playing the violin, transcends a reliance on simple musical intelligence. To become a successful violinist requires bodily-kinesthetic dexterity and the interpersonal skills of relating to an audience and, in a different way, choosing a manager; quite possibly it involves an intrapersonal intelligence as well. Dance requires skills in bodily-kinesthetic, musical, interpersonal, and spatial intelligences in varying degrees. Politics requires an interpersonal skill, a linguistic facility, and perhaps some logical aptitude. Inasmuch as nearly every cultural role requires several intelligences, it becomes important to consider individuals as a collection of aptitudes rather than as having a singular problem-solving faculty that can be measured directly through pencil-and-paper tests. Even given a relatively small number of such intelligences, the diversity of human ability is created through the differences in these profiles. In fact, it may well be that the "total is greater than the sum of the parts." An individual may not be particularly gifted in any intelligence; and yet, because of a particular combination or blend of skills, he or she may be able to fill some niche uniquely well. Thus it is of paramount importance to assess the particular combination of skills that may earmark an individual for a certain vocational or avocational niche.

Implications for Education

The theory of multiple intelligences was developed as an account of human cognition that can be subjected to empirical tests. In addition, the theory seems to harbor a number of educational implications that are worth consideration. In the following discussion we will begin by outlining what appears to be the natural developmental trajectory of an intelligence. Turning then to aspects of education, we will comment on the role of nurturing and explicit instruction in this development. From this analysis we find that assessment of intelligences can play a crucial role in curriculum development.

THE NATURAL GROWTH OF AN INTELLIGENCE: A DEVELOPMENTAL TRAJECTORY

Since all intelligences are part of the human genetic heritage, at some basic level each intelligence is manifested universally, independent of education and cultural support. Exceptional populations aside for the moment, *all* humans possess certain core abilities in each of the intelligences.

The natural trajectory of development in each intelligence begins with *raw patterning ability*, for example, the ability to make tonal differentiations in musical intelligence or to appreciate three-dimensional arrangements in spatial intelligence. These abilities appear universally; they may also appear at a heightened level in that part of the population that is "at promise" in that domain. The "raw" intelligence predominates during the first year of life.

Intelligences are glimpsed through different lenses at subsequent points in development. In the subsequent stage, the intelligence is encountered through a *symbol system:* language is encountered through sentences and stories, music through songs, spatial understanding through drawings, bodily-kinesthetic through gesture or dance, and so on. At this point children demonstrate their abilities in the various intelligences through their grasp of various symbol systems. Yehudi Menuhin's response to the sound of the violin illustrates the musical intelligence of a gifted individual coming in contact with a particular aspect of the symbol system.

As development progresses, each intelligence together with its accompanying symbol system is represented in a *notational system.* Mathematics, mapping, reading, music notation, and so on, are second-order symbol systems in which the marks on paper come to stand for symbols. In our culture, these notational systems are typically mastered in a formal educational setting.

Finally, during adolescence and adulthood, the intelligences are expressed through the range of *vocational and avocational pursuits.* For example, the logical-mathematical intelligence, which began as sheer pattern ability in infancy and developed through symbolic mastery of early childhood and the notations of the school years, achieves mature expression in such roles as mathematician, accountant, scientist, cashier. Similarly, the spatial intelligence passes from the mental maps of the infant, to the symbolic operations required in drawings and the notational systems of maps, to the adult roles of navigator, chess player, and topologist.

Although all humans partake of each intelligence to some degree, certain individuals are said to be "at promise." They are highly endowed with the core abilities and skills of that intelligence. This fact becomes important for the culture as a whole, since, in general, these exceptionally gifted individuals will make notable advances in the cultural manifestations of that intelligence. It is not important that *all* members of the

Puluwat tribe demonstrate precocious spatial abilities needed for navigation by the stars, nor is it necessary for all Westerners to master mathematics to the degree necessary to make a significant contribution to theoretical physics. So long as the individuals "at promise" in particular domains are located efficiently, the overall knowledge of the group will be advanced in all domains.

While some individuals are "at promise" in an intelligence, others are "at risk." In the absence of special aids, those at risk in an intelligence will be most likely to fail tasks involving that intelligence. Conversely, those at promise will be most likely to succeed. It may be that intensive intervention at an early age can bring a larger number of children to an "at promise" level.

The special developmental trajectory of an individual at promise varies with intelligence. Thus, mathematics and music are characterized by the early appearance of gifted children who perform relatively early at or near an adult level. In contrast, the personal intelligences appear to arise much more gradually; prodigies are rare. Moreover, mature performance in one area does not imply mature performance in another area, just as gifted achievement in one does not imply gifted achievement in another.

IMPLICATIONS OF THE DEVELOPMENTAL TRAJECTORY FOR EDUCATION

Because the intelligences are manifested in different ways at different developmental levels, both assessment and nurturing need to occur in apposite ways. What nurtures in infancy would be inappropriate at later stages, and vice versa. In the preschool and early elementary years, instruction should emphasize opportunity. It is during these years that children can discover something of their own peculiar interests and abilities.

In the case of very talented children, such discoveries often happen by themselves through spontaneous "crystallizing experiences" (Walters & Gardner, 1986). When such experiences occur, often in early childhood, an individual reacts overtly to some attractive quality or feature of a domain. Immediately the individual undergoes a strong affective reaction; he or she feels a special affinity to that domain, as did Menuhin when he first heard the violin at an orchestral concert. Thereafter, in many cases, the individual persists working in the domain, and, by drawing on a powerful set of appropriate intelligences, goes on to achieve high skill in that domain in relatively quick compass.

In the case of the most powerful talents, such crystallizing experiences seem difficult to prevent; and they may be especially likely to emerge in the domains of music and mathematics. However, specifically designed encounters with materials, equipment, or other people can help a youngster discover his or her own métier.

During the school-age years, some mastery of notational systems is essential in our society. The self-discovery environment of early schooling cannot provide the structure needed for the mastery of specific notational systems like the sonata form or algebra. In fact, during this period some tutelage is needed by virtually all children. One problem is to find the right form, since group tutelage can be helpful in some instances and harmful in others. Another problem is to orchestrate the connection between practical knowledge and the knowledge embodied in symbolic systems and notational systems.

Finally, in adolescence, most students must be assisted in their choice of careers. This task is made more complex by the manner in which intelligences interact in many cultural roles. For instance, being a doctor certainly requires logical-mathematical intelligence; but while the general practitioner should have strong interpersonal skills, the surgeon needs bodily-kinesthetic dexterity. Internships, apprenticeships, and involvement with the actual materials of the cultural role become critical at this point in development.

Several implications for explicit instruction can be drawn from this analysis. First, the role of instruction in relation to the manifestation of an intelligence changes across the developmental trajectory. The enriched environment appropriate for the younger years is less crucial for adolescents. Conversely, explicit instruction in the notational system, appropriate for older children, is largely inappropriate for younger ones.

Explicit instruction must be evaluated in light of the developmental trajectories of the intelligences. Students benefit from explicit instruction only if the information or training fits into their specific place on the developmental progression. A particular kind of instruction can be either too early at one point or too late at another. For example, Suzuki training in music pays little attention to the notational system, while providing a great deal of support or scaffolding for learning the fine points of instrumental technique. While this emphasis may be very powerful for training preschool children, it can produce stunted musical development when imposed at a late point on the developmental trajectory. Such a highly structured instructional environment can accelerate progress and produce a larger number of children "at promise," but in the end it may ultimately limit choices and inhibit self-expression.

An exclusive focus on linguistic and logical skills in formal schooling can shortchange individuals with skills in other intelligences. It is evident from inspection of adult roles, even in language-dominated Western society, that spatial, interpersonal, or bodily-kinesthetic skills often play key roles. Yet linguistic and logical skills form the core of most diagnostic tests of "intelligence" and are placed on a pedagogical pedestal in our schools.

THE LARGE NEED: ASSESSMENT

The general pedagogical program described here presupposes accurate understanding of the profile of intelligences of the individual learner. Such a careful assessment procedure allows informed choices about careers and avocations. It also permits a more enlightened search for remedies for difficulties. Assessment of deficiencies can predict difficulties the learner will have; moreover, it can suggest alternative routes to an educational goal (learning mathematics via spatial relations; learning music through linguistic techniques).

Assessment, then, becomes a central feature of an educational system. We believe that it is essential to depart from standardized testing. We also believe that standard pencil-and-paper short-answer tests sample only a small proportion of intellectual abilities and often reward a certain kind of decontextualized facility. The means of assessment we favor should ultimately search for genuine problem-solving or product-fashioning skills in individuals across a range of materials.

An assessment of a particular intelligence (or set of intelligences) should highlight problems that can be solved *in the materials of that intelligence*. That is, mathematical assessment should present problems in mathematical settings. For younger children, these could consist of Piagetian-style problems in which talk is kept to a minimum. For older children, derivation of proofs in a novel numerical system might suffice. In music, on the other hand, the problems would be embedded in a musical system. Younger children could be asked to assemble tunes from individual musical segments. Older children could be shown how to compose a rondo or fugue from simple motifs.

An important aspect of assessing intelligences must include the individual's ability to solve problems or create products using the materials of the intellectual medium. Equally important, however, is the determination of which intelligence is favored when an individual has a choice. One technique for getting at this proclivity is to expose the individual to a sufficiently complex situation that can stimulate several intelligences; or to provide a set of materials drawn from different intelligences and determine toward which one an individual gravitates and how deeply he or she explores it.

As an example, consider what happens when a child sees a complex film in which several intelligences figure prominently: music, people interacting, a maze to be solved, or a particular bodily skill, may all compete for attention. Subsequent "debriefing" with the child should reveal the features to which the child paid attention; these will be related to the profile of intelligences in that child. Or consider a situation in which children are taken into a room with several different kinds of equipment and games. Simple measures of the regions in which children spend time and the kinds of activities they engage in should yield insights into the individual child's profile of intelligence.

Tests of this sort differ in two important ways from the traditional measures of "intelligence." First, they rely on materials, equipment, interviews, and so on to generate the problems to be solved; this contrasts with the traditional pencil-and-paper measures used in intelligence testing. Second, results are reported as part of an individual profile of intellectual propensities, rather than as a single index of intelligence or rank within the population. In contrasting strengths and weaknesses, they can suggest options for future learning.

Scores are not enough. This assessment procedure should suggest to parents, teachers, and, eventually, to children themselves, the sorts of activities that are available at home, in school, or in the wider community. Drawing on this information, children can bolster their own particular sets of intellectual weaknesses or combine their intellectual strengths in a way that is satisfying vocationally and avocationally.

COPING WITH THE PLURALITY OF INTELLIGENCES

Under the multiple intelligences theory, an intelligence can serve both as the *content* of instruction and the *means* or medium for communicating that content. This state of affairs has important ramifications for instruction. For example, suppose that a child is learning some mathematical principle but is not skilled in logical-mathematical intelligence. That child will probably experience some difficulty during the learning process. The reason for the difficulty is straightforward: the mathematical principle to be learned (the content) exists only in the logical-mathematical world and it ought to be communicated through mathematics (the medium). That is, the mathematical principle cannot be translated *entirely* into words (a linguistic medium) or spatial models (a spatial medium). At some point in the learning process, the mathematics of the principle must "speak for itself." In our present case, it is at just this level that the learner experiences difficulty—the learner (who is not especially "mathematical") and the problem (which is very much "mathematical") are not in accord. Mathematics, as a *medium*, has failed.

Although this situation is a necessary conundrum in light of multiple intelligences theory, we can propose various solutions. In the present example, the teacher must attempt to find an alternative route to the mathematical content—a metaphor in another medium. Language is perhaps the most obvious alternative, but spatial modeling and even a bodily-kinesthetic metaphor may prove appropriate in some cases. In this way, the student is given a *secondary* route to the solution to the problem, perhaps through the medium of an intelligence that is relatively strong for that individual.

Two features of this hypothetical scenario must be stressed. First, in such cases, the secondary route—the language, spatial model, or whatever—is at best a metaphor or translation. It is not mathematics itself. And at some point, the learner must translate back into the domain of mathematics. Without this translation, what is learned tends to remain at a relatively superficial level; cookbook-style mathematical performance results from following instructions (linguistic translation) without understanding why (mathematics retranslation).

Second, the alternative route is not guaranteed. There is no *necessary* reason why a problem in one domain *must be translatable* into a metaphorical problem in another domain. Successful teachers find these translations with relative frequency; but as learning becomes more complex, the likelihood of a successful translation may diminish.

While multiple intelligences theory is consistent with much empirical evidence, it has not been subjected to strong experimental tests within psychology. Within the area of education, the applications of the theory are currently being examined in many projects. Our hunches will have to be revised many times in light of actual classroom experience. Still there are important reasons for considering the theory of multiple intelligences and its implications for education. First of all, it is clear that many talents, if not intelligences, are overlooked nowadays; individuals with these talents are the chief casualties of the single-minded, single-funneled approach to the mind. There are many unfilled or poorly filled niches in our society and it would be opportune to guide individuals with the right set of abilities to these billets. Finally, our world is beset with problems; to have any chance of solving them, we must make the very best use of the intelligences we possess. Perhaps recognizing the plurality of intelligences and the manifold ways in which human individuals may exhibit them is an important first step.

Chapter 3

Questions and Answers About Multiple Intelligences Theory

Coauthored by Joseph Walters

Once the theory of multiple intelligences had been introduced, numerous questions were raised by friendly (and, at times, by not-so-friendly) critics. In this chapter, parts of which were originally coauthored by Joseph Walters, I answer the more common questions, grouping them as appropriate. In the next chapter, I take a more comprehensive look at the relations among the concept of "intelligence" and other efforts to describe significant human achievement.

The Term "Intelligence"

Your "intelligences"—musical, bodily-kinesthetic, and so on—are what others call talents or gifts. Why confuse the issue by using the word "intelligence" to describe them?

There is nothing magical about the word "intelligence." I have purposely chosen it to join issue with those psychologists who consider logical reasoning or linguistic competence to be on a different plane than musical problem-solving or bodily-kinesthetic aptitude. Placing logic and language on a pedestal reflects the values of our Western culture and the great premium placed on the familiar tests of intelligence. A more Olympian view sees all seven as equally valid. To call some