

Two theories on the nature of intelligence

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Two Theories on the Nature of Intelligence 2/11/2013 Desiree K. | To this day, how exactly to define intelligence is still debated. There are, however, two major schools of thought on its nature and properties. This paper examines and evaluates the two opposing theories on the nature of intelligence. The two opposing theories of intelligence are the one general intelligence school of thought and the multiple intelligences school of thought. The general intelligence proponents believe that there is one factor from which all intelligence is derived; the multiple intelligences proponents believe that there are different kinds of intelligence. Each theory has merit and evidence to support its claims. In the last decade of the nineteenth century, a French physician named Alfred Binet was commissioned by the school system to develop a way to differentiate those students who were uneducable, or severely mentally handicapped, from the other students. He developed an intelligence test to do so. The very first intelligence tests, introduced a decade earlier, emphasized sensory tasks, physical measures, and simple processes. Unlike these tests, Binet developed an intelligence test that consisted of items that required complex processes of the mind and examined the comprehensive individual. Consequently, the results from Binet's scales were successful in discriminating between the two types of students. The success of Binet's test led to a much greater question to be asked: what exactly are these tests measuring? What the tests claimed to measure was intelligence. But, if they measured intelligence, then the next question that arose was this: what exactly is intelligence? It is at this point that the great debate on the definition of intelligence began. There is a general consensus that there are different levels of intelligence, and that

different individuals have different capacities of intelligence. In other words, " individuals differ from one another in their ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by taking thought" (Neisser et al., 1996, p. 77). But, how many and what kinds of different types of intelligences exist, and how to define intelligence, is still at debate. Two Theories on the Nature of Intelligence Today, there are two major schools of thought on the nature of intelligence. The first, supported by such psychologists as Eysenck, Galton, Jensen, and Spearman, believe that all intelligence comes from one general factor, known as g. The proponents of the other school of thought include Gardner, Sternberg, and Thurstone. These psychologists think that there is more than one general type of intelligence, or in other words, that there are different types of intelligences. An interesting note about this school of thought is that there is disagreement, even within that camp, on exactly how many different types of intelligences there are.

One General Intelligence

There are strong arguments to support the theory of one general type of intelligence. The most convincing evidence for a single general intelligence model is the fact that there is proof of a single general factor that governs the level of intelligence of an individual. This is also known as the positive manifold (Spearman, 1904). Furthermore, there is a very high correlation between IQ and very simple cognitive tasks, which supports the theory of one general intelligence (Eysenck, 1982).

Positive manifold.

The first argument in support of one general intelligence is the fact that there is a high positive correlation between different tests of cognitive ability. Spearman (1904), in doing his

research, administered to many people different types of tests, covering several different areas of cognitive ability. When he examined the results of these different tests, he found that there was a positive correlation between the tests for a given individual. In other words, if a certain person performed well on a test of verbal abilities, then that same person also performed well on another test of another cognitive ability, for instance, a mathematics test. Spearman named this positive correlation among tests the positive manifold. This positive manifold was also called the general intelligence factor, or *g*. This is the single factor that determines the intelligence of the individual. Jensen (1997) supported the theory of one general intelligence by stating, "the positive correlation between all cognitive test items is a given, an inexorable fact of nature. The all-positive inter item correlation matrix is not an artifact of test construction or item selection, as some test critics mistakenly believe" (p. 223). This positive manifold led Spearman (1904) to find a large first factor that was dubbed general intelligence, or *g*. Reaction time and *g*. Another strong argument in support of one general intelligence is the fact that there is a very high correlation between reaction time and IQ. According to Eysenck (1982), "IQ correlates very highly (.8 and above, without correction for attenuation) with tests which are essentially so simple, or even directly physiological that they can hardly be considered cognitive in the accepted sense" (p. 9). For instance, an example of the type of tests used to measure reaction time is a test in which a light is turned on. The participant is asked to press a button as soon as he or she sees the light go on. From tests such as these, the reaction time can be measured. Given that only very simple sensory and motor movements are necessary to respond, it

is difficult to argue that cultural, environmental, gender, socio-economic, or educational discrepancies will affect the participants ability to respond to the testers' questions (Eysenck, 1982). Common definitions of intelligence are " success in problem solving, ability to learn, capacity for producing noegenetic solutions, understanding of complex instructions or simply all-round cognitive ability" (Eysenck, 1982, p. 8). A common thread in all of these definitions of intelligence is that they all require the nervous system, especially the brain, and sensory organs to be functioning properly.

Furthermore, in order for these types of tasks to be completed, they require that the information processing that goes on within the bodily systems is relatively without error. Jensen (1993), as well as others, synthesized these facts and conjectured that " the most obvious hypothesis is that speed of information processing is the essential basis if g, and one possible neurological basis of speed of processing is the speed of transmission through nerve pathways" (p. 54). The speed of information transmission can be reasonably well measured or extrapolated from reaction time scores. Therefore, if an individual has faster neural processing speed, then he or she have a better reaction time. In turn, given that reaction time is highly correlated with IQ, then those individuals with faster neural processing speeds have higher IQ's. Consequently, neural processing speed determines the level of intelligence of the individual; this intelligence is the one general intelligence, g. Summary. Sternberg and Gardner (1982) summarized the theory of one general intelligence by stating " general intelligence can be understood componentially as deriving in part from the execution of general components in information processing behavior" (p. 251). And Spearman

(1973/1923) concluded that "cognitive events do, like those of physics, admit throughout of being reduced to a small number of definitely formulatable principles in the sense of ultimate laws" (p. 341). These psychologists, as well as many others, believe that intelligence can be defined by a single factor. Whether that single factor be termed positive manifold, neural processing speed, or g, the complexities of the human mind and its processes can be reduced to a single factor, defined as intelligence.

Multiple Intelligences The different proponents of one general intelligence all agree that there is a single factor that determines intelligence, and the proponents of multiple intelligences agree that there is more than one single type of intelligence. However, the different proponents of multiple intelligences do not agree on how many different intelligences there are, or could be. I believe that the theories put forth by Gardner and Sternberg have the most merit. Both of them have their own theory on multiple intelligences; Gardner (1983) believes there are seven forms of intelligence; Sternberg (1985) believes there are three forms of intelligences. Gardner's theory. Gardner's theory of multiple intelligences suggests that there are seven different forms of intelligence. They are linguistic, musical, spatial, bodily, interpersonal, intrapersonal and logico-mathematical. In developing his theory, Gardner (1983) attempted to rectify some of the errors of earlier psychologists who "all ignore[d] biology; all fail[ed] to come to grips with the higher levels of creativity; and all [were] insensitive to the range of roles highlighted in human society" (p. 24). So, Gardner based his own theory of intelligence on biological facts. Li (1996) summarizes Gardner's theory as follows: Premise 1: If it can be found that certain brain parts can distinctively

map with certain cognitive functioning (A), then that cognitive functioning can be isolated as one candidate of multiple intelligences (B). (If A, then B).

Premise 2: Now it has been found that certain brain parts do distinctively map with certain cognitive functioning, as evidenced by certain brain damage leading to loss of certain cognitive function. (Evidence of A).

Conclusion: Therefore, multiple intelligences. (Therefore B.). (p. 34)

Gardner's theory has a very solid biological basis. Premise two takes into account the brain as a major physical determinant of intelligence. By studying individuals who had speech impairment, paralysis, or other disabilities, Gardner could localize the parts of the brain that were needed to perform the physical function. He studied the brains of people with disabilities postmortem and found that there was damage in specific areas, in comparison to those who did not have a disability. Gardner found seven different areas of the brain, and so his theory consists of seven different intelligences, each related to a specific portion of the human brain (Li, 1996). Gardner looked to develop a theory with multiple intelligences also because he felt that the current psychometric tests only examined the linguistic, logical, and some aspects of spatial intelligence, whereas the other facets of intelligent behavior such as athleticism, musical talent, and social awareness were not included (Neisser et al., 1996). Sternberg's theory. The triarchic theory of intelligence developed by Sternberg is " a comprehensive theory, more encompassing. . . because it takes into account social and contextual factors apart from human abilities" (Li, 1996, p. 37). Sternberg (1985) felt that the theories that preceded him were not incorrect, but, rather, incomplete. Consequently, his theory, like Gardner's, takes into account

creative or musical intelligence. But as for the other six intelligences from Gardner's theory, Sternberg classifies them into two different types of intelligences: analytic (or academic) and practical. These two types of intelligences differ and are defined as follows: Analytic problems tend to have been formulated by other people, be clearly defined, come with all information needed to solve them, have only a single right answer, which can be reached by only a single method, be disembodied from ordinary experience, and have little or no intrinsic interest. Practical problems tend to require problem recognition and formulation, be poorly defined, require information seeking, have various acceptable solutions, be embedded in and require prior everyday experience, and require motivation and personal involvement. (Neisser et al., 1996, p. 79) If an individual could solve one or the other of these types of problems well, then that individual would have a high analytic or practical intelligence, respectively. Also, there exist virtuosos, or individuals who are extremely talented in the fine arts, these people would have a high creative intelligence. One reason why Sternberg's theory has received so much acclaim is that in real-life situations, it has proven itself. For example, Brazilian street children can do the math that they need to know in order to run their street businesses, but they are unable to pass a math class in school (Carragher, Carragher, & Schliemann, 1985). Evidence such as this shows that there are two different types of mathematical intelligence, an academic classroom mathematical intelligence and a street wise practical intelligence. Other theories. In addition to Gardner's and Sternberg's theories on multiple intelligences, there are other theories as well, including Thurstone's and Guilford's. Both were proponents

of multiple intelligences. Thurstone (1924) stated that " the biological function of intelligence is to protect the organism from bodily risk and to satisfy its wants with the least possible chance of recording failure on the environment" (p. 162). With this in mind, he found several primary mental abilities. As expected, these abilities are those abilities that the individual uses in order to survive and succeed in society. He found this using factor analysis, like Spearman, but Thurstone took the factor analysis a step further and rotated the factors. He arrived at 13 different factors as opposed to Spearman's one and called these primary mental abilities. These factors included spatial, perceptual, numerical, logical, verbal, memory, arithmetical reasoning, and deductive abilities (Thurstone, 1938). Guilford (1967) found that the structure of intellect was composed of 4 contents, 5 operations, and 6 processes. Each of these was mixed and matched to come up with 120 different combinations of abilities. Conclusion There are two distinct schools of thought on the nature of intelligence. The proponents of one general intelligence have a theory that explains the biological reasons for intelligence. Given that they see neural processing speed as the root for intelligence, their theory has an effective causal explanation. On the other hand, the theory of one general intelligence does not encompass all peoples. In the example with the Brazilian street children, they would most likely score poorly on an intelligence test, and be labeled with a low general intelligence. However, they are intelligent enough to be able to do all of the math that they need to know how to do. A drawback to the general intelligence school of thought is that it is heavily dependent on psychometric evaluations. Consequently, it cannot take into account the vast array of

different talents that people have. As for multiples intelligences, there are many theorists in that school of thought as well. Some of the theories presented by the proponents of multiple intelligences are excessive and have too many constructs to measure for example, Guilford's theory. But there are reasonable explanations of intelligence put forth by those from the school of multiple intelligences. Gardner's theory has a very clear causal explanation for intelligence, like the explanation of one general intelligence. But, unfortunately, it is very difficult to pinpoint and confirm Gardner's hypotheses experimentally, because of the delicacy involved with the human brain. Sternberg's theory does not have a biological basis to it, and that detracts from its validity. But that may also be its strength. The theory does not focus on the brain and biological functions, but on different social situations. Therefore, the theory applies to different social situations and environments, as none of the other theories does. But, given that there still is a substantial debate about the nature of intelligence, and no one theory is accepted by all, there is still room for improvement on any given theory.

Peer Commentary Intelligence: Two Major Schools of Thought Valerie L. Dammann Northwestern University I enjoyed reading and rereading Paik's review paper regarding intelligence--one versus multiple. Paik does a good job of covering the two different schools of thought regarding intelligence and what each psychologist believes to be true. I agree with Neisser et al. (1996) that there are different levels of intelligence and each individual has a different measure of intelligence. I also believe that individuals' intellectual performance varies depending on the situation in which they find themselves. This is why I tend to agree more with the psychologists who

believe in multiple intelligences, such as Gardner, Sternberg, and Thurstone, rather than those who believe in one intelligence, such as Eysenck, Galton, Jensen, and Spearman. After researching articles written on these theories, Paik has covered the main points well, although I would like to have seen him go into further detail regarding Gardner's seven different forms of intelligence. Paik does a nice job of explaining Gardner's Premise 2, which takes into account the brain as a major physical determinant of intelligence. Paik also does a nice job of stating the main points of Sternberg and Thurstone, although I would like Paik to have talked a little more about how Thurstone took Spearman's method of factor analysis one step further by rotating the factors (Thurstone, 1938). Paik concludes his paper by reiterating the two distinct schools of thought regarding intelligence. He briefly covers the main points for one general intelligence as well as for multiple intelligences and concludes with the debate about the nature of intelligence and how no one theory is accepted by all and there is still room for improvement on any given theory. Overall, I enjoyed reading Paik's review paper on intelligence and gained a little more knowledge about the subject. Peer Commentary Calling Attention to More Diverse Approaches to Intelligence KwangMin Jang Northwestern University In the article " One Intelligence or Many? Alternative Approaches to Cognitive Abilities," Paik summarizes and evaluates the two major schools of thought on the nature of intelligence. As Paik correctly notes, some researchers such as Spearman and Jensen argue that there is one general intelligence, or g , which many abilities have in common, whereas other researchers such as Gardner and Sternberg think there are many different intelligences that are independent

of each other. However, there is not only an either-or approach to intelligence such as one versus many. There are still other approaches that try to make a compromise between the two opposing approaches. The other approaches "opt for a multifactorial description with factors hierarchically arranged and something like g at the top" (Neisser et al., 1996, p. 96). Therefore, although Paik argues well enough about the two opposing theories of intelligence in terms of the relations among many different abilities--one versus many--what is further needed for better understanding of the nature of intelligence is to give more attention to diverse approaches to intelligence. This is needed because, "in a field where so many issues are unresolved and so many questions unanswered, the confident tone that has characterized most of the debate on these topics is clearly out of place" (Neisser et al., 1996, p. 97). That is what Paik also concluded in his paper as "there still is a substantial debate about the nature of intelligence, and no one theory is accepted by all." Other approaches besides the psychometric and multiple intelligence approaches to intelligence should briefly be mentioned here. Paik has already discussed the psychometric and multiple intelligence approaches in detail. The other approaches considered here are developmental approaches and biological approaches (Neisser et al., 1996). These approaches give us a broader understanding about the development and physiological structure of intelligence. In the developmental perspectives on intelligence, two researchers deserve to be mentioned. One is the Swiss psychologist Jean Piaget and the other is the Russian psychologist Lev Vygotsky. They were interested in how intelligence develops in the first place. Piaget thought that intelligence develops in all

children through " the assimilation of new information into existing cognitive structures and the accommodation of those structures themselves to the new information" (Neisser et al., 1996, p. 80). He devised a method to assess children's understanding of conservation, the principle that material quantity is not changed by changes of shape. In his method, a child watched water being poured from a small container to a large one and was asked if the large container had less water in it. The answer indicated the development of that child's intelligence. Whereas Piaget thought that intelligence naturally develops fully in all children, Vygotsky believed that intelligence is social in origin and has potential to develop throughout life. He thought that " language and thought first appear in early interactions with parents, and continue to develop through contact with teachers and others" (Neisser et al., 1996, p. 80). From the biological approaches to intelligence, researchers study the brain to understand intelligence. Developments of brain anatomy and physiology concerning the cortical neurons, cerebral glucose metabolism, evoked potentials, nerve conduction velocity, and sex hormones give new ideas about what intelligence is and how to measure it (Neisser et al., 1996). For example, the brain is studied using PET and MRI scans to understand individual differences in intelligence. The biological approaches give us high hopes that many anomalies about intelligence will be resolved in the near future by advances of research methods. As briefly reviewed here, there is a wide range of conceptions of intelligence. Paik reviewed the psychometric approaches and multiple intelligence approaches well in his paper. However, there are still other approaches that have contributed to our understanding of intelligence. I have reviewed only some

of them here, such as developmental and biological approaches. In a field such as intelligence with many anomalies, we should not limit our study to an either-or approach. Instead, we should study diverse approaches and hesitate to conclude too early.

Author Response Additional Theories of Multiple Intelligences: A Barrage of Opinions Han S. Paik Washington University

After reading the peer commentaries on my article, "One Intelligence or Many? Alternative Approaches to Cognitive Abilities," it seems that there is a general consensus among the readers that there is a lack of development of the theories of multiple intelligences. There was an overall sense of a sufficient summary of the two different theories and the paper in general, but commentators seemed to feel that the section on multiple intelligences was lacking in depth and breadth. None of the readers commented on the discussion of one general intelligence, but all of them did comment on different parts of the section concerning multiple intelligences.

In response to the comments put forth by Dammann and Jang, I feel that the suggestions that they offer would add more detail and provide a more expansive view of other theories of multiple intelligences, but that was not my objective in writing this paper. I attempted to discuss, and not necessarily evaluate, the two opposing major schools of thought, the camp of one general intelligence and the camp of multiple intelligences. In the discussion of these two different views on intelligence, I tried to provide an objective view of the two different camps, and not obscure the reader's perception of either theory with my own judgments. Consequently, I did my best to spend an equal amount of time explaining both of the theories.

Unfortunately, there are inherently quite a few more different theories on

multiple intelligence, compared to the number of theories on one general intelligence. In my detailed explanation of one general intelligence, there is in that camp widespread agreement on many things. On the other hand, there are several different theories of multiple intelligences, and all psychologists do not completely agree. As a result, I was forced to choose those theories of multiple intelligences that I felt would best represent that camp. In her commentary, " Intelligence: Two Major Schools of Thought," Dammann cites Gardner's seven different forms of intelligence and Thurstone's method of factor analysis compared to Spearman's method as areas that could use more attention to detail. I attempted to provide an overview of Gardner's theory, so I stated the biological evidence to support his theory and the different forms of intelligences that he believed exist. I did not go into further detail regarding Thurstone's use of factor analysis, namely that in doing his research, Thurstone rotated the different factors to arrive at thirteen factors instead of Spearman's one factor. Jang states in his peer commentary that there is a need " to give more attention to diverse approaches to intelligence." This would give a better understanding of the nature of intelligence. I concede that a further discussion would give my article on the theories of intelligence a more comprehensive view of the theories that exist today. The two approaches that Jang mentions that I excluded from my article are the developmental and biological approaches to intelligence. As I stated before, I did not want my article to overflow with the many different perspectives on multiple intelligences while the theory of one general intelligence went by the wayside. The reason that I did not include a discussion of the developmental approaches to intelligence in my

article is that what Jang discusses is not necessarily a theory of intelligence. It is closer to a method to test intelligence, or a psychometric evaluation of a person. It is similar to Binet and his tests and theories. This is not within the scope of my paper. The biological approach that Jang mentions in his commentary is very similar to the one general intelligence school of thought. It is related to the neural processing speed and the arguments and premises that come with that theory of intelligence. All of the criticisms from each of the peer commentators were well accepted. I admittedly did not include many of the different theories of multiple intelligences that exist today, but I did not do so for a reason. There is equal merit to both schools of thought, and I did not want one or the other to dominate an article that was intended to represent both equally.

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