An Introduction to Multiple Intelligences

Peter Garik and Tom Hunt

A Brief History of Intelligence Theories

Before discussing theories on intelligence, it is important to first define the concept. Definitions range from the concise "the intellectual ability for solving problems" to the detailed:

> Intelligence is a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience. It is not merely book learning, a narrow academic skill, or test taking smarts. Rather it reflects a broader and deeper capability for comprehending our surroundings – "catching on," "making sense" of things, or "figuring out" what to do. (Gottfredson, 1997)

Initial theories on intelligence considered intelligence a single process—e.g., *g* (Spearman, 1904). Thorndike later defined intelligence in three parts: abstract, mechanical, and social (Thorndike, 1920). Other theories have varied from seven (Thurstone, 1938) to 150 categories (Guilford, 1967) of intellectual abilities.

Regardless of the number of processes and/or categories, intelligence has been partitioned into two major types: *fluid* and *crystallized* (Horn, & Cattell, 1966). Fluid intelligence are innate abilities (i.e. independent from education and/or experience) for learning and adaptation, and crystallized intelligence consists of abilities and/or knowledge that are acquired from experience.

The theory of multiple intelligences (MI) "posits that individuals possess eight or more relatively autonomous intelligences" (Gardner, 1983; Davis, Christodoulou, Seider, & Gardner, 2011). The intelligences that have been identified to date are linguistic, logical-mathematical, spatial[1], musical, bodily-kinesthetic, interpersonal, intrapersonal, and naturalistic. Whether or not Gardner's MI theory is the final step in a long line of intelligence theories, remains to be seen.

Recent advances in electronics and computing have allowed researchers to better identify the biological basis of intelligence. This emerging field, called *neuro-ingelligence*, uses neuroimaging techniques[2] to determine regions of the brain associated with processing specific information (e.g., verbal, mathematical, etc.), and the efficiency of the processing. Current work includes studying the development of these regions, and the influence of genetic, biological, and environmental factors (Haier, 2011).

---

1. Also called visio-spatial
2. Functional MRI (fMRI), near infrared spectroscopy, electroencephalogram (EEG), etc.

The Multiple Intelligences[3]

Gardner's pluralistic theory of inteligence is based on evolutionary biology, neuroscience, psychometrics, and psychological studies of prodigies and savants. This research led to the identification of seven intelligences (Gardner, 1983), and the later addition of naturalistic (Gardner, 1999). The criteria used for identifying an intelligence are that the intelligence should:

…be seen in relative isolation in prodigies, savants, stroke victims, or other exceptional populations. (e.g., certain individuals should demonstrate particularly high or low levels of a particular capacity in contrast to other capacities).

…have a distinct neural representation. (e.g., the neural structure and functioning should be distinguishable from that of other major human faculties).

…have a distinct developmental trajectory. (e.g., different intelligences should develop at different rates and along paths which are distinctive).

…have some basis in evolutionary biology. (e.g., an intelligence ought to have a previous instantiation in primate or other species, and have putative survival value).

…be susceptible to capture in symbol systems, of the sort used in formal or informal education.

…be supported by evidence from psychometric tests of intelligence.

…be distinguishable from other intelligences through experimental psychological tasks.

…demonstrate a core, information-processing system. (e.g., there should be indentifiable mental processes that handle information related to each intelligence).

Table 1. Multiple intelligence definitions

Intelligence	Definition
Linguistic	An ability to analyze information and create products involving oral and written language such as speeches, books, and memos.
Logical-Mathematical	An ability to develop equations and proofs, make calculations, and solve abstract problems.
Spatial	An ability to recognize and manipulate large-scale and fine-grained spatial images.
Musical	An ability to produce, remember, and make meaning of different patterns of sound.
Bodily-Kinesthetic	An ability to use one's own body to crate products or solve problems.
Interpersonal	An ability to recognize and understand other people's moods. desires, motivations, and intentions.

3. This section is condensed from Davis, Christodoulou, Seider, & Gardner, 2011, except where explicitly cited.

Table 1. Multiple intelligence definitions

Intelligence	Definition
Intrapersonal	An ability to recognize and understand one's own moods, desires, motivations, and intentions.
Naturalistic	An ability to identify and distinguish among different types of plants, animals, and weather formations that are found in the natural world.

Each of the following sections provides more detail on each MI. As you are reading the sections, try to distinguish unique and common characteristics for each intelligence. For example, if we were discussing human senses, we could state that touch and hearing are similar because hearing is actually sensing the cilial movement in response to a specific frequency range. You should also try to come up with examples of how you and others use the MI and the interaction with the other intelligences. For example, try to imagine which MIs a deaf person uses when signing. Finally, try to think of careers or people who use the MI well.

LINGUISTIC

The linguistic intelligence is the primary means of communication for humans. In current society, this includes utilizing both the written and spoken word. This intelligence can potentially be subdivided into interpretation and generation. The choice, order and inflection of words can drastically change the meaning. Do a web search for "funny headlines" to find interesting examples of "failures." Individuals with highly developed linguistic abilities are able to master more than one language.

LOGICAL-MATHEMATICAL

The logical-mathematical intelligence is used to process data, identify patterns within the data, and determine the events causing and resulting from the data. The use of this ability can range from basic mathematics (e.g., multiplication, algebra, etc.) and logic (e.g., "If…then") to complex mathematics (e.g., partial differential equations with boundary values) and logic (e.g., trying to synchronize traffic lights for a large city). The data can be abstract or numerical.

SPATIAL

The spatial intelligence is used to interpret dimensions of physical objects, the relationship(s) of the dimensions, and potential interactions with other objects. This skill can also be used in creating physical objects that interact with other objects.

MUSICAL

The musical intelligence is used to communicate using sequences of tempos, frequencies, and/or amplitudes of sounds using voice(s) and or instrument(s). This intelligence is used both for interpreting and creating music.

BODILY-KINESTHETIC

The bodily-kinesthetic intelligence involves precise control the body. This can range from the whole body, as in gymnastics or dance, to the fine hand-eye coordination required to (e.g.) carve wood.

INTERPERSONAL

The interpersonal intelligence is an individual's ability to discern others' intents, moods, motivations, etc. using inferred or sublet indications (i.e. not by direct verbal statement from another person).

INTRAPERSONAL

The intrapersonal intelligence is an individual's understanding of his or her own abilities, capacities, feelings, etc., and the use of this understanding when undertaking new tasks (e.g., self-motivation).

NATURALISTIC

The naturalistic intelligence is used to identify and organize naturally occurring patterns. These patterns can consist of fauna and flora, weather and seasons, and man-made objects.

Using MI in Teaching and Learning

Unfortunately there is no cookbook of recipes containing the proportions of each MI to apply to a specific topic. The most efficient method is to pay attention to your students' questions and statements, and analyze them to determine which MI(s) form the basis of the students' positions (i.e. use your interpersonal intelligence). Start by becoming familiar with the MIs, the characteristics associated with each MI. Next, use your intrapersonal intelligence to determine how you use each MI to analyze the topic you will be teaching.

The examples demonstrate using one MI to enhance the learning of subjects normally associated with one of the other MIs.

THE SOLAR SYSTEM

Whereas the student can experience the dynamic effects of the solar system, it is impossible for the student to obtain a physical perspective that allows for observing the effects orientation, position, and time have on seasons and eclipses. Although an animation can be used to demonstrate these phenomena, a hands-on approach using proportionally scaled objects may be more appropriate.

Using styrofoam balls to represent the Sun, Moon, and Earth, and a teriyaki stick for the Earth's axis students are tasked to create appropriate models. The students work in groups to decide how to demonstrate relative positions of the Sun, Moon, and Earth for the different lunar phases, seasons, eclipses, and tides. They also draw some examples. To resolve issues, they physically stand up and revolve around the Earth around the Sun while maintaining the Earth's axis at a constant angle to the plane of the ecliptic. A recent class asked me to play *Turn, Turn, Turn* by the Byrds (in past years it was Vivaldi's *Seasons*, but what the hey).

In terms of MI, we use spatial intelligence, bodily-kinesthetic intelligence, interpersonal intelligence, logical-mathematical intelligence, and a touch of musical intelligence to discuss the dance of the Earth-Sun-Moon system. Throughout, there were students who used spatial intelligence to mentally picture the dynamics (e.g., what happens to the lunar nodes as the Earth revolves around the Sun), and others who needed to think aloud (linguistic intelligence). Still others built their understanding through discussion (interpersonal intelligence).

ATOMIC BONDING

Moving from the cosmic to the microscopic scale, imagine that you are teaching a lesson on atomic bonding. You have covered all of the aspects of bonding (periodic table, forces, electron sharing, activation energy, etc.), but some students still do not seem to grasp the concept. From the MI perspective, you have covered spatial aspect of bonding (hybridization, VESPER), logical-mathematical (electronegativity, enthalpy), linguistic (implicit with your discourse and the students' reading), naturalistic (flame tests), intrapersonal (students' wondering why they do not understand the concept), interpersonal (students feeling each others' pain), and you may have even broken out your guitar and sung *The Elements* (Lehrer, 1959) to your students.

When tutoring students having this difficulty, body-kinesthetic examples often help students to learn the concepts of bonding. The exercise is not simply shaking a test tube filled with chemicals, but is an actual body-kinesthetic exercise that allows the students to feel the effects of structure and position on bonding.

The body-kinesthetic exercise to demonstrate bonding uses spherical magnets[4] to demonstrate how different arrangements of the same magnets require different forces to assemble and disas-

semble depending on the structure. For example, the structure in Figure 1a requires less energy to assemble or disassemble when compared with the structure in Figure 1b.

Figure 1. Magnet orientation: cubic and face-centered orthorhombic.

(a) Cubic (b) Face-centered orthorhombic

Orthogonal view of schematic representation of magnetic pole orientation.

This exercise works primarily by using the body-kinesthetic intelligence to reinforce, or validate, the logical-mathematical reasoning. When creating either of the structures shown in Figure 1, the forces required to start the initial rows of spheres is distinguishable. Similarly, the forces required to deform either structure are also distinguishable. There is also a noticeable difference in the sound of the spheres clicking into place. On a lesser scale, the visio-spatial intelligence is also reinforced with this exercise by providing visible representations of the otherwise invisible atoms.

The spherical magnets can also be used to demonstrate other properties of bonding. Using spheres with different diameters to represent different atoms is one example. It is important to keep in mind that the static nature of the magnetic poles does not allow for the same configurations possible with actual atoms.

References

Buros Institute of Mental Measurements (2012), Test Reviews, http://buros.unl.edu/buros/jsp/search.jsp.

Davis, K., Christodoulou, J., Seider, S., & Gardner, H. (2011). The theory of multiple intelligences. In Sternberg, R. J.; Kaufman, S. B. (Eds.), The Cambridge handbook of intelligence (pp. 485–503). New York, NY: Cambridge University Press.

Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books New editions 1993, 2004.

Gardner, H. (1999). *The disciplined mind: What all students should understand*. NewYork, NY: Simon & Schuster.

Gottfredson, L. S. (1997). Mainstream science on intelligence: An editorial with 52 signatories, history, and bibliography. *Intelligence*, *24*, 13–23.

4. Small spherical neodymium magnets are available in sets as a game called buckyballs or neocube.

Guilford, J. P. (1967). *The nature of human intelligence*. New York, NY: McGraw-Hill.
Haier, R. J. (2011). Biological basis of intelligence. In Sternberg, R. J.; Kaufman, S. B. (Eds.), *The Cambridge handbook of intelligence* (pp. 351–368). New York, NY: Cambridge University Press.
Horn, J. L., & Cattell, R. B, (1966). Refinement and test of the theory of fluid and crystallized general intelligences. *Journal of Educational Psychology*, *57*, 253–270.
Lehrer, T. (1959). *The Elements*. Retrieved from http://www.archive.org/details/elements_0
Spearman, C. (1904) General intelligence, objectively determined and measured. *American Journal of Psychology*. *15*, 204–293.
Thorndike, E. (1920). A constant error in psychological ratings. *Journal of Applied Psychology*, *4*, 25–29.
Thurstone, L. (1938) *Primary mental abilities*. Chicago, IL: University of Chicago Press.

Appendix A: Testing Intelligence

There is no shortage of tests available for measuring intelligence. As of late January 2012, there are 244 tests listed in the "Intelligence and General Aptitude" category (Buros Institute, 2012). Of these tests, 31 have the word "intelligence" in the title, 29 have "verbal" or "word"; 3 have "logic". Tests from other categories are shown in Table 2.

Table 2. Intelligence and other assessments

		Multiple Intelligence							
Assessment Category	**Total**	**Ling.**	**L-M**	**V-S**	**Mus.**	**B-K**	**Inter**	**Intra**	**Nat.**
Intelligence & General Aptitude	244	29	3	9	0	0	0	0	0
Achievement	111								
Mathematics	91		91						
Science	46		46						
Miscellaneous	331								
English and Language	222	222							
Reading	167	167							
Foreign Languages	53	53							
Fine Arts	20				14				
Personality	782						11	40	
Total	2,067	471	140	9	14		11	40	

A search of the Buros database for the phrase "multiple intelligence" yielded two instruments. By comparison, a search for academic papers for the same phrase yielded 232 articles in peer-reviewed journals. Searching the books category at Amazon yielded 6,824 results although the number of duplicate entries is not easily determinable—i.e. a single book may exist in multiple

formats (hardback, paperback, electronic), be available from multiple sellers, and be translated into multiple languages. A similar search of google books yields “about” 11,000 results.

Despite the academic and popular interest in multiple intelligences, there appears to be little if any interest in assessing MI as a whole. It is important to note that although some instruments test more than one intelligence, these tests do not cover all of the MIs. For example, the Weschler Adult Intelligence Scale (WAIS) and the Weschler Intelligence Scale for Children (WISC) instruments test verbal, reasoning (logical), and visio-spatial intelligences, but do not test the other intelligences.

Appendix B: Multiple Intelligence Exercises

The following sections contain exercises to enhance your understanding of multiple intelligence theory.

COMMON TRAITS ACROSS MULTIPLE INTELLIGENCES

To fill in Table 3, you first identify traits present in a multiple intelligence, and then the relative strength of the trait (on a 0 to 5 scale) for each intelligence. Be prepared to discuss the commonality and differences for each intelligence.

Table 3. Common traits of MIs

	Multiple Intelligence							
Trait	Ling.	L-M	VS	Mus.	B-K	Inter	Intra	Nat.

IDENTIFY THE MULTIPLE INTELLIGENCE(S)

Table 4 contains a list famous people. Choose which MIs you think they have (on a scale of 0 to 5) and explain your reasoning.

Table 4. MIs of famous people

	Multiple Intelligence							
Person	**Ling.**	**L-M**	**VS**	**Mus.**	**B-K**	**Inter**	**Intra**	**Nat.**
Albert Einstein								
Noam Chomsky								
Pablo Picasso								
Mikhail Baryshnikov								
Thomas Hunt Morgan								
Jane Goodall								
Sylvia Earle								
Helen Keller								
Ludwig van Beethoven								
Carl Jung								
Jean Piaget								
R. D. Lang								