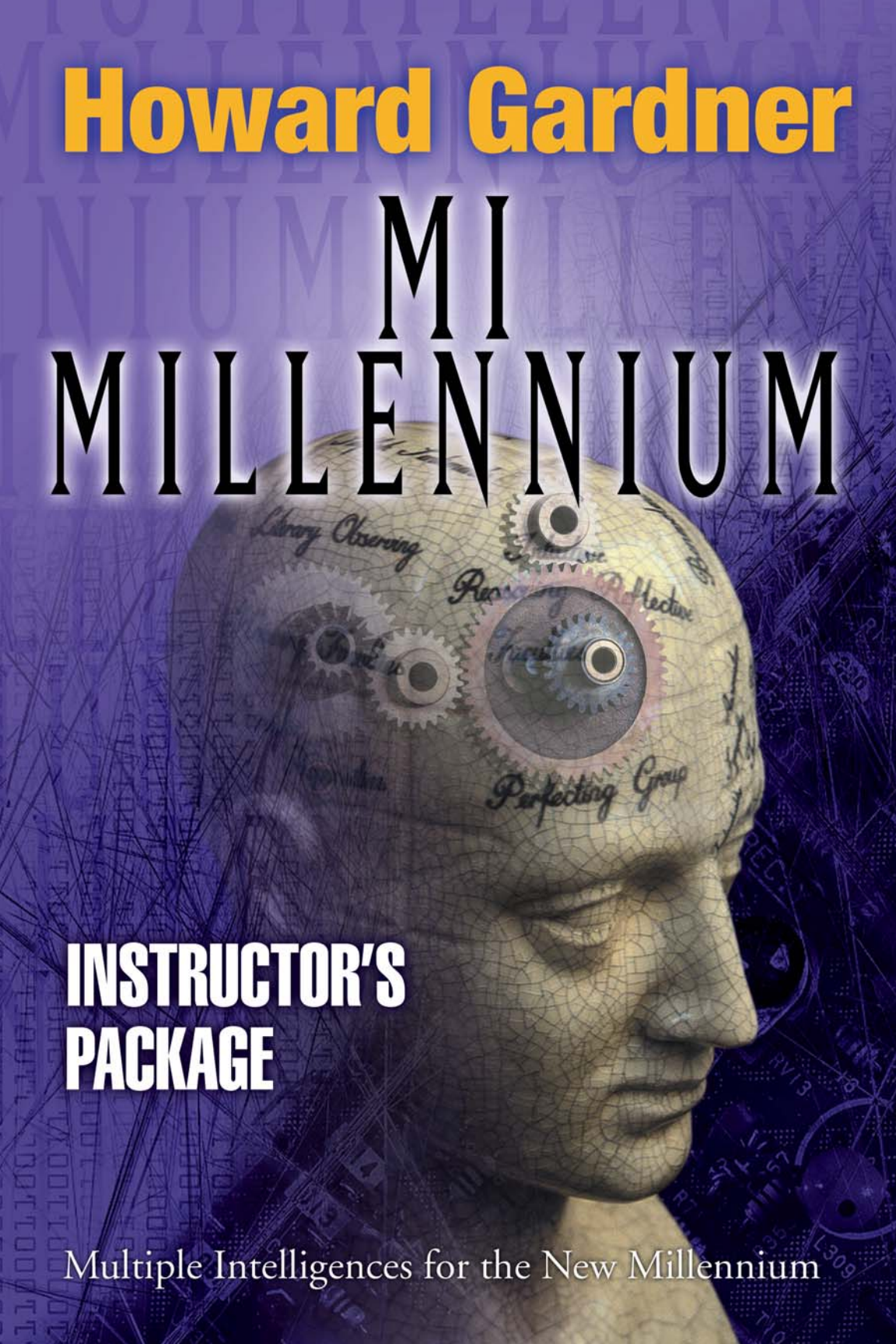
Howard Gardner

MI MILLENNIUM



INSTRUCTOR'S PACKAGE

Multiple Intelligences for the New Millennium

About this Guide

This guide is intended to assist in the use of the video *MI: Millennium* for instructional purposes.

The following pages provide an organizational schema for the video along with general notes for each section, key quotes from the video, as well as suggested discussion questions relevant to the section.

The program is divided into eight parts, each clearly distinguished by a section title during the program.

Structure:

Part 1 Who Owns Intelligence?

Part 2 A New View

Part 3 The Nine Intelligences?

Part 4 The Three Axes of Intelligence

Part 5 MI in Practice: Individualization and Assessment

Part 6 Disciplinary Understanding: Entry Points

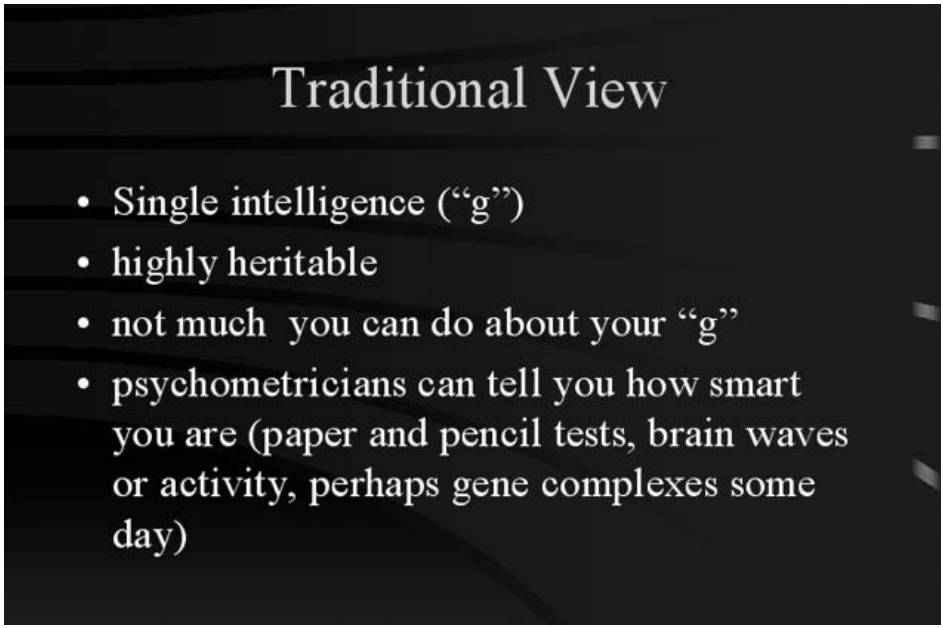
Part 7 MI in the New Millennium

Part 8 Intelligence and Ethics

1. Who Owns Intelligence?

In this introductory section, Howard Gardner presents an historical context for the development of intelligence theory. He begins this historical survey with a discussion of Alfred Binet, the French psychologist who invented the test that became known as the IQ test. In turn, Gardner proposes that throughout the twentieth century, psychometricians have 'owned' intelligence- that is, how we define it, how we value it, and how we assess it.

Gardner cites the 1994 book *The Bell Curve,* as it exemplifies the traditional view of intelligence as both highly heritable and predictable. Within this perspective lies the assumption that intelligence can be assessed with a single test, most commonly a paper and pencil test. In turn, Gardner argues how intelligence testing has become a kind of selection mechanism, opening opportunities to some and not others.



However, Gardner suggests that the traditionalists may be losing their hold on the definition of intelligence:

"We're in a situation now where geneticists, brain scientists, computer scientists, as well as individuals who are involved in the social sciences, all have a claim on saying what intelligence is, so to speak, in sharing the ownership of intelligence." [from video]

Gardner concludes this introductory section by questioning our attempt to determine intelligence through traditional psychometric means, and by suggesting a reexamination of what intelligence is and how it might be assessed.

Suggested Questions and Activities for Discussion:

- Why is it important to understand the historical development of intelligence?

- How do the roots of a psychometric understanding of intelligence shape the way we think about what intelligence is and how it is determined?

- What assumptions about intelligence are made from the perspective of Richard Herrnstein and Charles Murray, the authors of The Bell Curve?

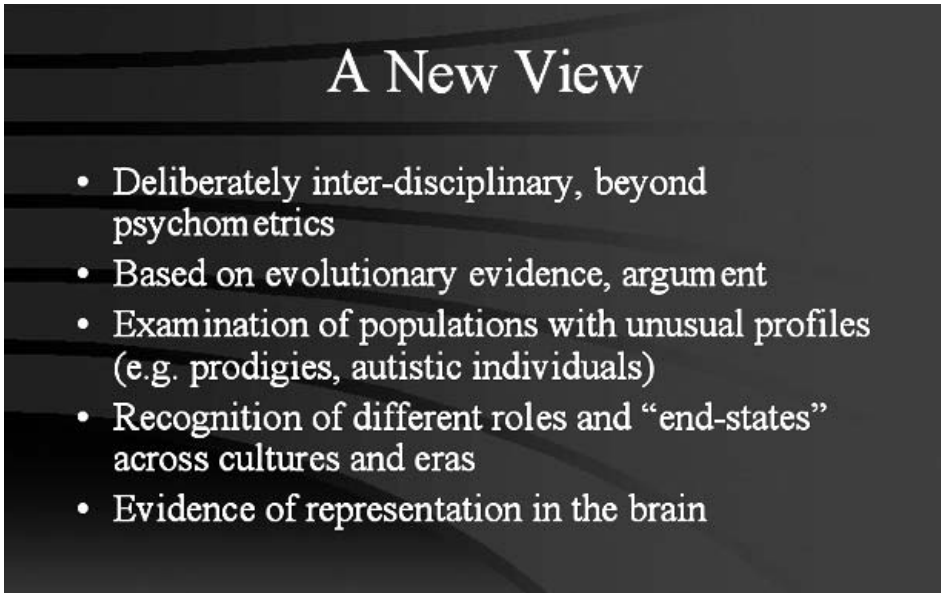
- In a traditionally held view of intelligence, is intelligence static or dynamic? Why is this significant?

- What is your definition of "intelligence?"

- Brainstorm a list of factors that you think impact a person's intelligence as traditionally defined. Discuss with others whether these factors are hereditary, environmental, or a combination of the two. Return to this list at the conclusion of the tape and see if your list has changed.

2. A New View

Along with other colleagues, Gardner has developed a new view which is called the theory of multiple intelligences, also referred to as MI theory. As he tells us, *"it operates on quite different premises, and takes into account very different kinds of evidence."* Rather than being based upon psychological tests, it's deliberately interdisciplinary, drawing not only on psychology, but also on anthropology, biology, neurology, and other disciplines.



Research for MI theory is based lines of evidence from areas such as:

Evolutionary science

"Human beings have evolved over hundreds of thousands, perhaps millions of years, to have a certain kind of mind/brain which allowed us to survive in different environments, such as the savanna of east Africa. Thus, we are the product of that very long evolutionary process. And the mind / brain—what we do well, what we do poorly, and what we can't do at all—[reflects] what was needed to survive over that long period of time in various ecologies." [from video]

The study of unusual populations (e.g., prodigies, savants, autistic individuals).

"It is extremely difficult to explain prodigies or savants if you believe there's only one kind of intelligence, because if that were the case, you'd either be very good in everything, kind of average in everything, or below average. So I think these unusual populations really challenge the unitary view of intellect." [from video]

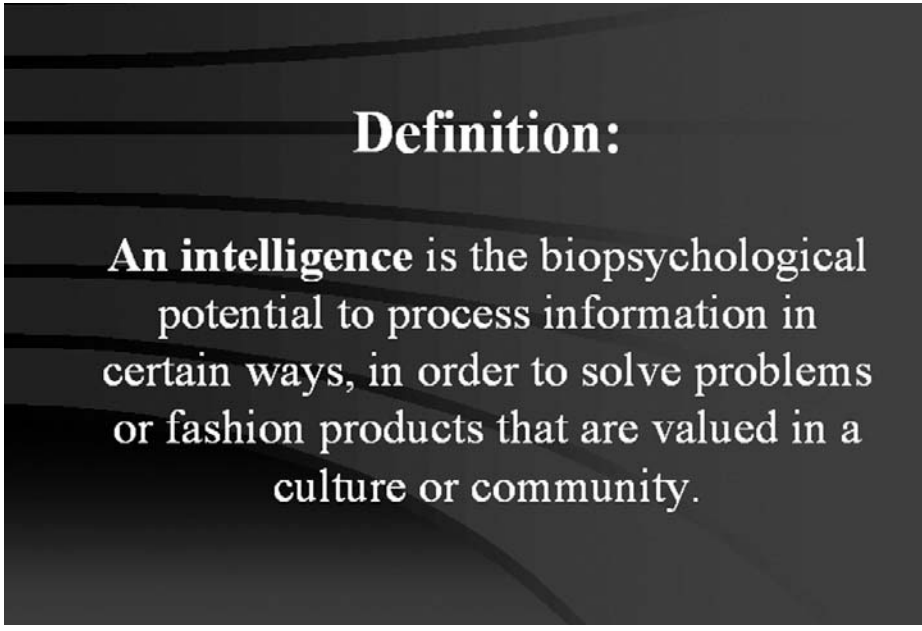
The study of roles or "end states" valued by different cultures or communities.

"It is important to understand that the IQ test was developed to figure out who would have trouble in school in Paris in 1900.... But, I can assure you, that if IQ tests had been made up by business people, they would have very different kinds of items on them. They wouldn't care if you could recite numbers backwards, but they might want to know whether you can tell what a good deal is, whether you take risks, whether you're entrepreneurial.... And if we had developed intelligence tests in different eras—the Paleolithic era, the New Stone Age, the feudal era, or the Renaissance—intelligence tests would be different. [The point is that] they always have a local and historical limitation on them. [from video]

Evidence of localization.

"An important part of my own test for what defines an intelligence is whether there is evidence that a particular capacity is represented in a certain part of the brain, rather than other parts of the brain. Is there some evidence of localization of that capacity." [from video]

Here, Gardner turns to his own definition of intelligence as a biopsychological potential: "*biological because we are biological creatures, and psychological, because we have a mind. We have a brain, and that has a lot to do with what we're like. But we also are psychological creatures. We have a mind.*"



Here, Gardner invokes a "computer metaphor" for the brain in order to describe how different areas of the mind / brain have evolved to process different kinds of information, in order to solve different kinds of problems.

"The mind is best thought of as a set of different computers, computers which evolved over long periods of time . . . and my own claim, as you may know, is that we have a number of different computers, each of which processes a certain kind of information—linguistic information or spatial information or personal information—in a certain kind of way." [from video]

Finally, in presenting this new view of intelligence, Gardner asserts that these information processing capacities have to be valued in one culture or community in order to be recognized as intelligence. Therefore, what we consider intelligence is dynamic, depending on what is available in our culture, and what is valued in our culture.

Suggested Questions:

- Gardner calls his view of intelligence the theory of multiple intelligences. Discuss the significance of his reference to multiple intelligences.

- How does the study of unusual populations contribute to an understanding of persons possessing multiple intelligences?

- Gardner defines intelligence as a "biopsychological" potential. Explain his use of this term.

- How does the example presented by Gardner of the mind as being thought of as a set of computers relate to an understanding of an individual as possessing multiple intelligences?

- To what does Gardner refer when he talks of a "dipstick" theory of intelligence?

- What intelligences are most valued in your culture or sub-culture? Least valued? Can you present examples to support your position? Why are some valued more (or less) than others?

3. The Nine Intelligences?

Having set forth his criteria for what counts as an intelligence, Gardner now turns to each of the eight intelligences previously identified within MI theory.

Linguistic	those who work with language (poet, writer, orator)
Logical-Mathematical	(logician, mathematician, scientist, computer expert)
Musical	(composer, conductor, performer)
Spatial	(pilot, navigator, sculptor, architect, surgeon)
Bodily-Kinesthetic	Use of the body to solve problems or create (dancer, athlete, craftsperson)
Interpersonal	Understanding of other people (teacher, clinician, political leader, clergy, salesperson)
Intrapersonal	Self knowledge (ability to make good personal choices)
Naturalist	Distinctions in the natural world (botanists, hunter)

Next, Gardner turns to the possibility of a ninth intelligence. Persons reading Gardner have said that he has intimated a "spiritual" intelligence. In this video he does acknowledge the importance of spirituality; however, he does not think that spirituality can be defined as an intelligence. Instead, Gardner proposes that, within the spiritual realm, there may exist what he refers to as an "existential intelligence." This is the intelligence that deals with big questions, often asked by philosophers, such as "Why are we here?" or "Why do we die?"

Because there is still insufficient evidence that this type of thinking is localized within a certain part of the brain, Gardner refrains from definitively identifying an existential intelligence as such. Though there is some evidence, the evidence is still emerging. So, for now, Gardner refers only to the possibility of this ninth intelligence.

Suggested Questions:

- Gardner discusses eight intelligences. Explain each intelligence and provide an example of the type of individual that exemplifies this intelligence.

- What types of intelligence do you most often rely on in your life? Can you cite examples of how you use that intelligence in your work?

- Because we are no longer hunter-gatherers in order to survive, identify some examples that Gardner cites as to how we might exhibit naturalist intelligence. Can you think of others?

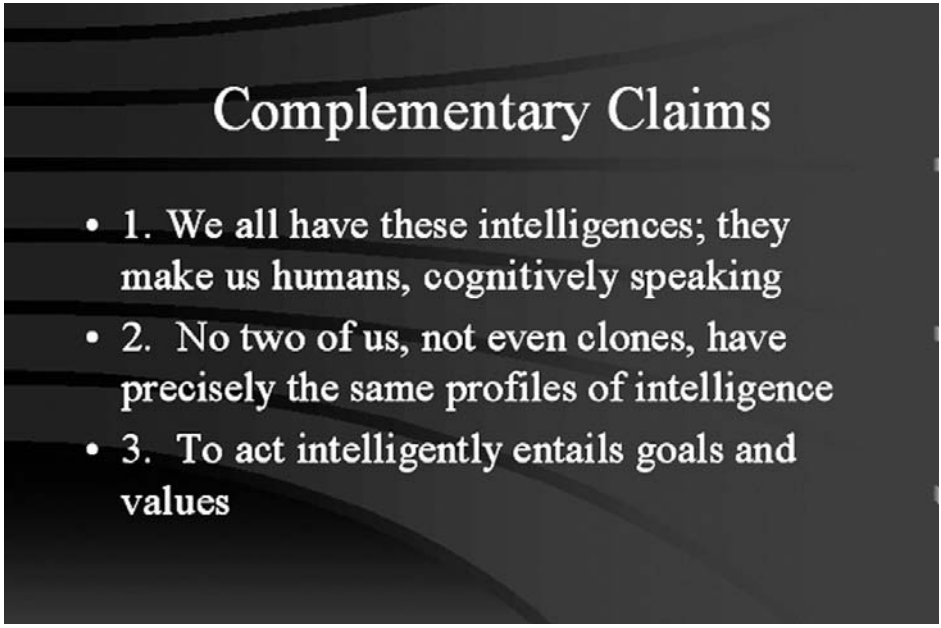
- Discuss the ninth intelligence considered by Gardner. Besides philosophers, what types of persons might most rely on existential intelligence?

4. The Three Axes of Intelligence

This section further develops the theory of multiple intelligences and delineates the three facets of intelligence as understood by MI theory. Gardner tell us that *"it's only very recently that I've come to appreciate that the claim that we all have these intelligences, actually has three different facets to it."*

The first one is that every human being, unless grossly abnormal, has all of these eight or nine intelligences. He contrasts human beings to birds that may possess more musical intelligence or rats that may have more spatial intelligence. Yet, our species definition—what make us human, cognitively speaking— is that we each possess all of the intelligences. This presents an important implication for educators, because it can be assumed that every student has all of these intelligences.

The second claim is equally true: No two human beings have exactly the same profile of intelligences. Gardner tells us that even identical twins use different parts of the brain to process language for instance.



"Even identical twins, who are technically clones, because they come from the same egg and sperm, have been examined carrying out language tasks, where you look at their brain functioning—functional MRI is the imaging technique—and even identical twins use somewhat different parts of the brain when they're processing language." [from video]

The third and most recent claim involves the distinction between "intelligence" and "acting intelligently." *"The claim I want to make here is you could have a very good*

computer in your mind/brain, and still act stupidly. " Do we act in an "intelligent" way given the situation, or in a "stupid" or inappropriate way? An understanding and exploration of context is crucial in determining whether something is done intelligently or stupidly. Again, the implication is that in order to assess individuals and to make claims about intelligence, context must be given primary consideration.

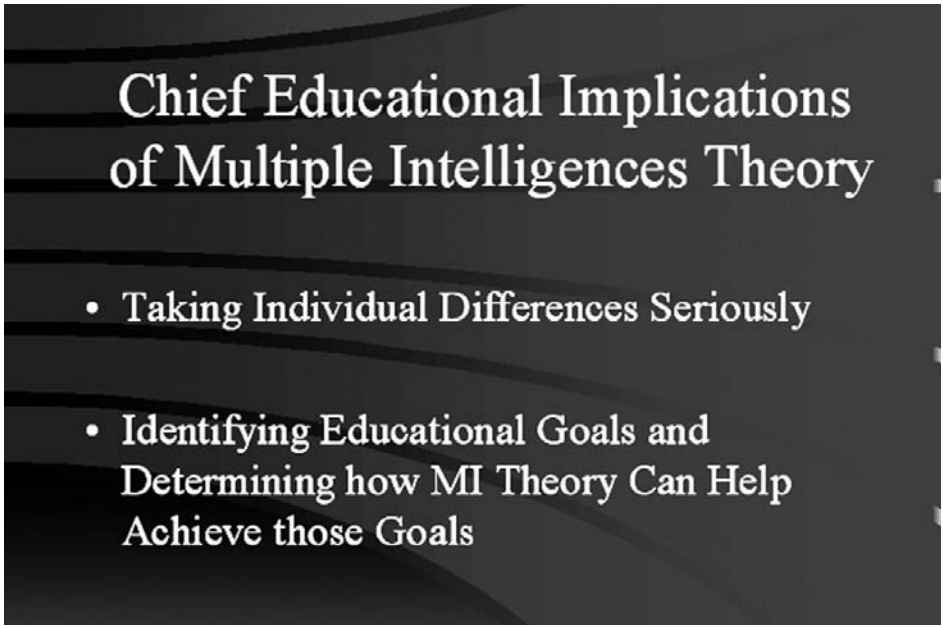
The discussion of context and the assertion that we each possess all of the multiple intelligences lays the foundation for the next section of the video which specifically addresses educational implications.

Suggested Questions:

- What are the three axes of intelligence presented by Gardner in this section?
- Gardner states that unless grossly abnormal, each human possesses all eight or nine intelligences. How do you respond to this claim?
- Do you think that you possess all of the intelligences? Can you identify the two or three areas in which you are strongest? On what do you base this response?
- What are the educational implications of the claim that every person possesses all eight or nine intelligences?
- What criteria should be used to determine whether someone acts intelligently in a given situation? Can you think of an example of someone that you considered to be smart who acted very stupidly or inappropriately in a particular situation?
- Before viewing the next section, write down or discuss some of the educational implications that you draw given the three axes of intelligence presented by Gardner.

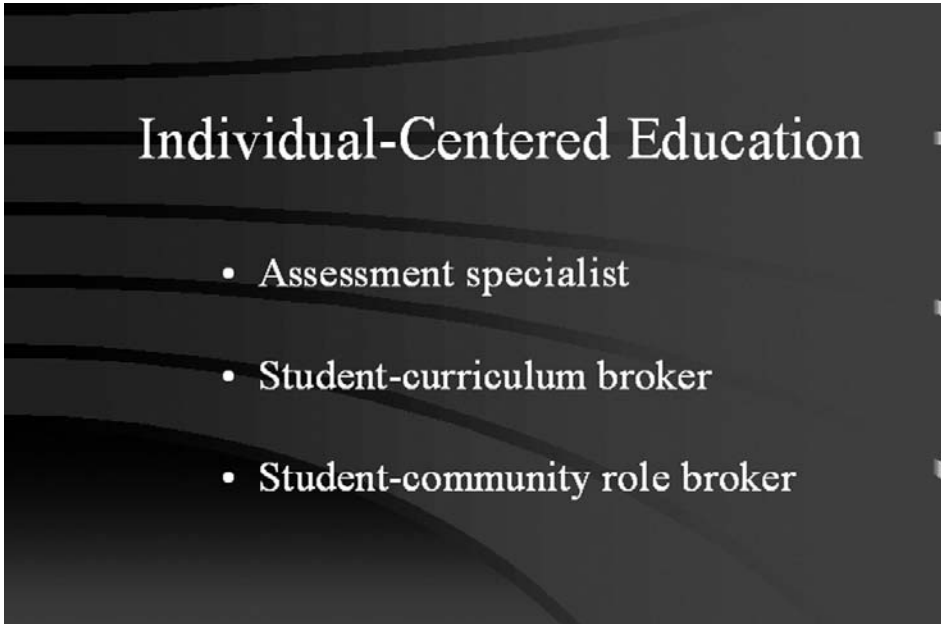
5. MI in Practice: Individualization and Assessment

This section focuses on some of the educational implications of multiple intelligences theory. Gardner states that there are at least two very important educational implications of the theory that he himself supports and encourages. First, the need to take differences among individuals seriously. Second, the importance of posing the question: Can the hypothesis of our multiple intelligences allow us to achieve specific educational goals?



These implications challenge the conventional wisdom of 'uniform schools', in which everyone is taught and assessed in the same way. If taken seriously, a commitment to using an MI perspective will require rethinking not only how students are taught, but how they are assessed. And it will require taking differences and strengths seriously, as well as an appropriate matching of students with curricula which addresses those differences in meaningful ways.

Gardner then presents evidence gleaned from ten years of work at Harvard's Project Zero. He describes a contextualized approach most fully developed for preschool age kids in Project Spectrum.



"What we do in Project Spectrum is we equip classrooms with lots and lots of very rich materials, so the classroom becomes more like a children's museum than simply a set of desks with a blackboard. There are lots of objects around the room for kids to play with, take apart, put together, see how facile they are at mechanical kind of things. Lots of musical instruments around for kids to play with, create their own music, listen, compare, and so on. We have kids make their own stories, build their own dioramas, model out of clay, dramatize stories which they're creating. We bring in objects which kids can examine with the naked eye or under magnification, and see what they notice, what they classify, and so on. "

We play lots of games with kids. Games, of course, are good at getting at logical mathematical intelligence. But they're also good at interpersonal intelligence, [For example], in a game you have to psych out the other person. And indeed, if before the age of four a child cheats, that's actually a sign of precocity, because it shows the child realizes other people may not know what he or she knows.

And here's a very nice kind of measure: you ask kids to recreate the large classroom in miniature, and this gets at their spatial intelligence. Then you also have little pieces of wood, in which we paste photographs of all the kids, and we ask, "Who plays with whom?" "Who likes whom?" "What did so-and-so do yesterday?" And it's a very nice, unobtrusive measure of interpersonal intelligence.

The point is, you can create a classroom where, without having to do any kind of special testing, by just watching kids at work, you can tell a lot about their intelligences. And I believe we can do the same thing with adults. If we're trying to capture their intelligences, we need to do it in an intelligence-fair way, by actually creating an environment where we can watch their intelligences at work. [from video]

Suggested Questions:

- Gardner states two very important educational implications to be drawn from MI Theory. What is the significance of each?

- Explain what Gardner means when he refers to our history of creating "uniform schools."

- How is the concept of a uniform school antithetical to MI theory?

- Given current critiques of public education, how does MI theory offer the potential to respond to some of these critiques?

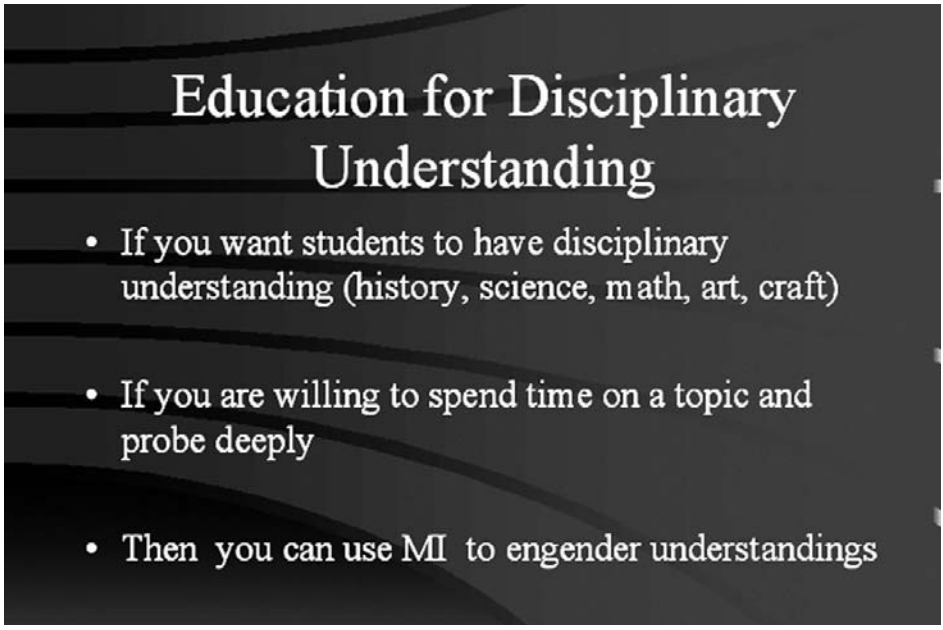
- Have you ever seen a classroom that resembles that described by Gardner when he talks about Project Spectrum? What did you observe students doing in this classroom?

- What are the barriers to creating classrooms like those described in Project Spectrum?

- What are the implications not only for teaching but also for assessment given the educational portrait in this section of the tape?

6. Disciplinary Understanding: Entry Points

Gardner defines disciplinary understanding as going well beyond simply taking chemistry, or world history, or geometry. It means being able to think and understand in the way a historian or scientist or mathematician or artist can do. This is what Gardner puts forth as being our most important educational goal— teaching for understanding in the disciplines and being able to understand important consequential topics.



"Disciplinary understanding means not having taken chemistry, or taken world history, or taken geometry. It means being able to think and understand in the way a historian or scientist or mathematician or artist can do. Disciplinary understanding is not easy to achieve, and I've written a lot about the difficulty of getting people really to be able to think in a disciplined way. But as far as I'm concerned, if that isn't the education goal, then we're spending an awful lot of money in vain in our schools." [from video]

In this section, Gardner references his book ***The Disciplined Mind***, in which he argues that after literacy is achieved, what we ought to be doing in schools K-12 is to help kids think mathematically, scientifically, historically, and in artistic and literary terms.

Assuming that one accepts disciplinary understanding as the goal of education, then the next step is the selection of topics.

"In the book ***The Disciplined Mind****, I selected three quite traditional topics: from the sciences and biology, the theory of evolution as developed by Darwin and as refined over the last 150 years; from history, the Holocaust of the Second World War; and from the arts, a musical example, the music of Mozart.*

What I tried to show was, first of all, that you could design a whole course around these topics. They're very rich, nutritious topics. They might be worth spending a whole course on. And furthermore, that if you were willing to spend time on these topics— evolution, the Holocaust, the music of Mozart—then you could really take advantage of the fact of our multiple intelligences." [from video]

Next, Gardner explains how multiple entry points can be used to approach any of these topics. Multiple entry points, he reminds us, are like different windows into the same room, with different entry points roughly corresponding to the different intelligences. Here, Gardner proposes the following entry points: narrative, quantitative/logical, existential, aesthetic, hands-on, and interpersonal/collaborative.

Gardner now illustrates multiple entry points to disciplinary understanding of the topics he's proposed.

"Let's say you want to know how to enter these topics. That means, you want to teach them, but you want to try to reach a lot of students in your class. The argument is that there are many entry points to any topic. I think of them as many windows into the room. And what you can do when you're approaching a topic like this is you can use several of these windows, and that way you can really get into the topic. And these windows, these entry points, reflect, in a rough and ready way, the different kinds of intelligences.

One way to present a topic is through a story—the story of Darwin and his trip on the Beagle, or the story of Adolf Hitler, or the story of Anne Frank, or the story of Mozart, or the story of the Marriage of Figaro, *which of course is a story in itself.*

A second way is through numbers. Numbers are connected to everything. Mozart happened to love to play with numbers, and there are all kinds of numbers and rhythmic things and metric things in any musical work. Of course, you can look at what happens to different populations in Europe in the second World War. That's a very number-rich and also very sobering topic. Darwin began to think about evolutionary questions when he was traveling around the Galapagos islands, and he noticed there were different numbers of different kinds of finches on each island, and he was very intrigued by that, and that got him to think about competition among species, and survival, and so on. So those are what I would call quantitative entry points.

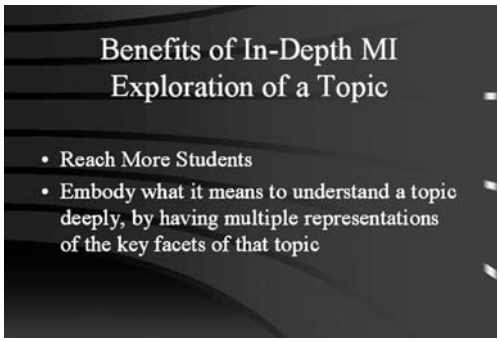
There are also logical entry points. You may remember that Darwin actually hit upon the formulation of evolutionary theory when he was reading Malthus, and Malthus had an argument about people struggling with one another for survival when there weren't enough resources. Darwin realized that this same kind of argument, the logic of that argument, could be applied to species struggling within a limited ecology. The final solution of Hitler's is a sick kind of logic. If there's a population you want to get rid of, and they won't die naturally, and you can't kill them in warfare, then just exterminate them. Any musical work has logic, as you will know if you've ever tried to complete a work, and found that you couldn't do it very well.

Existential entry points. My three topics are actually answers to three very big questions. Where do we come from? Evolution is the only scientific answer. There are of course faith-based answers to that question, but evolution is the only scientific answer to that existential question. What are some of the wonderful things human beings are capable of? Certainly the music of Mozart is one of them. What are some of the terrible things human beings are capable of? Certainly genocide, as epitomized in the Holocaust, is an example.

Aesthetic entry points. There are works of art about everything. Of course, The Marriage of Figaro *is a work of art. But there are works of art about evolution. If you look at the morphologies as they change over time, it's a very beautiful kind of study, and in fact, there's a whole subsystem in mathematics that looks at the change of shapes over time. With respect to the Holocaust, much great art has been generated about the Holocaust. Even if you think about movies in the last years, three major movies, all very good, about the Holocaust:* Sophie's Choice, Schindler's List, Life is Beautiful. *Those are aesthetic entry points.*

Hands-on entry points. Many people like to do things directly. Kids love to do things hands-on. Don't just listen to Marriage of Figaro*—sing an aria, perform a trio, play with a beginning. Why, in biology class, do we breed fruit flies? Because it's fun to do, and they don't live very long, so you can watch the traits as they change over the generations. And of course, there are now many Holocaust museums, even Holocaust museums for children, where you can learn in a tough, hands-on kind of way about what the Holocaust was all about.*

The final entry point from this list is the entry point of involving other people, learning with other people. Many people like to learn collaboratively. They like to role-play, dialogue, dramatize, argue. They like to get involved in projects where people have different roles. These are all ways in which you can learn in a collaborative way." [from video]



The section concludes with the clarification that not everything should be taught seven or eight ways, but rather with a challenge to represent knowledge in multiple ways. Further, it urges us to take "authentic assessment" very seriously, and to consider the ways in which students can use their multiple intelligences to show what it is that they understand, and what it is that they don't understand.

Suggested Questions:

- How does Gardner's discussion of entry points differ from a traditional or uniform approach to schooling?
- Identify and define the entry points presented by Gardner in this section.
- By yourself or with a small group, identify a topic and cite several entry points that might be used to access the topic.
- By yourself or with a small group, create an outline for a unit or course of study that would represent a disciplinary rather than a subject approach.
- What is authentic assessment? How is a discussion of authentic instruction and authentic assessment congruent with a discussion of entry points? What are some of the non-traditional (non-"paper and pencil") ways in which a student can exhibit his or her understanding of a complex topic?
- Select a topic other than one of the three presented by Gardner and discuss how it could be used to develop a course of study or unit engaging multiple entry points and a disciplinary approach.

MI in the New Millennium

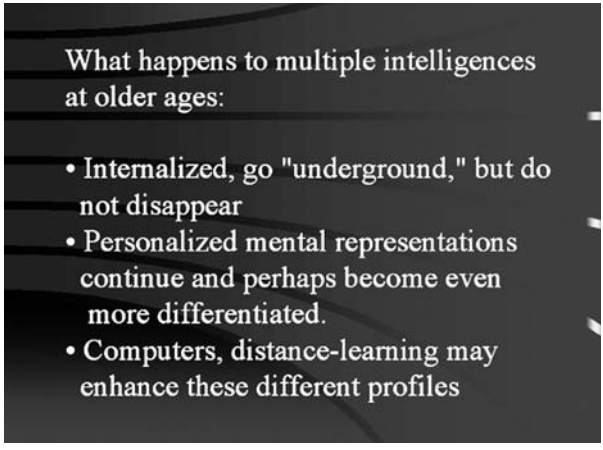
This section clearly presents some of the traditional views challenged by MI theory, as well as what happens to intelligence as we age, and what intelligence will need to encompass in an increasingly global and technological era.

Gardner first presents some puzzles or questions for consideration:

- Is intelligence one thing, or is it many different things as Gardner proposes?
- Should intelligence be narrowly defined or broadly defined to include various human capacities?
- How should intelligence be assessed?
- Is intelligence fixed in infancy, or does it develop indefinitely?
- Do multiple intelligences disappear or deepen as we age?
- Should intelligence be thought of in isolation, or yoked to other kinds of traits and virtues?

With respect to his first question, Gardner clearly advocates broadening the definition of intelligence. However, he cautions that we should not define intelligence so broadly that we blur the line between description and prescription. Specifically he refers to Dan Goleman, celebrated author of *Emotional Intelligence*, who moves beyond a "description" of the importance of understanding others and understanding self (interpersonal and intrapersonal intelligences as discussed by Gardner), toward a "prescription" of the kinds of people he admires and would like us all to be.

As we get older, Gardner proposes that our multiple intelligences in fact become more differentiated, and that we more fully develop that which we are good at, or at which we continue to acquire experience and practice.

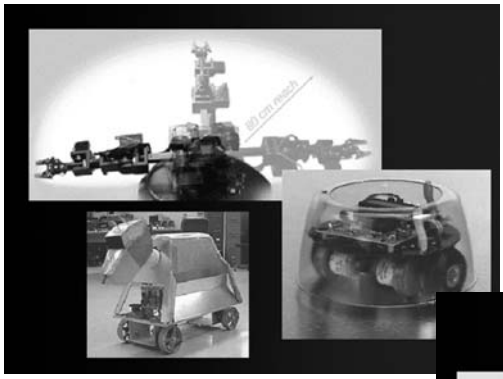


In the wake of a psychometrically oriented century, Gardner posits the question of who is going to "own" intelligence in the future, and what intelligence will have to entail in an increasingly globalized and technological world.

"First of all, intelligence is going to have to allow us to deal with people from all over the world, because we're increasingly becoming part of a single global village. Second of all, cultures will mix. We will contribute things to other cultures, and other cultures will contribute things to ours. Additionally, the separation of cultures and communities will increasingly become a thing of the past, as we'll be living in an ever more integrated kind of cultural matrix.

There are also financial and economic aspects of globalization. Money now goes around the world instantaneously. Trillions of dollars are exchanged every day. Multinational corporations have tremendous power over the fate of everybody. And any definition of intelligence has to include the understanding of these very important, but not immediately intuitive, kind of factors.

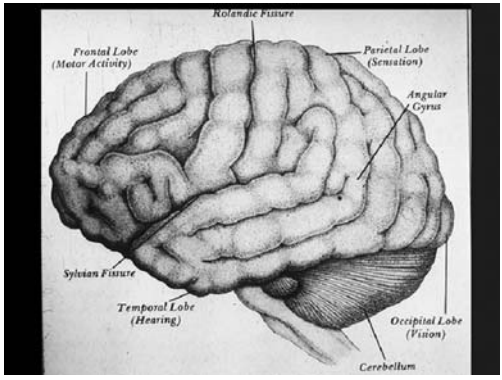
Furthermore, intelligence will not be restricted to the human world. It will increasingly become a property of artifacts. Robots will be smart, and in order to be able to deal with them, we'll have to be smart enough to understand what they're doing. Robots may well have as many intelligences or more intelligences than we do, and we're going to be able to map onto theirs. [from video]



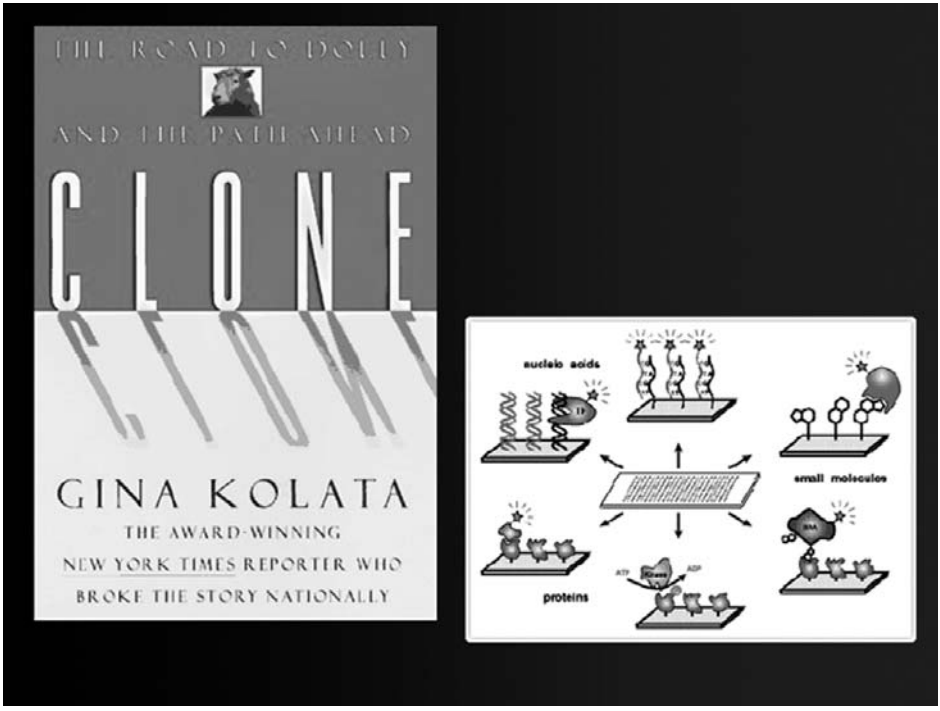
In the future, Gardner suggests that the development of our intelligences will not be restricted to the context of formal schooling. Here, Gardner suggests that with the aid of technology and the access to information that it affords, we will increasingly be educating ourselves.

Finally, Gardner contends that psychometricians will further lose their grip on the "ownership" of intelligence as we see continuing advances in brain and genetic science.

"Brain sciences are learning more and more about the brain. [In turn,] people will look for the centers of intelligence in the brain, and with brain operations now possible, they may even try to operate on them, change them, develop them, and so on.



Finally, there will be efforts to figure out the direct and exact genetics of one intelligence or many intelligences, and probably within our lifetime, people will try to manipulate the intelligence of their own offspring through genetic kinds of experiments. This is not something that I particularly welcome, but it is something that's going to happen. And once the brain scientists and the geneticists get involved in intelligence, [it's definition] will certainly no longer simply be in the hands of psychometricians." [from video]



Suggested Questions:

- Review the puzzles presented by Gardner at the beginning of this section. How has your perspective changed, or at least been challenged, as a result of the information presented?

- At the beginning of the tape, you were asked to present your own definition of intelligence. How does Gardner challenge you to rethink your definition?

- Gardner asserts that our intelligences become more differentiated as we get older. How do you respond to this assertion?

- What is significant about Gardner's statement that psychometricians will no longer own intelligence in the future?

- If it is in fact true that psychometricians will no longer own intelligence, what are the implications for education?

Intelligence and Ethics

In this concluding section of the video, Gardner discusses an important limitation of his work to this point. His own studies of intelligence, creativity, and leadership have been morally neutral. He presents examples of how intelligence, creativity, and leadership can be used both constructively and destructively.

"Both Goethe, the German poet, and Goebbels, the German propagandist, had lots of linguistic intelligence. Goethe used it to write great poetry. Goebbels used it to foment hatred. The intelligence was the same. The uses to which they put it were very, very different. Similarly, creative. You can create a statue. You can also destroy Twin Towers. Creativity, but of a very, very different sort. Leadership. You can be Nelson Mandela. You can be Slobodan Milosevic. I try to understand these things without regard to value judgement." [from video]

Gardner's more recent collaborative work is beginning to explore the question of how to yoke human virtues to a sense of responsibility, a sense of ethics, and a sense of morality. He and his colleagues are trying to discover how people who want to carry out "good work" manage to do so in a time that's very turbulent. So the final challenge that he leaves us with for the new millennium is to fashion a world in which intellect and character are harmoniously joined.

Suggested Questions:

- At the end of his talk, Gardner provides three parallel examples of intelligence, creativity, and leadership each with regard, and without regard, to a sense of moral obligation. Can you cite other examples?

- In his recent work, Gardner states that he is exploring how to yoke human virtues to a sense of responsibility. What forces are most important in achieving this goal? What societal forces impede this goal?

- What question would you most like to ask Gardner about this moral responsibility to which we are called?

- Can the ethical realm be probed by social-scientific inquiry?

Who Owns Intelligence?

Submitted to The Atlantic Monthly

As a psychologist, I've always assumed that my fellow psychologists and I owned the concept of intelligence. Of course, I realize that the word "intelligence" is used by those in the diplomatic community, and that it has a proper place in our idle chatter. But when it comes to the scientific study of intelligence, psychologists have had a virtual monopoly on the territory… at least until now.

We can even pinpoint the paternity of the scientific approach to intelligence. Almost a century ago, Alfred Binet, a gifted psychologist, was asked by the ministry of education in Paris to help determine who would experience difficulty in school. Given the influx of provincials to the capital, as well as immigrants of uncertain stock, it was important to know who might not advance smoothly through the system. Proceeding in an empirical manner, Binet posed many questions to youngsters of different ages. He ascertained which questions, when passed, predicted success in school, and which questions, when failed, foretold school difficulties. Those items that discriminated most effectively between the two groups became, in effect, the first test of intelligence.

Binet is a hero to many psychologists. He was a keen observer, a careful scholar, an inventive technologist. Perhaps even more important for his followers, he devised the instrument which is often considered psychology's greatest success story. Millions of people who have never heard Binet's name have had their fates determined by instrumentation that the French psychologist inspired. And thousands of measurement specialists—called psychometricians—earn their livings courtesy of Binet's invention.

But while successful over the long run, the psychologist's version of intelligence is now facing its biggest threat. Many scholars and observers—and even some iconoclastic psychologists—feel that intelligence is too important to leave to the psychometricians. Experts are extending the breadth of intelligence—proposing many intelligences, including emotional intelligence and moral intelligence. They are experimenting with new methods of ascertaining intelligence, including ones that avoid tests altogether in favor of direct measures of brain activity. They are forcing society to confront a number of questions: What is intelligence? How ought it to be assessed? And how do our notions of intelligence fit with what we value about human beings? In short, as my title suggests, experts are competing for the "ownership" of intelligence in the next century.

The outline of the psychometricians' success story is well-known. Binet's colleagues in England and Germany contributed to the conceptualization and instrumentation of intelligence testing—which soon became known as the IQ test. (An Intelligence Quotient designates the ratio between mental age and chronological age. Clearly it is preferable for a child to have an IQ of 120—where one is smarter than one is old—than an IQ of 80—where one is older than one is smart.) And, like other Parisian fashions of the period, the intelligence test migrated easily to the United States. First used to determine who was feeble-minded, it was soon used to assess "normal children," to identify the "gifted," and to determine who was fit to serve in the army. By the 1920s, the intelligence test had become a fixture in educational

practice in the United States and through much of Western Europe.

Early intelligence tests were not without their critics. Many enduring concerns were first raised by the influential journalist Walter Lippmann in a series of published debates with Stanford University's Lewis Terman, the "father" of IQ testing in America. Lippmann noted the superficiality of the questions, their possible cultural biases, and the "high-stake" risks of assessing an individual's intellectual potential via a brief oral or paper-and-pencil measure. IQ tests were also the subject of many jokes and cartoons. Still, by sticking to their trade, the psychometricians were able to defend their instruments, even as they made their way back and forth between the halls of academe, their testing cubicles in schools and hospitals, and the vaults in their banks.

Perhaps surprisingly, the conceptualization of intelligence did not advance much in the decades following Binet and Terman's pioneering contributions. Intelligence testing came to be seen, rightly or wrongly, as primarily a technology for selecting individuals to fill academic or vocational niches. In one of the most famous—if irritating—quips about intelligence testing, the influential Harvard psychologist E. G. Boring declared "Intelligence is what the tests test." So long as these tests did what they were supposed to do—that is, give some indication of school success—it did not seem necessary or prudent to probe too deeply into their meanings or to explore alternative views of the matter.

Psychologists of intelligence have argued chiefly about three questions. The first: Is intelligence singular, or are there various more-or-less independent intellectual faculties? Hedgehog Purists—ranging from the English psychologist Charles Spearman at the turn of the century to his latter day disciples Richard Herrnstein and Charles Murray (of The Bell Curve fame)—defend the notion of a single supervening "g" or general intelligence. Foxlike Pluralists—ranging from Chicago's L. L. Thurstone, who posited 7 vectors of the mind, to California's J. P. Guilford, who discerned 150 factors of the intellect—construe intelligence as composed of some or even many dissociable components. In his much cited The Mismeasure of Man, paleontologist Stephen Jay Gould argued that the conflicting conclusions reached on this issue simply reflect alternative assumptions about statistical procedures rather than "the way the mind is." Still, psychologists continue to debate this issue, with a majority sympathetic to a single, "general intelligence" perspective.

The lay public is more interested in a second contentious question: Is intelligence (or are intelligences) largely inherited? It should be noted that this is by and large a Western question. In the Confucian societies of East Asia, it is assumed that individual differences in endowment are modest and that differences in achievement are due largely to effort. In the West, however, there is much sympathy for the view—first defended vocally within psychology by Lewis Terman—that intelligence is inborn and that there is little one can do to alter one's quantitative intellectual birthright.

Studies of identical twins reared apart provide surprisingly strong support for the "heritability" of psychometric intelligence. That is, if one wants to predict someone's score on an intelligence test, it is more relevant to know the identity of the biological parents (even if the child has not had appreciable contact with them) than the identity of the adoptive parents. By the same token, the IQs of identical twins are more similar than the IQs of fraternal twins. And, contrary to common sense

(and political correctness), IQs of biologically-related individuals grow more similar in the later years of life, rather than more different. Still, because of the intricacies of the discipline of behavioral genetics, and the difficulties of conducting valid experiments with human childrearing, one still finds those who defend the proposition that intelligence is largely environmental, as well as those who believe that we cannot answer this question at all.

Most scholars agree that, even if psychometric intelligence is largely inherited, it is not possible to pinpoint the sources of differences in average IQ between groups, such as the 15-point difference typically observed between African-American and white populations. That is because it is not possible in our society to equate the contemporary (let alone the historical) experiences of these two groups. The conundrum: One could only ferret out the differences (if any) between black and white populations in a society that was literally colorblind.

One other question has intrigued lay individuals and psychologists: Are intelligence tests biased? If one looks at early intelligence tests, the whopping cultural assumptions built into certain items are evident. There are obvious class biases—who except the wealthy can answer a question about polo? There are also subtler nuances—while ordinarily it makes sense to turn over money found on the street to the police, what happens in the case of a hungry child? Or with respect to a police force that is known to be hostile to members of one's own minority group? Only the canonical response to such a question would be scored as correct.

Psychometricians have striven to remove the obviously biased items from such measures. Yet, it is far more difficult to deal with biases that are built into the test situation itself. For example, an individual's background certainly figures into his reactions to being placed in an unfamiliar locus, instructed by an interrogator dressed in a certain way, and having a printed test booklet thrust into his hands. And as psychologist Claude Steele has argued in these pages, the biases prove even more acute in cases where an individual knows that her intellect is being measured, and where she belongs to a racial or ethnic group that is widely considered to be less smart than the dominant social group.

Talk of bias touches on the frequently held assumption that tests in general, and intelligence tests in particular, are inherently conservative instruments—Tools of the Establishment. It is therefore worth noting that many test pioneers thought of themselves as progressives in the social sphere. They were devising instruments that could reveal individuals of talent, even if those persons came from "remote and apparently inferior backgrounds". And occasionally the tests did discover intellectual "diamonds in the rough". More often, however, the tests picked out individuals of privilege—the correlation between zip code and IQ is high. The still unresolved question of the casual relation between IQ and social privilege has stimulated many a dissertation across the social sciences.

Paradoxically, one of the clearest signs of the success of intelligence tests is that they themselves are not widely administered any more. In the wake of legal cases about the propriety of making consequential decisions about education on the basis of IQ scores, many public school officials have become test-shy. By and large, testing of IQ in the schools is restricted to cases in which there is a recognized problem (a suspected learning disability) or selection procedure (determining eligibility for a program that serves gifted children).

However, despite this apparent setback, intelligence testing, and the line of thinking that underlies it, have actually won the war. Many widely used scholastic measures, chief among them the SAT (recently renamed the Scholastic Assessment Test) are thinly disguised intelligence tests—almost clones thereof—which correlate highly with scores on standard psychometric instruments. Virtually no one raised in the developed world today has gone untouched by Binet's deceptively simple invention of a century ago.

Secure in practice, the concept of intelligence has in recent years undergone its most robust challenge since the days of Walter Lippmann. Individuals informed by psychology but not bound by the assumptions of the psychometricians have invaded this formerly sacrosanct territory. They have put forth their own conceptions about what intelligence is, how (and whether) it should be measured, and which values should be invoked in considerations of the human intellect. For the first time in many years, the Intelligence Establishment is clearly on the defensive—and it seems likely that the new century will usher in quite different ways of thinking about intelligence.

The history of science is a tricky business, particularly when one sits in the midst of it. One evident factor in the rethinking of intelligence is the perspective introduced by those scholars who are not psychologists. Anthropologists have noted the parochialism of the Western view of intelligence. Some cultures do not even have a concept called intelligence, and others define intelligence in terms of traits that we in the West might consider odd—obedience, or good listening skills, or moral fiber, for example. Neuroscientists are skeptical that a single or unitary form of intelligence is consistent with the highly differentiated and modularized structure of the brain. Computer scientists have devised programs deemed to be intelligent; these programs often go about problem solving in ways quite different from those followed by human beings or other animals.

The insularity of most psychological discussions came home to me recently when I appeared on a panel devoted to the topic of intelligence. I was the only psychologist. An experimental physicist summarized what is known about the intelligence of different animals. A mathematical physicist discussed the nature of matter, such that it allows for conscious and intelligent behavior. A computer scientist described the kinds of complex systems that can be built out of simple, nerve-like units, and the point at which these systems begin to exhibit intelligent and perhaps even creative behavior. As I listened intently to these thoughtful scholars, I realized with clarity how psychologists no longer own the term of intelligence—if they ever really did. What it means to be intelligent can turn out to be a profound philosophical question—one that requires grounding in biological, physical, and mathematical knowledge. Correlations among test scores just do not cut it, once one ventures beyond the campus of the Educational Testing Service.

Even within the field of psychology, the natives have been getting restless. Unquestionably the most restless is Yale psychologist Robert Sternberg. A prodigious scholar, Sternberg, not yet fifty, has written dozens of books and hundreds of articles, the majority of them focussing on intelligence in one or another way. Sternberg began with the strategic goal of understanding the actual mental processes mobilized on standard test items, such as the solving of analogies. But he soon went beyond the

components of standard intelligences testing, by insisting on two hitherto neglected forms of intelligence: the "practical" ability to adapt to varying contexts (as we all must in these days of divorcing and downsizing); and the capacity to automate familiar activities so that one can deal effectively with novelty and display "creative" intelligence.

More so than many other critics of standard intelligence testing, Sternberg has gone to some pains to measure these new forms of intelligence through the kinds of paper-and-pencil laboratory methods favored by the profession. And he has found that a person's ability to deal with novel information, or to adapt successfully to diverse contexts, can be differentiated from success at standard IQ test style problems. His efforts to create a new intelligence test have not been crowned with easy victory. Most psychometricians are conservative—they like their Wechslers and their Stanford-Binets "straight"; and if new tests are to be marketed, it is thought that they must correlate well with existing instruments! So much for openness to novelty within the psychometric industry.

Others in the psychology orbit, less bound by the strictures of the tribe, are really pushing the envelope in the struggle over the ownership of intelligence. Psychologist-journalist Daniel Goleman has achieved world-wide success with his book Emotional Intelligence. Contending that this new concept (sometimes nicknamed EQ) may matter as much as IQ, Goleman draws attention to such pivotal human capacities as the abilities to control one's own emotional reactions, and to "read" the signals of other individuals. Noted psychiatrist Robert Coles has published The Moral Intelligence of Children. In Coles' view (following that earlier sage of Concord, Ralph Waldo Emerson) "character is higher than intellect." He decries the amorality of our families, and, hence, our children; he shows how we might cultivate human beings who develop a sense of right and wrong and are willing to act on that sense even when it runs counter to self-interest. There are more frankly popular accounts, dealing with Leadership Intelligence (LQ), Executive Intelligence (EQ or ExQ), and even Financial Intelligence (We have avoided abbreviating this term so far…).

Like Coles' and Goleman's efforts, my own work on "multiple intelligences" also eschews the psychologists' credo of operationalization and test-making. Instead, I began by asking two questions: the Evolutionary Question, "How did the human mind/brain evolve over millions of years?"; and the Comparative Question, "How can we account for the diverse skills and capacities that are or have been valued in different communities around the world?"

Armed with those questions, and a set of eight criteria for what "counts" as an intelligence, I have concluded that all human beings possess at least eight intelligences: linguistic and logical mathematical (the two most prized in school and the ones central to success on intelligence test-type instruments); musical; spatial; bodily-kinesthetic; naturalist; and two forms focussed on human beings (interpersonal and intrapersonal).

I make two complementary claims about intelligence. The first is a universal claim. We all possess these eight intelligences—and possibly more. Indeed, rather than seeing the human as a "rational animal," I offer a new definition of what it means to be a human being, cognitively speaking: homo sapiens sapiens is the animal that possesses these eight forms of mental representation.

My second claim concerns individual differences. Due to the accidents of heredity, environment and

their interactions, no two of us exhibit the same intelligences in precisely the same proportion and blend. Our "profiles of intelligence" differ from one another. This fact poses intriguing challenges and opportunities for our educational system. We can either ignore these differences and pretend that we are all the same; historically speaking, that is what most educational systems have done. Or we can fashion an educational system that tries to exploit these differences, individualizing instruction and assessment as much as possible.

As the century of Binet and his successors draws to a close, it is apposite to take stock and to anticipate the course of thinking about intelligence. While my crystal ball is no clearer than anyone else's (the species may lack Future Intelligence), it seems safe to predict that interest in intelligence will not go away.

To begin with, the psychometric community has scarcely laid down its arms. New versions of the standard tests continue to be created and occasional new tests (like the Kaufman A B C) surface as well. Researchers in the psychometric tradition churn out fresh evidence of the predictive power of their instruments and the correlations between measured intelligence and one's life chances. And, quite intriguingly, some in the psychometric tradition are searching for the biological basis of intelligence: the genes that may "load" for intelligence; the neural structures that are crucial for intelligence; or tell-tale brain wave patterns that distinguish the bright from the more cognitively challenged.

Beyond various psychometric twists, interest in intelligence is likely to grow in other ways. It will be fed, on the one hand, by the creation of machines that display intelligence, and, on the other, by the possibility that we can genetically engineer organisms of specific intelligence or intelligences. Moreover, observers as diverse as Richard Herrnstein (The Bell Curve) and Robert Reich (Clinton's first Secretary of Labor) have agreed that in coming years, a large, perhaps disproportionate part of society's rewards will go to those individuals who are skilled symbol analysts—who can sit at a computer screen (or its technological successor), manipulate numbers and other kinds of symbols, and use the results of their operations to suggest plans, tactics, and strategies for an enterprise—ranging from business to science to war games. These individuals may well color how "intelligence" is conceived in decades to come—just as the need to provide good middle-level bureaucrats to man an empire served as a primary molder of intelligence tests in the early years of the century.

Surveying the landscape of intelligence, I discern three sets of struggles between opposing forces. The extent to which, and the manner in which, these various struggles are resolved will influence the lives of millions of individuals. To put my cards on the table, I feel that the three struggles are interrelated; the first struggle provides the key to the others; and there is an optimal way in which to resolve the ensemble of struggles.

The first struggle concerns the breadth of our definition of intelligence. One camp consists of traditionalists who believe in a single form of intelligence, one that basically predicts success in school and in school-like activities. Arrayed against the traditionalists are the progressive pluralists. These individuals believe that there are many forms of intelligence. And some of these pluralists would like to broaden the definition of intelligence considerably, to include the abilities to create, to lead, and/or to stand out in terms of emotional sensitivity or moral excellence.

The second struggle concerns the assessment of intelligence. Again, one readily encounters a traditional position. Once sympathetic to paper-and-pencil tests, the traditionally-oriented practitioner now looks to computers to provide the same information more quickly and more accurately.

But other positions abound. "Purists" disdain psychological tasks of any complexity, preferring to look instead at reaction time, brain waves, and other "purer" physiological measures of intellect. "Simulators" move in the opposite direction, to more realistic life-sized measures that closely resemble the actual abilities that are prized. And "skeptics" warn against the continuing expansion of testing. They emphasize the damage often done to individual life chances and self-esteem by a regimen of psychological testing. And they call instead for less technocratic, more humane methods: these range from self-assessment, to the examination of portfolios of student work, to selection in the service of social equity.

The final struggle concerns the relationship between intelligence and what qualities we value in human beings While no one would baldly equate intellect and human value, nuanced positions have emerged on this issue. Some (in the Bell Curve tradition) see intelligence as closely related to a person's ethical and value system; they anticipate that brighter individuals are more likely to appreciate moral complexity and to behave judiciously. Some call for a sharp distinction between the realm of intellect, on the one hand, and character, morality, or ethics on the other. Society's ambivalence on this issue can be discerned in the figures that become heroes in the media. For every Albert Einstein or Bobby Fischer who is celebrated for his intellect, there is a Forrest Gump or Chauncey Gardiner, who is celebrated precisely for those human (and humane) traits that would never be captured on any kind of an intelligence test.

Reflecting on these struggles, I believe that the most pivotal battlefield is likely to be the one in which the new dimensions and boundaries of intelligence are thrashed out. Thanks to the work of the past decade or two, the stranglehold of the psychometricians has at last been broken. This is a beneficent development. Yet now that the Scylla of the psychometricians has been overcome, we risk succumbing to the Charybdis of "anything goes"— emotions, morality, creativity all become absorbed into the "New Intelligence." The challenge is to chart a concept of intelligence that reflects new insights and discoveries and yet can withstand rigorous scrutiny.

An analogy may help. One can think of the scope of intelligence as represented by an elastic band. For many years, the definition of intelligence went unchallenged and the band seemed to have lost its elasticity. Some of the new definitions expand the band so that it has become quite taut and resilient; and yet earlier work on intelligence is still germane. Other definitions so expand the band that it finally snaps— and the earlier work on intelligence can no longer be drawn upon.

Until now, the term intelligence has been limited largely to certain kinds of problem-solving involving language and logic— the kinds of skills at a premium in the lawyer or law professor. However, humans are able to deal with numerous other contents besides words, numbers, and logical relations— for example, the contents of space, music, the psyches of other human beings. Like the elastic band, conceptions of intelligence need to be expanded to include human skill in dealing with these diverse kinds of contents. And we must not restrict

attention to the solving of problems that have been posed by others; we must consider equally the capacities of individuals to fashion products (like works of art, scientific experiments, effective organizations) that draw on one or more of several human intelligences. The elastic band can accommodate such broadening as well.

So long as intelligences are restricted to the processing of "contents in the world," we avoid epistemological problems. So it should be. "Intelligence" should not be expanded to include personality, motivation, will, attention, character, creativity, and other important and significant human capacities. Such stretching is likely to snap the band of intelligence altogether.

Let's see what happens when one crosses one of these lines— for example, when one attempts to conflate intelligence with creativity. Beginning with a definition, we extend the descriptor "creative" to those individuals (or works or institutions) who meet two criteria: 1) They are innovative; 2) Their novelty is eventually accepted by a relevant community or domain.

No one denies that creativity is important—and, indeed, it may prove even more important in the future, when nearly all standard (algorithmic) procedures are carried out by computers. Yet creativity should not be equated with intelligence. An expert may be intelligent in one or more domain but there is no necessity that he or she be inclined toward, or successful in, innovation. Similarly, while the ability to innovate clearly requires a certain degree of intelligence (or intelligences), there is not otherwise a significant correlation between measures of intellect and creativity. Indeed, creativity seems more dependent on a certain kind of temperament and personality (risk-taking, tough-skinned, persevering, above all, having a lust to alter the status quo and leave a mark on society) than on efficiency in processing various kinds of informational content. By collapsing these categories together, we risk missing dimensions that are important but separate; and we may think that we are training (or selecting) one, when we are actually training (or selecting) the other.

Consider, next, what happens, when one stretches intelligence to include good or evil attitudes and behaviors. By this incursion into morality, we are now confronting human values within a culture. There may be a few values that can be expressed generically enough so that they command universal respect: the Golden Rule (Biblical or Etzioni-style) is one promising candidate! Almost every other value, however, turns out to be specific to cultures or subcultures— even such seemingly unproblematic ones as the unacceptability of incest, killing, or lying. Once one conflates morality and intelligence, one needs to deal with the widely divergent views of what is good and bad and why. Moreover, one must deal with the fact that individuals who score high on tests of moral reasoning often act immorally outside the test situation; even as courageous and self-sacrificing individuals turn out to be unremarkable on formal tests of moral reasoning and on intelligence tests. Far preferable to construe intelligence itself as morally neutral, and then apply a different set of calipers to decide whether a given use of intelligence qualifies as moral, immoral, or amoral in a given context.

As I see it, no intelligence is moral or immoral in itself. One can be gifted in language and use that gift (as did Johann Wolfang von Goethe) to write great verse, or (as did Josef Goebbels) to foment hatred. Mother Teresa and Lyndon Johnson, Niccolo Macchiavelli and Mohandas Gandhi may have had

equivalent degrees of interpersonal intelligence; but the uses to which they put their skills could not have been more varied.

One might respond by saying "Perhaps there is an intelligence that determines whether or not a situation harbors moral considerations or consequences." I have less problem with such a formulation. Note, however, that the term "moral intelligence" loses much of its force. After all, Adolf Hitler or Joseph Stalin may well have had an exquisite sense of which situations were considered moral; however, they either did not care, or they embraced their own peculiar code of what counted as moral (" Eliminating Jews is the moral thing to do in quest of a pure Aryan society" "Wiping out a generation is a desirable move if you want to establish a communist state.")

Writing as a scholar rather than a layperson, I see two problems with the notion of an emotional intelligence. First of all, unlike language or space, the emotions are not "contents" to be processed; rather cognition has evolved so that we can make sense of human beings (self and others) that possess and experience emotions. Emotions are part-and-parcel of all cognition, though they may well prove more salient at certain times or under certain circumstances: they accompany our interactions with others, our listening to great music, our feelings when we solve— or fail to solve— a difficult mathematical problem. If one calls some intelligences emotional, this term suggests that other intelligences are not— and that implication flies in the face of experience and empirical data.

The second problem— the conflation of emotional intelligence with a certain preferred pattern of behavior. This is the trap that Daniel Goleman sometimes falls into in his otherwise admirable volume Emotional Intelligence. Goleman singles out as emotionally intelligent those individuals who use their understanding of emotions to make individuals feel better, solve conflicts, or cooperate in home or work situations. No one would dispute that such individuals are wanted. However, it is important not to assume that individuals who are emotionally intelligent will necessarily use their skills for prosocial ends.

For this reason, I prefer the term "emotional sensitivity"— a term (encompassing my two "personal intelligences") that could apply to individuals who are sensitive to emotions in themselves and others. Presumably, clinicians and salespersons excel in sensitivity to other persons; poets and mystics to emotions in themselves. And there are other individuals—autistic or psychopathic persons, for example— who seem completely insensitive to the emotional realm. I would insist, however, on a strict distinction between emotional sensitivity and being a "good" or "moral" person. A person may be sensitive to the emotions of others, but use that sensitivity to manipulate, deceive, or create hatred. Just as sadists know well what causes pain for others, masochists know only too well what causes pain in themselves.

I call, then, for a delineation of intelligence that includes the full range of contents to which human beings are sensitive; but one which, at the same times designates, as off limits, such valued but separate human traits as creativity, morality, or emotional appropriateness. I believe that such a delineation makes scientific and epistemological sense; it reinvigorates the elastic band without stretching it to the breaking point; it helps to resolve the two remaining struggles: how to assess, and what kinds of human beings to admire.

Once we decide to restrict

intelligence to human information-processing and product-making capacities, we can make use of the established technology of assessment. That is, we can continue to use paper-and-pencil or computer-adapted testing techniques, while looking at a broader range of capacities, such as musical sensitivity or the understanding of other persons. And we can avoid ticklish and possibly unresolveable questions about the assessment of values and morality that may well be restricted to a particular culture, and that may well change over time.

Still, even with a limited perspective on intelligence, important questions remain about which assessment path to follow— that of the Purist, the Simulator, or the Skeptic. Here I have strong views. I think it is a fool's errand to embrace the search for a "pure" intelligence—be it general intelligence, musical intelligence, or interpersonal intelligence. I do not believe that such alchemical intellectual essences actually exist; they are a product of our penchant for creating terminology rather than determinable and measurable entities. Moreover, the correlations that have been found between "pure measures" and the skills that we actually value in the world are too modest to be useful.

What does exist is the use of intelligences, individually and in concert, to carry out tasks that are valued by a society. Accordingly, we should be assessing the extent to which humans succeed in carrying out tasks of consequence that presumably involve certain intelligences. And so, to be concrete, we should not test musical intelligence by looking at the ability to discriminate between two tones or timbres; rather we should be teaching individuals to sing songs or play instruments or transform melodies and see how readily they master such skills. By the same token, we should abjure a search for pure emotional sensitivity—e. g. , a test that matches facial expressions or sensitivity to one's own galvanic skin response. Rather, we should place (or observe) individuals in situations where they have to be sensitive to the aspirations and motives of others; for example, we could see how individuals handle a situation where they and colleagues have to break up a fight between two teenagers or convince a boss to change a policy of which they do not approve. These are realistic contexts for assessing a person's mastery of the emotional realm.

Here powerful new simulations can be invoked. We are now in a position to draw on technologies which can not only deliver realistic situations or problems; these simulations also record the success of subjects in dealing with these virtual realities, and even "intelligently" revise next steps in light of what the subjects have (or have not) accomplished. And so, to build on the same examples, one can present a student with an unfamiliar tune on a computer and have the student learn that tune, transpose it, orchestrate it, and the like. Such experiences would reveal much about the student's intelligence in musical matters.

By the same token, one can present simulated human interactions and ask subjects to judge the shifting motivations of each actor. Or one can create an interactive hypermedia production, featuring unfamiliar persons trying to accomplish some sort of goal; the subject can be asked to work with these persons and to respond to their various moves and counter moves. The program can alter responses in light of the "moves" of the subject. While not perhaps identical to a poker game with high stakes, such a measure should reveal much about the interpersonal or emotional sensitivity of a subject.

A significant increase in the breadth—the elasticity—of our concept of intelligence, then, should open the possibility for innovative forms of assessment, ones far more realistic than the classical short-answer examinations. Why settle for an IQ or SAT test, where the items at best are remote "proxies" for the ability to design experiments, write essays, critique musical performances, etc. ? Why not instead ask individuals actually (or virtually) to carry out such tasks? And yet, by not opening up the Pandora's box of values and subjectivity, one can continue to make judicious use of the insights and technologies achieved by those who have devoted decades to perfecting mental measurement.

To be sure, one can create a psychometric instrument for any conceivable human virtue, including morality, creativity, and emotional intelligence in its several senses. Indeed, since Daniel Goleman's book was published, there have been dozens of efforts to create tests for emotional intelligence. But the resulting instruments are not necessarily meritorious. Such instruments are far more likely to satisfy the testmaker's desire for reliability (the person gets roughly the same score on two separate administrations of an instrument) than the need for validity (the test measures the trait that it purports to measure, such as emotional sensitivity or genuine musicality).

Such instruments-on-demand prove dubious for two reasons. First of all, beyond some platitudes, it is too difficult to secure agreement on what it means to be moral, ethical, a good person: consider the different values of Jesse Helms and Jesse Jackson, Margaret Thatcher and Margaret Mead. Second of all, individuals' "scores" on such tests are much more likely to reveal their test-taking savvy (skills in language and logic) than their fundamental character.

In speaking about character, I turn to our final concern: the relationship between intelligence and what I will, for short, call virtue: those qualities of the human being that we admire and that we wish to hold up as examples to our own children and to other person's children. No doubt, the desire to expand intelligence to encompass ethics and character represents a direct response to the general feeling that our society is lacking in these dimensions; the expansionist view of intelligence reflects the hope that if we transmit the technology of intelligence to these virtues, we might in the end secure a more virtuous population.

I have already indicated my strong reservations about hijacking the word intelligence so that it becomes all things to all people— the psychometric equivalent of the true, the beautiful, and the good. Yet the problem remains: How, in a post-Aristotelian, post-Confucian era, one in which psychometrics looms large, do we think about the virtuous human being?

My analysis suggests one promising approach. We should recognize that intelligences, creativity, and morality— to mention just three desiderata— are separate. Each may require its own form of measurement or assessment, and some will prove far easier to assess in an objective manner than others. Indeed, with respect to creativity and morality, we are more likely to rely on overall judgments by experts, than on any putative test battery. At the same time, there is nothing to prevent us from looking for individuals who combine more than one of these attributes: individuals who have musical and interpersonal intelligence; individuals who are psychometrically intelligent and creative in the arts; individuals who combine emotional sensitivity and a high standard of moral conduct.

Let me introduce another analogy at this point. In college admissions, much attention is paid to scholastic performance, as measured by College Board examinations and grades. However, other features are also weighed, and sometimes a person with lower test scores is admitted in preference to those who "ace" the tests, if he/she proves exemplary in terms of citizenship or athletics or motivation. Admissions officers do not confound these virtues (indeed they may use different "scales" and issue different "grades"); but they recognize the attractiveness of candidates who exemplify two or more of these desirable traits.

We have left an Eden where various intellectual and ethical values necessarily comingle, and it is unlikely that we will ever recreate one. We should recognize that these virtues can be separate and, empirically speaking, often will prove to be all-too-remote from one another. When we attempt to aggregate them, through phrases like "emotional intelligence" "creative intelligence" or "moral intelligence", we should realize that we are expressing a wish rather than denoting a necessary or even a likely coupling.

There is one ally in converting this wish to reality. That is the existence of powerful examples— individuals who actually succeed in exemplifying two or more cardinal human virtues. It is always risky to name names— particularly in an era where one generation's heroes become the subject of the next generation's pathographies. And yet, in the recent past, one can without apologies mention scientists like Niels Bohr, statesmen like George Marshall, writers like Rachel Carson, athletes like Arthur Ashe, musicians like Louis Armstrong or Pablo Casals or Ella Fitzgerald.

In studying the lives of individuals like this, we discover human possibilities. Young human beings learn primarily from the examples of powerful adults around them—ones who are admirable as well as ones who are simply glamorous. It is possible that sustained attention to such admirable examples will increase the incidence of future individuals who actually do yoke capacities that, we now understand, are scientifically and epistemologically separate.

In one of the most important (and oft quoted) phrases of the century, the British novelist E. M. Forster counselled us "Only connect." I believe that, though well-motivated, some expansionists in the territory of intelligence have prematurely asserted connections that do not exist. But I also believe that it is within our power as human beings to help forge connections that may be important for our physical and psychic survival.

Just how the precise borders of intelligence are drawn is a question that we can leave to scholars. But the imperative to broaden our definition of intelligence in a responsible way goes well beyond the academy. Who "owns" intelligence" promises to be an even more critical issue in the next century than it has been in this era of the IQ test.

An Education For The Future: The Foundation of Science and Values

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I. Introduction

It is already a cliché to remark that our time is one of tremendous breakthroughs. I refer to new work in technology, nanotechnology, the genetics revolution, robotics, artificial intelligence, perhaps even the creation of new species, by accident or by design.

It is also a cliché to note that education is becoming increasingly important. Anything predictable and rule-governed will be automated. Only those persons who are well and broadly and flexibly educated will be able to function productively in this new world. Around the world, education leads the list of public concerns. Today, I will speak with you about education of children and adolescents; issues of collegiate and professional education deserve separate treatment on another occasion.

II. Two Dilemmas

By background, I am a psychological researcher who has studied mind and brain with particular reference to learning and to education. I just mentioned the consensus today about the importance of education. Alas, there is not comparable agreement about WHAT education should be and HOW it should be achieved. I want to mention two dilemmas—both connected to the cognitive, the knowledge agenda of school.

The first dilemma: What should be taught?

What should be highlighted: facts, information? data? If so, which of the countless facts that exist? Subject matters and disciplines—if so, which ones? **Which** science, **which** history? Should we nurture creativity, critical thinking? If there is to be an additional focus, should it be arts, technology, a social focus, a moral focus? If you try to have all of these foci, you would break the backs of students and teachers, even given a demanding elementary and secondary school curriculum. If knowledge doubles every year or two, we certainly cannot multiply the number of hours or teach twice as quickly. Some choice, some decisions about what can be omitted, is essential.

The second dilemma: How should we teach?

Even if we could agree on which emphases should be adopted, one must still determine whether to teach all subjects or all students the same way, or to individualize the curriculum for each student or groups of students. How much emphasis should there be on computers, distance education, various media? What should be the role of home, school, the

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church, the media, or extra-curricular activities? How much responsibility should be placed on teachers, students, peers, parents, the wider community? Issues of pedagogy/instruction turn out to be as vexed as issues of curriculum /content.

III. Two Firm Foundations

Since there are far too many possibilities, we must make hard decisions. In making those decisions, I will argue that we should depend primarily on two foundations or bases: the science of learning, and our own values as human beings living in communities. Let me comment on both.

First, the Science of Learning: Today I want to dwell on two major findings from the field of cognitive studies, findings with which I have been personally involved.

First finding: As human beings we have many different ways of representing meaning, many kinds of intelligence. Since the beginning of the last century, psychologists have spoken about a Single Intelligence that can be measured by an IQ test; my research has defined 8 or 9 human intelligences (linguistic; logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, intrapersonal, naturalist, possibly an existential intelligence). We all possess these several intelligences, but no two of us—not even identical twins—possess the same profile of intelligences at the same moment. In most countries throughout history, school has focussed almost exclusively on language and logic. Formal education has virtually ignored other forms of mental representation—artistic forms (musical), athletic (bodily), personal (knowledge of others and self); knowledge of natural world; knowledge of big questions. All of these "Frames of Mind" are there to be mobilized; if they are not, one could well call education "half-brained."

Second finding: Facts are easy to memorize, and some of us are good at remembering them—this facility can help us win money, in fact nowadays one can win millions of dollars, on a television quiz show in the U. S. But Disciplinary Understanding is much more elusive, much more difficult to bring about. Over the millennia, human beings have developed several powerful disciplines or ways of knowing the world—chief among them scientific, humanistic, historical, artistic, mathematical forms of thought. How desirable it would be if we could simply explain these to young people ("here are the three steps to think scientifically" or "this is what it takes to think historically"), even better if we could give youngsters a shot or a pill ("here, take this mathematics pill before you go to bed on Wednesday evening"), and the students would then have mastered the discipline. In fact, however, disciplinary learning proves difficult and takes many years of guided practice and apprenticeship.

Our research has suggested one reason why. When children are young, without help from others, they develop powerful theories about the world. They develop theories of matter (e. g. , if you break an object into small bits, and you keep cutting these bits up into smaller bits, eventually there is nothing left; or, when dropped, heavier objects accelerate to the earth more rapidly than lighter objects); theories of life (if it moves, it is alive; if it does not move, it is dead; if it is on a computer screen, one can't be sure if it is living or dead; or, to

choose another biological example, all animals were created at the same prehistoric moment and none has evolved since); and theories of mind (you have a mind and I have a mind; if you look like me, then your mind is like mine and you are good; but if you look different from me, then you have a different kind of mind and you are bad).

Many of the theories espoused by young children are wonderful; some are charming; but as you have just heard, some of them are Dead Wrong from the point of view of physics, biology, psychology, history. Unfortunately, these erroneous theories are also very powerful. Even the best students in the best schools adhere to these theories. In fact, when, outside the content of school, they are asked to explain a phenomenon, they typically do so in the same way as students who have never studied the subject. In education, if we want to develop better and more disciplined ways of thinking, we must first rub out or eliminate the misleading theories that children have constructed on their own. And then gradually we must help children adopt – a more accurate work is "construct"—better theories, such as the scientific theories used by contemporary biologists or physicists, many of which go directly against common sense. It does not seem sensible that human beings evolved from earlier primates; it does not seem sensible that matter exists even if it cannot be seen by the naked eye or that you could become very ill by exposure to a germ that you cannot see; it does not seem sensible that those who look very different from us could become our friends—but each of these statements happen to be true. We must help students to eradicate the wrong theories and gradually replace them with more adequate disciplinary ways of thinking.

To summarize what I've introduced thus far: To begin with, disciplinary understanding is important—perhaps, in fact, it is the best justification for 10-15 years of school! (We could keep youngsters off the street for eight hours a day with much less money). Disciplinary understanding is also hard to achieve. Next, as human beings, we all have available different ways of representing the world, different intelligences, so to speak. The question is: Can educators build on this recently established knowledge about how human beings learn? In a word, I believe that the answer to this question is "yes" and shortly, I will try to justify my answer.

Let me turn now to the second major foundation, complementing the science of learning — That is the sphere of Values:

As a teacher or educational policy maker, you could know all of the scientific facts about learning, and it would still not tell you what to do in class on Monday morning. That is because such decisions about a course of action always involve value judgments. For example, let us say that you accept the claim that there are multiple intelligences. You could decide that you still want to make individuals as similar as possible, and so you would minimize or ignore the pluralism of intellect. Multiple intelligences are then seen as an obstacle. Many in the U. S. and the Netherlands would take that "uniform" position. To honor the finding about multiple intelligences, you could decide to teach every topic in seven or eight ways. You could decide to put together all the children who are **strong** in a given intelligence, or, for that matter, if you are a pessimist put together all of the children who are **weak** in a given intelligence. You could try to strengthen those intelligences that are weak, or ignore weaknesses and build instead on areas of strength. You could decide to

learn about each child and personalize education as much as possible. That last option is what I personally favor—and in the age of the computer, it is at least feasible to personalize education for every child, and not just for those from wealthy families who can afford the latest hardware and software.

Take note: ALL these decisions entail value judgments; none of them can be decided simply because one has established that there are multiple intelligences.

So taking advantage of this august occasion, and throwing caution to the winds, let me indicate my own wishes, my own value system, for education in the future. I believe that the best education must build on what has worked in the past. At the same time the best education must take into account the most contemporary findings and the needs of future generations. I put forth these views not because I'm certain they are right, but to encourage discussion and debate.

IV. Looking in Both Directions

Drawing on the Past

Let me first draw on the legacies of the past. I believe that the primary cognitive purpose of education for the young should be to help students understand the world around them—the physical world, the biological world, the social world, the world of personal experiences. This is best done by first training them in the three basic literacies (Reading, Writing, Calculation) — nowadays we might add computing; and then introducing them to the major families of disciplines: science, which seeks the truths about the physical, social, and biological worlds, and which uses the powerful tools of mathematics; the study of art and nature, which tells us about the beauties of the natural and the manmade worlds and which give us the tools to produce objects that we ourselves cherish; and history and literature, which tell us about the human past, document the good and evil choices that humans have made and the consequences of these choices, and help us to determine what we ourselves should do when faced with dilemmas. In sum, the disciplines represent humanity's most determined efforts to learn and to understand what is true, beautiful and good, and by extension to spurn falsehood, to turn away from what is repulsive, and to avoid evil deeds.

Thus far, my prescription for precollegiate education is traditional and conservative, and I make no apologies for that. Indeed, it resembles the "four profiles" that you offer in secondary school in the Netherlands. But my claim to be an "educational conservative" does not last long. I believe that students are most likely to develop disciplinary understanding if they investigate a limited number of topics in great depth; that is, if they give up the false dream of "coverage" (from Plato to NATO in 36 weeks) in favor of intimate knowledge of a limited number of really important issues—for example, the theory of evolution in biology, or the meanings of political revolution in history, or the mastery of one art or craft. Also, I do not value the memorization of vast amounts of information. Tomorrow, or perhaps even today, we can get all the information that we need on a single CD or a palm pilot that one can carry around in one's hand—thus freeing us to focus on important knowledge, important understanding, important wisdom, which cannot be so readily "packaged" in that way. You can have the list of all Dutch sovereigns or prime ministers at your fingertips; but you can't click a mouse and suddenly think scientifically or historically, let alone make judicious

decisions. I am not arguing **against** cultural literacy — I'm arguing **in favor** of mastering the intellectual tools of the major disciplines.

The capacity to think intelligently is very different from knowing lots of information. Such intelligent thinking, such understanding is likely to come about only if one has rounded, three-dimensional familiarity with a subject, so that one can probe it in many different ways. And here at last is where our multiple intelligences can make their contribution. If we are willing to spend time on a topic and probe it penetratingly, we do not have to approach it in just a single way (which is almost always through written texts or lectures). Instead we can learn about it in many different ways, using our multiple intelligences, and that concept or topic is much more likely to remain with us, embedded in our neural networks, and to be usable in flexible and innovative ways. In fact, I would guess that if you were asked to remember material from Dutch history, you wouldn't remember long timelines, but rather a few events — the Golden Age of the 17th century or the Resistance of World War II — that you studied in detail.

An example. You can't understand the theory of evolution by simply memorizing a definition. Instead you can build mastery of the theory by being exposed to definitions (evolution is…); AND stories (the story of Darwin's voyage on the Beagle or the story of a particular contemporary species, be it mouse or man); AND static pictorial accounts (a tree diagram of different lineages in the hominid line); AND dynamic graphic recreations on a computer (in which one sees species evolving, morphing into others, sometimes thriving, like **homo sapiens**, and sometimes waning, like Neanderthal); as "entry points" to evolution, one could further mention works of art AND numerical puzzles and demonstrations AND the raising of the most profound existential questions— where do we come from, why are we here, what will happen to us and our species in the future? Each of these "entry points," stimulating different intelligences, can yield a fuller understanding of the processes of evolution. Taken together, they stand as a model of what it might mean truly to understand a topic.

So, my recommendations can be stated simply. First obtain the literacies; then study in depth key topics in the major disciplines; approach those topics in many ways; and give youngsters many chances to master and many vehicles to exhibit their understandings. Let them use their knowledge of evolution to evaluate the discovery of a new set of dinosaur bones or the spreading of a computer virus, as seems to happen each new week, at least on my machine. Various tasks can be left for the university: a specialization in one or another discipline; work that is explicitly multi- or interdisciplinary; and the mastery of facts that may be useful to know if you want to become an expert in, say, botany or medieval history and, if you happen to lose or misplace your Palm Pilot in which the lists of information had been stored…and had forgotten to "synch it" the previous night.

Peering Toward the Future

I turn, finally, to the question of how education may differ in the future. The widespread availability of powerful technologies will be a great boon. Students will be able to get much information on their own, often in vivid form. They will be able to encounter multiple representations of material, for example through hypertext linkages, surfing the world wide web, or experimenting in virtual reality. There will

be waning demand for live presentations of "straight, canned lectures"—such as this one!—for such lectures can be recorded and accessed, if one wishes, on the Internet at any time in day or night. In fact, I now post lectures like this on my web site and this past fall I videotaped my entire course on "Cognitive Development" and placed it on a web site at Harvard University.

In the future, students and parents will expect to be able to interact with teachers, in person and via the Internet, including instructors and experts whom they have never met. (We teachers will get even less sleep than we do now!) There may well be more home schooling, and more mixed forms of schooling, with students doing more at home, more with parents, more with ad hoc or planned groups, with only certain kinds of activity occurring each day within a single building. Flexibility is likely to prevail at school, as it is beginning to prevail at the workplace, in both of our countries.

I find these prospects exciting. The challenging of teaching young persons is going to increase in the years ahead. Not only will students be encountering spectacular demonstrations through technology; the world itself, in its technological facets, will continue to change at dizzying rates, as I noted in the beginning. We live during the first time in history when we human beings could destroy the world through nuclear weapons. We also live at the first time in history where—through genetic engineering or nanotechnology—we could create new toxins, or new forms of bioterror, which could destroy the planet.

We also live at the first time in history where we will have machines that are at least as smart as we are in many ways; machines that can plan economies, wage diplomacy, alter politics, and, for all I know, manage our leisure life, our love life, the place and manner of our deaths, and rebirths, how and whether we will be remembered. There will be experiments in cloning organs or whole human beings, and there will be attempts to merge humans and robots, for example, through the implanting of silicon chips in our brains; some will even hope to achieve immortality in that way, by downloading the wet brains into a vast dry database. I will leave it to you to determine whether this prospect of indefinite lives more closely approximates a dream or a nightmare!

I am not saying that these issues—what **used** to be the stuff of science-fiction—should dominate the curriculum of the school. I am saying something more radical. I am saying that they are **already** beginning to constitute the curriculum of life each day. Students won't have to learn in school about cloned organs and organisms or silicon implants in the hippocampus because they will see them on television or surf past them on the Internet, or hear them argued about around the dinner table at night or at the cybercafé around the corner.

And so the tasks of educators will become dual and dually challenging: on one hand, to inculcate the traditional disciplines and ways of thinking as I have described them; and, on the other hand, to help students cope with and perhaps take an active role in deciding how to deal with these dazzling developments, which, as I say, are no longer restricted to the pages of science fiction.

As I think about the future of precollegiate education, and as I bear in mind some of the issues that I've heard spoken about in the last few days in Amsterdam and The Hague, let me share a few more thoughts with you:

1. Public vs. Private Education

Throughout the world, societies are rethinking the relationship between the

world of education and the marketplace. In the United States, as you probably know, there are many private initiatives in education. Some individuals would like to have all education choice determined by portable vouchers that pay for one's schooling, and these proponents may even look forward to the disappearance of public education as we know it.

I believe that market control of education would be grave mistake. Public education has much to learn from business, and I for one appreciate the various kind of financial and advisory support that businesses can provide. However, the goal of business—to make a profit—is fundamentally at odds with the goal of education—to have an informed citizenry capable of independent analysis and decisions. Education is also an area of expertise and is becoming increasingly so; just as we should not entrust business people to make medical decisions, we should not allow business people to make educational decisions.

2. Multicultural issues

When a country consists primarily of a single culture, then the issues of cultural education are relatively simple. Citizens should come to understand the history, governance, art forms, and values of their particular culture. However, nowadays, two new issues arise. On the one hand, many countries such as the United States no longer have a dominant culture, but are exquisitely multicultural. On the other hand, we are all members of a global society and we all need to be prepared to deal with individuals from a diversity of backgrounds.

It is important to learn about one's own background culture, but in my view that task that can only rarely be undertaken by a school system in a multicultural society. How, in a Los Angeles highschool with individuals speaking 50 or even 70 different languages, can one genuinely provide an introduction to even a small percentage of these cultures? Cultural education is better left to afterschool or weekend options.

While cultural education is an option, introduction to the global society is becoming a necessity. Unless students have some grasp of trends and realities around the globe, and some sense of how to deal with individuals from diverse backgrounds and often conflicting value systems, they will be ill-equipped to survive in the future. In an area like this, we in American have much to learn from nationalities like the Dutch, who have, in a sense, been "globally aware" for centuries.

3. Academic vs. Practical Training

In years past, most societies featured a fairly early "tracking mechanism," where the most successful students took an academic "Gymnasium" or "lycee-style" curriculum and had the opportunity for higher education; while the rest either dropped out of school, worked in farms or factories, or entered a vocational track.

Nowadays, it is considered suspect to advocate such a tracking system. After all, most vocations run the risk of being automated; and we are living in a "learning" or "knowledge society" where individuals must be familiar with symbolic or notational systems. Otherwise they will have little chance to benefit fully from the opportunities available in a technologically-sophisticated setting.

However, it is also apparent that not all students want to continue in school beyond the age of 15 or 16, nor that this is necessarily the optimal place for them to spend half of their waking hours at that stage of their life. In many cases, they and the society would be much better off if they mastered a trade, did community

service, became involved in an artistic troupe, or went to work in a developing country.

My own belief is that we should not force all young people to pursue higher education before they reach the age of 20 but that we should extend the option to them throughout their lives. Just as students in all developed countries now have the opportunity for a free primary and secondary education, we should gradually extend this privilege to the tertiary level. In this country, universally-available university education should be the goal. However, it should be up to the student when and even whether to pursue that option. With the explosion of learning opportunities (e. g. , distance learning, on the job learning, simulated learning) and with the proliferation of institutions that provide education (e. g. , for-profit, corporate, the military), there is no reason for everyone to proceed along a single lockstep route from kindergarten through graduate school.

I should add, finally, that we have probably had too sharp a division between academic and practical learning. Much academic learning can be enlivened and enhanced if it has a "real life" component, or even vivid multimedia facets. Recent Dutch experiments with project-based and theme-related curricula illustrate the power of education that activates the multiple intelligences of the learner. And by the same token, there is every reason to infuse on-the-job training with exposure to general concepts and principles that extend beyond the particular task that is being mastered. One advantage of a "multiple intelligences approach" to education is that it does not simply consist of a set of hurdles designed just to pick out those individuals with a blend of linguistic-logical intelligence—though I suspect that particular blend is well-represented today in this room!

4. **Disciplinary and interdisciplinary studies** Earlier I took the position that precollegiate education should focus on the major academic disciplines. I stand by that assertion. At the same time, all of us have become aware that so much cutting edge work in the world is focussed on problems, not on disciplines; and that much of the best work combines a number of disciplines, whether it be the intersection of genetics and information science, cognitive science and neuroscience, economics and behavioral science, or arts and computers. Since postgraduate education needs to take an increasingly interdisciplinary stance, what implications might follow for precollegiate education?

In America, many middle and high schools claim that they are carrying out interdisciplinary work. Yet, examined more closely, these programs typically involve treatment of a topic from a number of angles, rather than a true blending of more than one discipline in an effort to elucidate a complex topic or problem. Indeed, unless a person has mastered more than one discipline, we cannot properly speak of interdisciplinary work; it would be like calling a person bilingual before she had mastered more than a single language.

So what about efforts at interdisciplinary work before tertiary education? I think it is possible to lay the groundwork for interdisciplinary education in at least three ways:

Among the young: Encourage wide reading (or even wide surfing of the web). This is the best route to cultural literacy. When young individuals pick up ideas informally on many topics approached from many angles, they accumulate a fount of knowledge which later serves them well;

During the middle school years: Feature complex problems which require considerations from a number of different disciplinary perspectives. For example, ask students to consider what would happen if the earth ran out of petroleum or if computers were "hacked" by organisms from outer space. Even when students are not fully versed in a discipline, it is instructive to realize that they will have to bring more than one perspective—and more than one intelligence—to bear on a solution.

In secondary school:
Devote a fair amount of time to active efforts at synthesis across disciplines. Most students see secondary school as a series of unrelated topics, as they wander from one class or test to the next one on the schedule. This estrangement is not essential. Particularly if there is coordination among faculty, it is possible to approach some of the same topics (e. g. , light, the Renaissance, patterns) from more than one disciplinary perspective. Then, if there are special weeks or classes devoted to efforts to bridging these perspectives, students can begin to gain a feeling for what genuine interdisciplinary work is like. The "theory of knowledge" course of the International Baccalaureate Diploma Programme is a good example of an opportunity to synthesize knowledge at the secondary school level.

Let me stress that, in offering these comments about public/private education, multicultural education, vocational training, and interdisciplinary education, putting forth my own views, even prejudices, I am not speaking as a disinterested expert. Indeed, one cannot even begin to think about such issues unless one puts forth one's own value system. The answers can be guided by findings from research but they can never be dictated solely by the results of scientific or social scientific research.

V. Two Crucial Values
In touching upon values, I want to emphasize the enduring importance of two values: the Assumption of Responsibility; and a Respect for Humanity. We encourage students to carry out work, but that work needs to be **good** in two ways: exemplary in quality but also responsible. More specifically, the work that we do as adults should take into account our responsibilities to five different spheres: to our own personal set of values; to other individuals around us (family, friends, colleagues/peers); to our profession/calling; to the institutions to which we belong; and to the wider world— people whom we do not know, those who will live in the future, the health and survival of the planet. Attention to these responsibilities is important for **any** worker, be he or she a physician, physicist, physical therapist or fisherman.

Such responsible education cannot be completed in the early years of life; but it must begin there. Adult years are far too late. And so parents and teachers must embody a sense of responsibility in their own lives and seek to nurture a comparable sense of responsibility in all young people. This is especially difficult to do in uncertain and turbulent times like these: when things are changing very quickly, market forces are very powerful, there are not equivalently potent counterforces, and our whole sense of time and space is being altered by technologies like the world wide web.

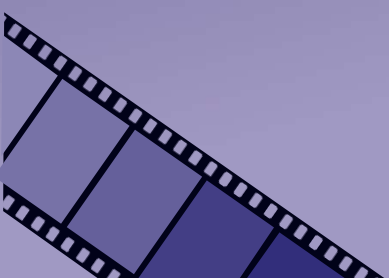
Many people in my country and elsewhere are worried about the alienation that many young people experience—alienation from the world of school and, in some sad cases, alienation from the world at large. I lack the expertise to discuss this national and perhaps world-wide phenomenon. But I

do know that we must help students to find meaning in daily life, to feel connected to other individuals and to their community—past, present, and future; and to feel responsible for the consequences of their actions. We must help them to achieve the state of flow—the balance between skills and challenges—which motivates individuals to return to a pursuit time and again. Plato understood this 2500 years ago when he stated, "Through education we need to help students find pleasure in what they have to learn."

The second value is an appreciation of what is special about human beings. Human beings have done many terrible things but countless members of our species have done wonderful things as well: works of art, works of music, discoveries of science and technology, heroic acts of courage and sacrifice. One only need walk around the Rijksmuseum or the Stedelijk, or to spend hours in and around the buildings on Dam Square to be reminded of what has been achieved over the centuries in this small but dynamic nation. Our youngsters must learn about these achievements, come to respect them, have time to reflect about them (and what it took to achieve them) and aspire some day to achieve anew in the same tradition…or perhaps even to found a new tradition. Learning about human heroism may be another clue to how to nurture youngsters who embody positive values. We should not be afraid to state our values; but of course it is far more important to embody them, to live them day in and day out. The scholarly disciplines are among the most remarkable of human achievements—and we must remember that they are much easier to destroy than to build up. Totalitarian societies first burn the books; then they humiliate the scholars; then they kill those who do not buckle under. As the events of the last century remind us, a Dark Age can always descend upon us.

We should remember that one of the most magnificent of human inventions is the Invention of Education—no other species educates its young as do we. At this time of great change, we must remember the ancient value of education and preserve it—not just facts, data, information, but Knowledge, Understanding, Judgment, Wisdom. We must use the ancient arts and crafts of education to prepare youngsters for a world that natural evolution could not anticipate and which even we ourselves as conscious beings cannot fully envision either. In the past, we could be satisfied with an education that was based on the literacies; that surveyed the major disciplines; and that taught students about their own national culture. We must maintain these three foci, but we must add two more: preparation for interdisciplinary work and preparation for life in a global civilization. And, speaking in the land of Erasmus and Spinoza, we must keep alive the important values of Responsibility and Humanity.

The great French playwright Jean-Baptiste Molière once declared "We are responsible not only for what we do but also for what we do not do." We must not shirk from the responsibility to prepare children and youth for a future which we can only glimpse— as through a glass darkly. That is the challenge faced as never before by education today. Let us combine the best of physical, natural, and social science, with the most precious of human values. Let us do so on a Global Scale. Then and only then can we have an educational system that reflects the best facets of the human condition.



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