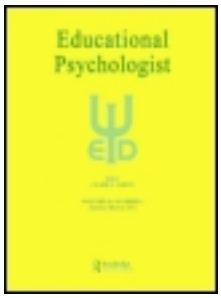

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The Science of Multiple Intelligences Theory: A Response to Lynn Waterhouse

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For a scholar, a fate worse than being criticized is being ignored. Waterhouse (2006) has done Howard Gardner the courtesy of reading much of the primary and secondary literature on multiple intelligences (MI) theory. Although the authors disagree with several of her interpretations and conclusions, we appreciate her efforts as well as the opportunity to respond. We have 2 main criticisms: (a) Waterhouse misunderstands and oversimplifies MI theory and (b) Waterhouse's own line of argument undermines her claim that MI theory is not supported by the literature. This response reorients and clarifies for the reader the usefulness and implications of MI theory with the goal of demonstrating why Waterhouse's critique misses the mark in a number of respects.

Gardner introduced multiple intelligences (MI) theory in the book, *Frames of Mind,* published in 1983. In arriving at his theory, Gardner combined the empirical findings of hundreds of studies from a variety of disciplines (see the extensive bibliography in the original book). Although he included psychometric and experimental psychology, he did not limit his base of support to just these disciplines. Rather, MI theory also encompasses cognitive and developmental psychology, differential psychology, neuroscience, anthropology, and cultural studies.

Gardner's major claim is that a description of individuals in terms of a small number of relatively independent computational capacities is more useful to cognitive scientists, psychologists, and educators than a description in terms of an innumerable collection of sensory-perceptual modules, on the one hand, or a single, all-purpose intelligence, on the other. An intelligence is defined as a biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture.

This definition sets the stage for our first comment on Waterhouse's (2006) account of MI theory. Her view fails to encompass the several levels on which MI theory examines intelligences—as *composites* of fine-grained neurological subprocesses but not those subprocesses themselves, as biopsychological information processing capacities, and as the bases on which an individual can participate in meaningful activities in the broader cultural milieu. Indeed, Waterhouse misses this latter level altogether, except for her assertion that MI theory is a questionable basis for education, a key cultural institution.

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MI THEORY TAKES A MIDDLE ROAD

Gardner has never claimed that MI theory represents "the" definitive description of human cognitive capacities. Rather, he maintains that relatively independent yet interacting intelligences provide a better understanding of the variety and scope of human cognitive feats than do competing accounts.

This debate of whether intelligence is a singular individual quality or a plethora of components (Guilford's 1967 structure of intellect model had 120!) has waxed and waned throughout the 20th century. Spearman (1904), Binet and Simon (1909/1976), L. M. Terman (1925) and L. W. Terman and Oden, 1947, and Wechsler (1958) paved the path for IQ, the "first factor" from paper-and-pencil IQ tests that has been correlated with other paper-and-pencil tests and linguistic and logical scholastic success—but far less impressively with real-world success (see Moran & Gardner, 2006). Indeed, the *lack* of extraordinary success among the children with high IQs in Terman's 70+-year longitudinal study is remarkable in showing the limits of IQ as a conceptualization of intelligence. Yet, because IQ tests seem easy to administer

and score, and because they are well entrenched in the educational psyche, they remain the standard in most schools, despite lack of agreement about what they actually measure and predict (see Neisser, 1998, for a critical discussion).

At the other end of the spectrum are people who equate intelligence with sensory-perceptual abilities, such as verbal, perceptual speed, number, word fluency, space/visualization, and mechanical acumen (Thorndike, 1921; Thurstone, 1938; Vernon, 1950). One advantage of this slant is that these abilities are easy to "see" experimentally: They can be manipulated by standard cognitive psychological and social psychological research intervention paradigms. As such, this approach tends to be favored by psychologists. Both the IQ and the sensory-perceptual abilities foci continue today. Yet, they may be cases of the cliché of the man looking for his dropped car keys underneath the street lamp because that is where the light is. Intelligence as IQ or sensory-perceptual ability is easy to test, so many educators and psychologists understandably prefer these approaches.

An MI approach demands a change of minds among researchers and educators: It requires an interdisciplinary perspective, cultural sensitivity, and an interactionist-dynamic research methodology. The first two reasons support Gardner's decision to incorporate anthropological studies and case materials from a variety of cultures in devising and revising his theory (see Gardner, 2006a). The third reason supports his decision to include developmental findings and to push for assessment criteria and environments that are intelligence-fair, are individual-focused (rather than "average kid"-focused), and capture the often dynamic interactions among intelligences.

The advantage of this approach is that it better explains the wide variety of "intelligent" performances among children and adults depending on level of training, context, culture, and innate predisposition. An MI approach better addresses the incongruities and imbalances of intelligent behavior not only between individuals but also within individuals. Finally, an MI approach does not overprivilege the "average" person—rather, it makes room in the scholarly debate for experts whose intelligence profiles fit perfectly with a cultural domain; creators whose intelligence profiles are incongruous with a cultural domain in a fruitful, surprising way; and savants and brain-damaged patients who exhibit a striking disparity among abilities.

MI THEORY COMPRISES SEVERAL LEVELS OF ANALYSIS

Where should "intelligence" be situated? At the modular level of specific neural processes, the middle level of coordinated intelligences, or the social level of how intelligences intersect with cultural domains? On the fine-grained end of the spectrum, each intelligence makes use of psychological subcomponents (e.g., face detection or object tracking). In his own work, for example, Gardner (1994; Gardner, Brownell, Wapner, & Michelow, 1983) dissected several aspects of linguistic intelligence, including sensitivity to syntax, metaphor, and narrative. He also drew on others' work to understand and formulate how these subcomponents comprise an intelligence—in this case, linguistic intelligence. We are pleased by the extent to which this identification of subcomponents has been reinforced by findings in neuroscience (e.g., the discovery of many specific neural systems, mediating capacities like theory of mind, recognition of natural kinds, understanding of self, understanding of others) and developmental studies (e.g., identification of core systems of numerical, linguistic, and causal reasoning). For the summaries of these findings, see Gardner 2006a and 2006b.

At the broader end of the spectrum, intelligences interact with the opportunities and supports of social groups, such as professions and vocations. Gardner's work over the last 2 decades has focused on this interaction (Gardner, Csikszentmihalyi, & Damon, 2001; Kornhaber, Krechevsky, & Gardner, 1990). Social groups organize information into disciplines and domains (i.e., bodies of knowledge), toward which individuals can mobilize one or more intelligences to produce proficient and/or expert behavior (Connell, Sheridan, & Gardner, 2004). As a result of this work—as well as the work of Csikszentmihalyi (1988), Hutchins (1980), Salomon (1993), and many others—we have refashioned the concept of intelligence so that it comprises what the individual brings and what the cultural and social environments contribute to a particular cognitive performance.

In the middle of this spectrum are the intelligences themselves. Based on the eight criteria outlined in chapter 4 of *Frames of Mind,* Gardner (1999) holds that there are eight intelligences, each oriented to a specific type of information: linguistic, logical-mathematical, musical, spatial, bodily kinesthetic, naturalistic, interpersonal, and intrapersonal. He has analyzed the potential of a ninth intelligence, existential, but is not yet convinced it fulfills all of the criteria. Note that information is not synonymous with sensory input. Rather, information comprises a collection of such inputs in any format that can be interpreted, understood, and made use of by the person (or, more precisely, by his or her computational capacities).

MI theory also stresses that the interaction among these intelligences is important for understanding how people's minds work. For example, the intelligences can be grouped together for various purposes (e.g., those that deal with objects, with persons, with more abstract entities). One key modification of the theory entails two overarching intelligences profiles: searchlight and laserlike (Gardner, 2006a). Waterhouse (2006) regards these terms as additional intelligences, but they are not. Intelligence profiles describe the strength of intelligences relative to each other. Searchlight profiles— especially characteristic of politicians and businessmen—involve a ready shifting among intelligences that are often of comparable strength. Laserlike profiles—especially characteristic of artists, scientists, and schol-

ars—demonstrate one or two powerful intelligences used in great depth that overshadow the other intelligences.

Deployment of the Word *Intelligence*

In addition to Waterhouse's (2006) mischaracterization of the nature and scope of MI theory, her article includes several specific terminological and level-confusion errors. Consider, for example, the first paragraph of the article:

1. Gardner has never combined interpersonal and intrapersonal intelligence into a single intelligence. Interpersonal intelligence processes information related to other people and interacting with them. Intrapersonal intelligence processes information about the self. They are clearly different.
2. Naturalist intelligence does not include empathy for natural things. Empathy is an emotional capacity not an information processing capacity. Naturalist intelligence processes information related to distinguishing among natural and manmade objects, which is evolutionarily derived from the hominid capacity to recognize, group, and label distinctions among natural phenomena.
3. Gardner never described the searchlight and laserlike profiles as "additional intelligences." As noted previously, these conceptualizations describe the ways in which the several intelligences interact and are deployed.

In later passages, Waterhouse (2006) confuses an intelligence, which is an individual's biopsychological information processing capacity, with a skill, which is a cognitive performance that includes the supports and constraints of the environment (see Fischer, 1980). In our terms, she collapses the middle intelligence level with the broad cultural domain level. Further on, she characterizes the object and location perceptual neural pathways as additional "place" and "object" intelligences—confusing the levels of sensory input and subcomponents with the middle level of intelligences. As an additional example, she characterizes Kahneman's decision-making styles as still more intelligences—the "intuitive" and the "deliberative"—which confuses the individual intelligences with profiles or means of deploying those intelligences. These errors of detail—misusing MI theory terms and using empirical findings at the inappropriate level of analysis—cast doubt on Waterhouse's (2006) analyses and conclusions.

MI THEORY AS AN EDUCATIONAL "PROGRAM"

Waterhouse (2006) castigates educators for building practices on an "unproved theory." We would turn this accusation on its head. It has taken a century and many millions of dollars to bring IQ testing to its current, not especially impressive (although highly reliable!) status. IQ-based education, which Waterhouse lauds, has yielded no genuine implications for classroom instruction or the improvement of performances, only feelings of pride or shame on the part of test-takers or their families.

It should be stressed that Gardner himself has never put forth an educational recipe growing out of MI theory. At most, he has indicated some general implications—individualizing education, approaching topics through multiple entry points—that are consistent with the theory. Waterhouse's (2006) assertion that educational applications of MI theory are harmful is without merit. This claim is offered without evidence and by ignoring considerable counterevidence. With colleagues, Kornhaber (Kornhaber, Fierros & Veenema, 2004) studied 41 schools that had used MI-inspired practices for several years. She documents numerous ways—quantitative as well as qualitative—in which these schools and their students have benefited. In our view, it is up to educators to decide whether ideas derived from, inferred from, or catalyzed from MI theory are useful to them.

RIVAL VIEWS OF SCIENCE

We are puzzled when Waterhouse (2006) asserts that MI theory is not empirical, is not based on empirical findings, or has no support in the empirical literature. The theory originated entirely from empirical findings. In our view, Waterhouse embraces a naïve view of science, which contemporary philosophers or historians of science rarely hold. As put forth by Diamond (2005), science is misrepresented as "the body of knowledge acquired by performing replicated experiments in the laboratory" (p. 17). Rather, as Diamond goes on to point out, science is (and has been from its origins) a much broader enterprise: the acquisition of reliable knowledge about the world. Many fields— population biology, astronomy, epidemiology, geology, and paleontology, to name a few—proceed by incorporating and contextualizing relevant empirical findings. That is, science progresses not only through experimentation but also by synthesizing the experimental, observational, and theoretical work of others to build a foundation for future research.

MI theory was put forth deliberately as a work of synthesis: a work that organizes and integrates large bodies of empirical work from a variety of disciplines. Rather than utilizing only the experimental and psychometric psychological findings, which were the dominant approach to intelligence at the time, Gardner cast a wide net that included neuroscience, cognitive science, anthropology, and evolutionary sciences. This broader view allowed Gardner to reconceptualize intelligence(s)—that is, to understand the concept in a new light free from the constraints of a single disciplinary lens.

Gardner continues to assess and integrate new empirical findings from these and other various domains to refine MI theory (e.g., Gardner, 2006a). This ongoing process of analysis and synthesis has resulted in the addition of intelligences,

the conceptualization of intelligence profiles, and the modest educational guidelines described previously. In each of these modifications, the changes have been guided by the usual considerations of logic, clarity, and usefulness expected in scientific theorizing and synthesizing.

At the most fundamental level, we believe that Waterhouse (2006) does not acknowledge or understand the enterprise in which Gardner has been engaged: synthesizing the empirical findings of others. Yet, there is a paradox: Synthesis is precisely the enterprise of her own article—assembling and making sense of a body of literature. Moreover, in her own synthesizing efforts, she makes use of categories that are precisely at the same level as Gardner's intelligences—she readily invokes emotional intelligence, musical aptitude, spatial skill, and the like. Therefore, her own presentation undermines the heart of her critique.

ON TESTING

Waterhouse (2006) berates Gardner for not testing MI theory, and she quotes others who claim that MI theory has not been tested. As a work of synthesis, MI theory does not lend itself easily to testing through paper-and-pencil assessments or a one-shot experiment. Rather, it is repeatedly assessed and reformulated as new empirical findings from a variety of disciplines are analyzed and integrated. Theories such as evolution or plate tectonics or MI develop through the continuing accumulation of evidence, which makes the theory more or less plausible, more or less relevant for further research, and more or less useful to practitioners.

It is possible to develop a set of tests that purport to examine the core components of each intelligence proposed in MI theory. Were such tests to be developed, one could then examine the correlations among the subcomponents of each intelligence and correlations (or lack thereof) across the tests that purport to examine each separate intelligence. However, in her adherence to an IQ view of intelligence, Waterhouse (2006) claims that intercorrelations among subcomponents refute rather than support an MI perspective. She does not recognize that such correlations also could imply the concepts of searchlight and laserlike intelligence profiles—in other words, how the intelligences interact.

In fact, some useful tests have been developed. In the 1980s, Feldman, Krechevsky, Chen, Gardner, and other colleagues created "intelligence-fair" assessments of the intelligences for preschool children. An intelligence-fair assessment means it assesses a particular intelligence in its most natural milieu—for example, the bodily kinesthetic intelligence through movement activities or the interpersonal intelligence through social interaction—rather than through ersatz paper-and-pencil measures. These researchers piloted the Project Spectrum measures on select groups of young children in the Boston area, which yielded distinctive intelligence profiles in children as young as 3 or 4 years. These findings are described in a number of articles and in three books (Gardner, Feldman, & Krechevsky, 1998a, 1998b, 1998c). Educators in the United States and around the world—from Scandinavia to East Asia—continue to use these materials.

This project taught Gardner another key lesson: Developing tests is an expensive and time-consuming process whose final results may well be misused. Even as the IQ test yields premature, all-purpose descriptions of "smart" and "dumb," a Spectrum assessment unthinkingly might lead to labeling a child as "music smart" or "interpersonally stupid." Gardner would prefer to spend more resources helping learners understand and develop their individual intelligence profiles and spend less resources testing, ranking, and labeling them. He has made the personal decision not to become directly involved in testing. Nevertheless, both authors understand that assessment is a fundamental component of the educational system; we have no objection to others developing assessment instruments as long as they are intelligence-fair.

For example, we find encouraging those efforts to create milieus in which the intelligences can be observed using meaningful materials in meaningful situations. Recently both of us had the opportunity to learn about the Explorama at Danfoss Universe in southwestern Denmark. The Universe is an impressive new science park and museum complex open to the general public. Inspired by MI theory, the Explorama offers approximately 50 games that individuals can play alone or in small groups. The games range from language learning games, to games involving balancing or juggling, making and dissecting tunes, or working with individuals or robots to move objects around.

Of the dozens of efforts to create measures of the various intelligences, the Explorama is by far the most effective. It is fun to sample across the board or to delve into a particular task, it involves measures that do not require the intrusion of paper-and-pencil instrumentation, the materials are novel for the user yet easily understood by anyone from a schooled society, and it gives users the opportunities to predict their own intelligence profile and ascertain whether they are correct. We anticipate that the approach epitomized by the Explorama will prove usable in virtual as well as real-life settings and will give individuals all over the world the opportunity to understand—in an intuitive, phenomenological way—what is meant by multiple, relatively independent, intelligences.

FUTURE DIRECTIONS

Having critiqued Waterhouse (2006) on numerous accounts, we welcome her effort to compare and reconcile MI theory with accounts from information processing psychology, evolutionary psychology, and other contemporary approaches. However, although the tack used by Waterhouse is promising, the results are not convincing. For example, the "what" versus "where" dichotomy is hardly an all-purpose information pro-

cessing distinction; it refers primarily to the identification and location of objects. Similarly, some of the specific modules identified by evolutionary psychologists, contrary to Waterhouse's argument that they refute MI theory, align very well with Gardner's intelligences and their subcomponents. When authorities like Carey and Spelke (1994) speak about intuitive theories of mind, life, or causality, they might as well have used the terminology of interpersonal intelligence, naturalist intelligence, or logical-mathematical intelligence.

By limiting her synthesis to the singular disciplinary frames of psychometrics and experimentation, Waterhouse (2006) misses the core of MI theory. We are open to disconfirming evidence but not to closing down an entire line of inquiry. Maintaining our synthesizing stance, we are encouraged by the development of new methodologies that may satisfy both the quantitative bent of strict psychometricians, experimentalists, and statisticians and our insistence on studying intelligences in an intelligence-fair, contextualized manner. For example, configural and dynamical models (e.g., Lykken, McGue, Tellegen, & Bouchard, 1992; Van Geert, 2003), which allow for interactions and context, rather than more traditional factor analytic or regression models, which require independence of variables and large sample sizes, hold promise for a truly integrated conceptualization of intelligence.

CONCLUSION

MI theory will continue to be assessed in two ways. First, those familiar with the scientific evidence, and any new evidence that emerges from intelligence-fair testing, will weigh whether MI theory's synthesis of cognition speaks adequately to the data. Second, those interested in improving the lot of students in schools will note, formally and informally, whether practices informed by MI theory encourage student engagement and learning. We look forward to the ongoing debate.

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