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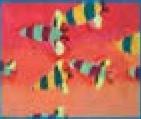
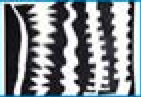
## Expanding Our Vision for the Arts in Education





Contributors

# *Expanding Our "Frames" of Mind for Education and the Arts*

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*In this article, Jennifer Groff explores the role of the arts in education through the lens of current research in cognitive neuroscience and the impact of technology in today's digital world. She explains that although arts education has largely used multiple intelligences theory to substantiate its presence in classrooms and schools, this relationship has ultimately hindered the field of arts education's understanding of the relationship between the arts, human development, and learning. Emerging research on the brain's cognitive processing systems has led Groff to put forth a new theory of mind,* whole-mindedness. *Here she presents the evidence and construct for this frame of mind, how it sits in relation to multiple intelligences theory, and how it might redefine the justification for arts education in schools, particularly in our digitally and visually rich world.*

Recently I came across a user question on eHow.com that asked, "Why do we teach the arts in education?" The bluntness of the question was striking, and it intrigued me that (1) someone would pose this question so broadly and frankly, as though there was no nuance behind it, whatever the answer may be, and (2) that eHow.com—a Web site generally devoted to providing basic information on general topics—would devote an entire page to answering it. In reality, "why teach the arts in education?" is a very good question, and one that I believe the arts education field can and should be asking itself. We live in a time when many educators, researchers, policy makers, and their stakeholders are likewise asking, "What is the role of education?" It is imperative that the arts education community answer this question as well.

Arts education professionals have a long and rich history of seeking research and evidence that best supports both how and why the arts can be understood as critical to education, learning, and human development. One of the central pillars of this effort is the theory of multiple intelligences (Roper & Davis,

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2000), which has had a complicated history with arts education. While the theory of multiple intelligences has been tied to substantiating the use of the arts in education, it has also faced more than its share of challenges. To the detriment of understanding the relationship between arts and human development and learning, the use of the theory has potentially left the field locked in a singular frame of mind that makes further innovation difficult.

This year marks the thirtieth anniversary of Howard Gardner's (1983) *Frames of Mind* and the introduction of the theory of multiple intelligences (MI theory). In the past three decades, the world has changed in ways we could never have imagined, and our digital minds have evolved along with an explosion of research and advancements in cognitive neuroscience. Since the origination of MI theory, cognitive neuroscience research, an emerging area of research on cognitive processing systems that seeks to elucidate the biological underpinnings of mental processes, has given us a much clearer picture of how our mind-brains process information and, more importantly, how that processing of information manifests itself in each of us. In 2010, building on new findings from the field of cognitive neuroscience, I postulated the theory of *whole-mindedness* (Groff, 2010). Developing this theory further, I explore how the cognitive constructs elucidated in recent research in cognitive neuroscience may exist in relation to the intelligences and how this new "frame of mind" might redefine education, especially as it concerns the arts.

The framework of whole-mindedness and the positions it suggests come from a larger, systems perspective of education and learning. As a cognitive sciences generalist, I design innovative learning environments that draw on the research of the learning sciences to create the foundations for physical environments as well as the learning technologies used within them. Though I have basic training in the visual arts and regularly draw and paint for my own pleasure, I neither identify myself as a professional artist nor as an arts educator. The connections I make between whole-mindedness and arts education are drawn from my studies in cognitive neuroscience and design, interpreted for general learning environments, and discussed herein with distinct implications that may inform arts teaching and learning.

In this theoretical article, I discuss the history and implications of MI theory as it is tied to arts education in order to situate the reader within established thought about the relationship of the arts in education to human development. I then provide a brief introduction to whole-mindedness and the understanding of education that this framing puts forth. Finally, I explore how such a framing of the mind positions the arts as integral to human development and education.

## The Theory of Multiple Intelligences: Framing and Foible-ing the Arts in Education

Thirty years ago, Gardner (1983) introduced the world to a theory that asked us to rethink how we see intelligence, the mind, and, most powerfully, the individual. In essence, MI theory proposes that human intelligence is not just a single general intelligence ("g") reflected by an intelligence quotient but that human intelligence encompasses a wider, more universal set of competences (Gardner, 1998). Using various research constructs and parameters, Gardner has derived eight distinct intelligences: spatial, linguistic, logical-mathematical, bodily-kinesthetic, musical, interpersonal, intrapersonal, and naturalistic.[1]

While many arts educators—and, certainly, educators more broadly—have celebrated the introduction of Gardner's theory, it has also been a target of analysis, scrutiny, and refutation by numerous researchers in psychology, cognitive psychology, and other domains. And despite its popularity among educators (particularly arts educators), the theory's application in classroom practice has been a topic of debate.

For many educators, MI theory has articulated what they've known all along—that students demonstrate abilities and talents in areas that go beyond just reading and math. For these educators, MI theory has provided the foundation to support multimodal learning—learning that takes place through more than one modality, such as image and text, often presented in multimedia environments (Metiri Group, 2008)—and the diversity of their students, to more effectively reach them, engage them, and employ their talents in a variety of ways. And it has also served as a means to directly substantiate the arts. With defined capacities like spatial intelligence, bodily-kinesthetic intelligence, interpersonal intelligence, and musical intelligence, there is a direct correlation of intelligence to visual art, theater, dance, and music—and an affirmation of the need to educate young people in these domains. In this way, advocates for the arts in education have used MI theory as evidence that in order to fully reach all students, the opportunities to engage in all of the intelligences must be provided. As a result, this theory has been relied on to make a case for the value of the arts in education for those who do not recognize the intrinsic and societal necessity of arts teaching and learning.

Despite the initial excitement and opportunity garnered by MI theory, over time this theoretical framework has struggled to bear this burden. For more than twenty years, Gardner (1999a, 1999b, 1993) and others have spoken out about the misinterpretation and misapplication of MI theory in educational settings—such as trying to teach all concepts or subjects using all intelligences or assuming it is enough to just engage skills of a certain intelligence no matter how one uses it. MI theory itself has faced an ongoing barrage of scrutiny and analysis from the academy as to its validity and lack of empirical evidence (Schaler, 2006; White, 2005; Willingham, 2004). This misapplication has tarnished the theory's image and has, albeit unintentionally, potentially stunted the growth of the field of arts education.[2]

Numerous times Gardner has commented on how he has had to discuss and debunk ways in which MI theory may or not may not be applied to education. In fact, the myths and missteps of using the theory for educational practice may be as well known as the contents of the theory itself (Schaler, 2006).

Examples that Gardner (1998, 1999a) has recounted range from singing the times tables or playing Bach while doing geometry to comingling MI theory in a school that used sensory-based learning styles and attempted to align each particular intelligence with a racial group. Additional misapplications include what popular arts education speaker Eric Booth (2009) has dubbed "the dance of the fractions," wherein dance and song are applied to any classroom topic. Of these various foibles, there are two that have significantly impaired the ability of MI theory to effectively support the arts.

1. *Confusing the means versus the ends.* An intelligence is not the same as a domain or discipline. The way MI theory is framed, it is too often misinterpreted as positing that "if a person is strong in an area, they therefore exhibit that intelligence" (Gardner, 1999a, p. 83). This is similar to the thinking that "bodily-kinesthetic intelligence exists, therefore we must teach gym and dance." Gardner (1999a) addresses this misconception in his book *Intelligences Reframed*, explaining that a domain is any cultural activity in which degrees of expertise can be identified and nurtured. For example, the domain of musical performance involves bodily-kinesthetic, personal, and musical intelligences. This is a critical distinction between an intelligence *associated with* a domain and an intelligence *as* a domain.
2. *Labeling kids and putting them into buckets.* Not long after MI theory began gaining traction in schools, a commonly heard phrase was "Johnny is a visual learner" or "Sarah is very active and a bodily-kinesthetic learner." The intelligences were conflated with learning styles, both of which were, and still are, confused and misapplied. Gardner (1999b), too, has acknowledged this frequent misuse. In reality, such a misapplication of MI theory has often led to putting kids in "buckets" and labeling them as being a certain way, which not only falsely categorizes young people but also prevents their full development and expression across the variety of their true intelligences.

Since the 1980s, MI theory has attempted to use empirical evidence to validate and explain the various talents observed in individuals. It was quickly viewed as a platform for empowering the arts in education and, more broadly, for opening the field of education to embody and support the diversity of individuals. But it has ultimately left us on shaky ground. Given this, and the fact that the world has changed dramatically since MI theory was originated, I propose that it is now time to update our frames of mind for arts education and the twenty-first-century learner.

## The Cognitive Revolution and Cognitive Processing Systems

Beginning in the 1950s, the cognitive revolution ushered in an exciting new era in our understanding of the mind. Although the cognitive revolution was well under way by the time MI theory was presented and later adopted by arts education advocates, the field of cognitive neuroscience was just emerging in the 1980s. MI theory was an incredible leap forward in the field; it synthesized various bodies of research, and, despite criticism, Gardner's conceptual insights have been lauded in many ways (Posner, 2004; Roper & Davis, 2000). However, MI theory was also conceived during a time when the theory of modularity of the mind was still popular and the cognitive revolution was just hitting its stride. In the time since, numerous critical advances have emerged that have had tremendous impact on the field. Among such advances is the advent of more sophisticated imaging technologies and data capture tools (e.g., fMRI, MEG, EEG, etc.). Technologies like these have had a major hand in expanding our view of the mind from a modular (where discrete modules within the mind perform specific functions) to a networked view, where no one cognitive function is localized to any single part of the brain but, rather, is distributed across many regions of the brain (Pinker, 1999). As such, the brain activity of a given task, as captured by fMRI, generally presents similarly but not identically among individuals.

At the same time, a dramatic field change came when the concept of neuroplasticity demonstrated that the mind is not fixed after adolescence, as previously believed, but plastic even into late adulthood (Pascual-Leone, Amedi, Fregni, & Merabet, 2005). This shift was profound: the brain could no longer be seen as fixed or static but as dynamic and responsive to experiences across a much greater portion of one's lifetime.

This era of profound change in the field coincided with an expanding interest in how images, rather than simply language, are processed by our mind-brains. For the longest time, the cognitive sciences had focused on development through language (Kosslyn, 1996). Indeed, language has long been our primary societal mode of information processing. We *talk* to one another, we *read* written text, we *write* a message back. However, around the 1960s and early 1970s, prominent researchers started to be more interested in understanding nonlanguage cognitive processing systems (Kosslyn, 1996; Piaget & Inhelder, 1971). Initial work by Piaget and Inhelder (1971) and Paivio (1986) proposed that we do in fact process information through two systems: the *verbal* (language, including all spoken and written text) and the *nonverbal* (objects and events), also referred to as the *imaginal* or the *visual* processing system. This initial frame of mind was called dual coding theory. Since its initial introduction, cognitive researchers have been keen to understand it more deeply, and what they have found has had significant implications for how we understand the mind.

The cognitive revolution has, in many ways, offered great potential for expanding our understanding of the arts and arts learning. In particular, the advancements in sophisticated imaging and data-capturing tools that have helped us to define and more clearly see basic structures of the brain have increased communication between the fields of psychology, cognitive psychology, and neuroscience to create the interdisciplinary domain of cognitive neuroscience.

### *A Journey in Cognitive Neuroscience: How We Process Information*

Every second, individuals encounter incredible amounts of information—spoken language, visual stimuli, tactile touch. But how does one use this information to make sense of the world?

Notable research by the Group Brain Project at Harvard University and the Imagery Lab at Harvard Medical School and Massachusetts General Hospital has demonstrated that the mind-brain can be thought of as comprising three interacting processing systems, because the nonverbal object and spatial systems appear to utilize the same underlying cognitive structures but manifest themselves in different ways (see figure 1) (Blazhenkova & Kozhevnikov, 2008; Chabris et al., 2006). The *visual-object* pathway processes information about the visual pictorial appearances of detailed images of individual objects and scenes in terms of their shape, color, texture, and so on. The *visual-spatial* pathway has to do with spatial relations and transformations and how individuals deal with materials presented in space—cognitive tasks associated with physics, mechanical, and engineering problems. Whereas text-based activities—including many educational assignments and assessments—activate students' verbal processing systems, engaging with painting, graphic design, or photography-based learning experiences, for example, promotes processing information through the visual-object pathway of their cognitive processing systems. In much the same way, engaging with visually dynamic movement such as filmmaking, video-media production and consumption, and theater arts interacts with an individual's visual-spatial pathway. Learning experiences in any of these three areas provide young people with the opportunity to process information through varying means and therefore the potential to develop these three separate but integrated pathways to cognitive processing.

Initial research suggests that each individual demonstrates varying ability across all three cognitive processing systems. While an individual may possess high or low ability in all three, most individuals demonstrate high ability in only one of the nonverbal processing systems, and that preference appears to manifest itself early, by elementary age (Kozhevnikov, Kosslyn, & Shephard, 2005). Another study (Blazhenkova & Kozhevnikov, 2008) found that a notable proportion of its participants (11 percent) scored above average on all three scales, while approximately 10 percent scored below average on all three; according to the authors, this indicates that an individual does indeed score differently on each scale and therefore should be both instructed and assessed independently on each. As demonstrated above, arts learning experiences in a variety of mediums complete the spectrum of such opportunities needed for instruction and assessment.

FIGURE 1 *Model of cognitive processing systems*

| *Cognitive Processing Systems* | | |
|---|---|---|
| *Nonverbal* | | *Verbal* |
| Object-visual (static images) | Spatial-visual (moving/manipulating images) | Verbal (language-based) |

*Source:* Groff (2010).

This need for creating a fuller array of opportunities is reinforced by how many people identify as dominant in nonverbal mechanisms. In an Internet survey of more than 3,800 individuals,[3] the Group Brain Project at Harvard found that over 80 percent of participants identified as some form of nonverbalizers, with roughly half identified as object visualizers (Chabris et al., 2006). This research suggests that there is a significant portion of the population whose dominant cognitive processing system is *not* language based and therefore is in need of alternate instructional and assessment opportunities—such as those that arts learning experiences provide—in order to reach their full cognitive potential. Similar follow-up studies found two other curious outcomes: (1) people with significant experience playing video games scored higher on a spatial visualization scale, and those with experience in representational art scored more strongly on object visualization assessments; and (2) teams composed of individuals with differing cognitive styles, with each team member assigned to roles that align with their cognitive styles, outperformed homogeneous teams (i.e., teams of two spatial visualizers or two object visualizers) (Chabris et al., 2006).

Numerous studies performed by the Imagery Lab at Harvard Medical School and Massachusetts General Hospital have also reinforced our understanding of these three distinct processing systems and how they appear to manifest themselves in individuals. Research has found that many adults state a preference for one system over another, and this generally aligns with their dominant performance on the survey instruments (Blazhenkova & Kozhevnikov, 2008). Ability in each of the processing systems has also shown increased performance in various domains. For example, the research of Kozhevnikov and Thornton (2006) shows that one's "spatial visualization ability significantly influences effectiveness of physics instruction but that not all physics problems require the significant use of visual/spatial processing" (p. 125), and, as a result, students with low spatial ability might experience considerable more difficulty in learning experiences that require them to interpret graphs or learn from dynamic animations (Isaak & Just, 1995). This argument demonstrates how complex tasks, and the skills necessary to perform them, require the ability and facility to engage with many different types of content and materials.

Though we can make no conclusive generalizations concerning the transfer of skills and abilities, the argument can be made that individuals who develop their visual-spatial processing systems in one domain—such as multimedia arts, theater, or dance instruction—may be developing strengths in cognitive processing systems that are central to engaging with complex tasks in other domains, such as physics, that likewise require acute visual-spatial processing.

These three mechanisms define what we currently know to be cognitive processing systems of the brain. They are the channels and mechanisms through which we process, manipulate, and access the information encountered through our experiences. Of course, in everyday problem solving and learning, one of these systems never works wholly independently; both the verbal and nonverbal systems complement one another, and both are critical to comprehension (Kozhevnikov, 2007).

Although the cognitive processing systems work together, research shows that individuals demonstrate a preference for and strength in at least one of them. Since one's cognitive preferences may manifest themselves as early as elementary age, researchers suspect that we are genetically predisposed toward one of the visual processing systems, which may begin to develop at the expense of the other. However, this hypothesis also suggests that one may have a tendency to develop in a given style but that certain experiences reinforce or diminish the development of each system: "early in life, this preferential attention might favor the development of spatial-processing abilities through more consistent use of spatial pathways, while restricting the development of object-processing abilities due to long-term underuse of the object-processing pathways" (Kozhevnikov, Blazhenkova, & Becker, 2010, p. 34).

As much as current research indicates the need to change the way we think about how the mind-brain processes information, practical concerns should force us to reconsider the type of information our brains have to process. In the last sixty years, we have undergone a visual revolution. Prior to television, we lived in a mostly verbal world. Language—be it printed text or the spoken word—was the central mechanism for producing and consuming information; but with the advent of television, all that began to change (Schlain, 1999). Suddenly captured moving images were mainstreamed. Of course, television was entrenched in American society by the time Gardner proposed MI theory. However, the digital revolution that, again, would change everything was yet to come.

Today, nonverbal communication is a dominant construct in our world. From online multimedia and video content to video games and mobile technologies, our nonverbal processing systems are hard at work in ways we never could have imagined just a few decades ago. And all of this nonverbal activity in our lives suggests great potential for the future of arts education as well as powerful cognitive implications (Restak, 2001) for learners writ large. In 2008, the Pew Internet and American Life Project found that more than 95 percent of teenagers play video games and that 35–65 percent play every day (female to male, respectively). More than six years later, we need newer data, but one can imagine how those numbers have changed now that those children who grew up on digital media are teenagers. These individuals are plugged in to digital media out of school, which creates a great disconnect (not just from an interest perspective but on a cognitive level as well) for many students while they are in school, an institution that has, in general, reacted with less enthusiasm to the digital world. Moreover, as a result of increased new media arts education instruction and DIY digital culture, we are reaching a period where it is just as easy for young people to produce that multimodal, multimedia content as consume it. In other words, youth do not just consume visual communication but produce—or "write"—with it, too. Whether through formal media arts instruction or on one's own, it has never been easier to create visual constructs, diagrams, videos, and animations—a common practice witnessed in many elementary schools today.

Our interaction with digital and visual media has exponentially increased within the last generation, and we must consider the very real and probable likelihood that we are developing a generation of visually dominant cognitive processors but immersing them and assessing them in a verbally dominant environment. More than 80 percent of participants in the Group Brain Project study were identified as dominant in visual processors, and with a number of that magnitude one may also consider that we have entered a time in which we are enhancing and increasing our nonverbal cognitive processing systems while still being mostly instructed and assessed in the nondominant verbal style—and all the while reducing access to arts education in public schools (Tamer, 2009).

Considering the potential to bolster one's nonverbal processing systems that arts instruction uniquely offers, educators and policy makers alike need to ask themselves: How are we helping learners to develop and employ their dominant and less dominant cognitive processing systems? Are we assessing students in ways that allow them to use their dominant cognitive processing systems? Are we providing young people with the opportunities and experiences to develop each? Such questions shed light on a condition McKim (1972) calls "visual atrophy," where the nonverbal processing system is left behind and visual cognition is underdeveloped. The research on brain plasticity reinforces this idea—that connections and synapses we use cognitively get reinforced and those we don't get pruned away—as a genuine concern. (Small & Vorgan, 2008). In our commandingly visual and dramatically digitally altered world, the need to foster and support the development of nonverbal processing systems is imperative. As such, schools must be able to support this need in young people. Given the inherently nonverbal nature of arts teaching and learning practices, a variety of domains are implicated as new educational models that must be explored.

## Whole-mindedness: The Theory of Cognitive Processing Systems

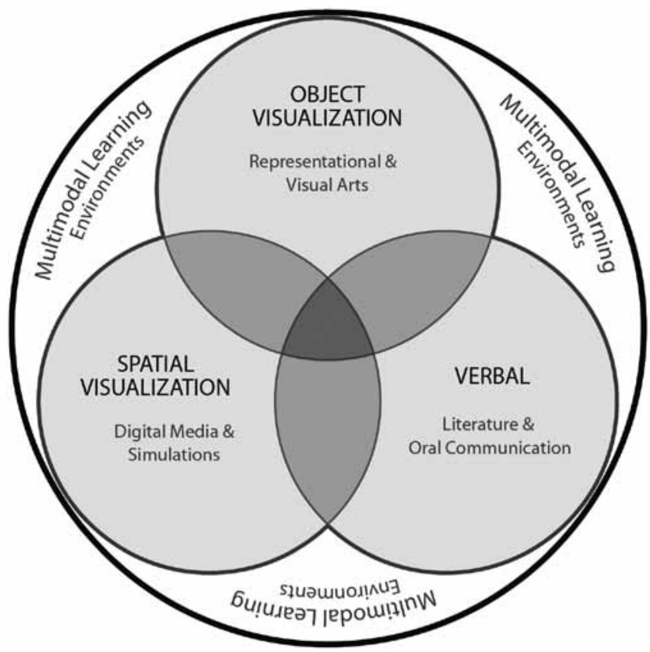
Helping to identify a learner's aptitude in all three cognitive processing systems and developing instructional experiences and opportunities to nurture all of them—including access to arts education—is of critical importance (Drake, 1996). The research cited above creates a new understanding of these central mechanisms of the brain and suggests a new *frame* of the mind, one that portrays each of these processing systems as a critical mechanism for engaging with our rapidly changing digital world. All are used to different extents to process, manipulate, understand, and apply to distinct problems. Each is unique and each is necessary; yet together they afford the potential for powerful and insightful processing and problem solving (see figure 2). This frame has been termed *whole-mindedness*—the robust development, and awareness, of all cognitive processing systems enabling an individual to leverage these diverse capacities to meaningfully engage with and produce materials borne of one or more modalities (Groff, 2010).

In essence, whole-mindedness suggests that each of us possesses these three cognitive processing systems, which will manifest themselves uniquely in each individual, but that robust cognitive development comes from the opportunity to engage with and support the development of each processing system to ultimately be used in synergy. Such opportunities are exactly like those provided by arts education experiences' complex combinations of nonverbal and both visual-object and visual-spatial engaging activities. From the emerging research on cognitive processing systems, the theory of whole-mindedness puts forth several implications for learning environments and education.

1. *Develop strengths.* Learning environments should allow for and support the use and development of one's dominant cognitive processing systems while learning new knowledge.
2. *Develop nonstrengths.* Learning environments should provide exposure and opportunity to develop and support one's less dominant cognitive processing systems from an early age onward.
3. *Scaffold for nonstrengths.* Learning environments should provide pedagogical supports, using technology if appropriate and available, to augment and support learners who are engaged in an activity that requires them to use a nondominant processing system.
4. *Create authentic assessments.* Learning environments should seek to create assessment experiences that allow students to utilize their dominant cognitive processing system.

These implications challenge many of the practices currently used to teach and enable learning in schools. For one, how are we to teach when the vast majority of learners prefer visual over verbal cognitive processing? If we are not aligning students with tasks and then combining them in teams and leveraging their dominant cognitive processing abilities, are we really able to cap-

FIGURE 2 *Framework for whole-mindedness*




*Source:* Groff (2010).

ture their true abilities in a given task or domain? Likewise, if we are not offering learning experiences that leverage all of these cognitive styles, are we underdeveloping all students' cognitive capacities? All of these questions, each legitimate in its own way, point us toward exploring *all* of the modalities that meet these criteria—including arts teaching and learning experiences.

### *Whole-mindedness, Education, and the Arts*

This emerging view of cognitive processing systems creates a much different frame for the arts in education, but foremost it makes a much different substantiation for their critical role in education. As mentioned previously, the Imagery Lab has made significant strides in demonstrating the distinct nature and capacities of the visual-object processing system (Kozhevnikov & Hegarty, 2001). Of course, this runs parallel to a time in history when the arts have been diminished in our schools (Tamer, 2009). Nonetheless, as Blazhenkova and Kozhevnikov's (2010) research suggests, the capacities associated with this cognitive processing system have never been more critical:

> Recently there has been a great increase in the importance of object information and object-abstract representations in various media, including educational media, movies, advertisements and contemporary art. Also contemporary media

> tends to use rapidly presented, emotionally charged visual stimuli that need to be processed holistically and quickly. Thus, in contemporary society . . . developing individuals' visual-object abilities might be critical not only for success in visual arts, but also in a wide range of professions and in everyday performance. (p. 24)

In fact, the most recent research on these three cognitive processing systems is demonstrating how the visual-object capacities are dominant in a large portion of the population (Chabris et al., 2006) and how the visual arts serve not only as a core tenet of an educational environment's ability to meet all learners but how engagement with and facility with this cognitive processing system are critical for meeting task demands in our current world and for the attainment of whole-mindedness. Although this work directly aligns with the visual arts, and while we do not yet understand how these processing systems interplay with other areas in the arts such as dance, theater, and music, there is enough early evidence to suggest that all three processing systems show up and cross over in various disciplines. Take, for example, the considerable number of scientists who are also active artists (Edwards, 2010). While we wait for more research in these areas, the current research demonstrating not only the evidence of object-visual processing but the dominance and majority of visual processors creates an argument for a new presence of and frame for the arts in education.

Simply put, our cognitive processing systems are the foundation for our engagement with the world. Helping learners develop and, more critically, understand how to *use* and *leverage* these processing systems as tools through which to engage with the world is central to healthy, rich, and balanced cognitive development. I am not suggesting that the goal of education—in the arts or otherwise—should be to ensure that each individual ultimately becomes necessarily and distinctly strong in all three processing systems; rather, it is necessary and essential to develop and utilize our dominant cognitive processing systems while having the opportunity to also develop our less dominant one(s). By doing so, we provide learners the opportunity to engage and leverage their strengths and to be aware of how to develop their less dominant capacities. Without such diversity in pedagogy and learning experiences, we risk the visual atrophy described by McKim (1972) and demonstrated by synaptic pruning (Cicchetti & Curtis, 2006).

The discourse and study of multimodal learning supports the whole-mindedness approach, asserting that "all modes are partial. Each contributes to the production of knowledge in distinct ways and therefore no one mode stands alone in the process of making meaning, rather each plays a discrete role in the whole: hence the need to attend to all" (Jewitt, 2008, p. 13). The emerging research on multimodality demonstrates that "significant increases in learning can be accomplished through the informed use of visual and verbal multimodal learning" (Fougnie & Marois, 2006). Connecting this work more strongly with our new developing understanding of the cognitive processing systems of the brain will help us focus on creating media and representational arts-based instructional materials, curricula, and policy directly targeted to the cognitive abilities, strengths, and challenges of each learner.

Multimodal technologies are at least part of the answer, and they appear to help bridge these gaps between one's ability and what is required for the task at hand. For example, digital technologies have shown to help improve spatial visualization abilities regardless of prior experience in domains such as physics. This indicates that through exploring and manipulating meaningful abstract images, as one does in media arts learning environments, we may improve spatial visualization skills (Kozhevnikov & Thornton, 2006) and become better learners and better workers. This type of evidence and commentary from cognitive neuroscientists provides powerful insights on the value of learning environments rich in the arts.

This new frame of mind has demonstrated the modalities through which we all process the world—language (verbal), holistic/static imagery (object-visual), and dynamic/conceptual imagery (spatial-visual). Our understanding of this new frame also demonstrates how various media and experiences affect their development and therefore underscores that we must provide students with a rich array of learning experiences required for robust cognitive development. Such a rich array must include not only language but visual modalities provided through technology and the visual arts in order to most fully develop an individual's maximum, whole-minded potential. Schools must not ignore this understanding but embrace it. Educators certainly elicit the verbal system—teaching learners how to properly enunciate, spell, communicate complex thoughts with words—yet how much school time is spent attending to visual-spatial processing and teaching students how to leverage their capacity in this area of their cognitive processing systems? We are seeing the accrual of real-world examples in the value of developing all three systems.

### *Whole-mindedness and Our Cognitive Processing Systems in Practice*

Examples that support this holistic cognitive development include targeted development of one's capacities and evidence of incidental development through noneducational experiences. For example, since 2004 Harvard Medical School has been offering the course "Training the Eye: The Art of Physical Diagnosis" seeking to improve the examination and diagnosis skills of their doctors-in-training largely by developing their object-spatial processing ability. The curriculum for the course includes training on formal art observation strategies and drawing techniques acquired through weekly visits to the Museum of Fine Arts in Boston. These museum visits are then connected to traditional medical school classroom instruction on various medical diagnostic exams. Evaluators of the course found that, by the end of the semester, students had increased sophistication in their descriptions of artistic and clinical imagery and improved capacity to make accurate observations of art and physical findings (Naghshineh et al., 2008).

This class is leveraging a pedagogy known as VTS (Visual Thinking Strategies) developed by Philip Yenawine (1997), director of education at the New York Museum of Modern Art, and based on Abigail Housen's (1992) aesthetic development theory. This innovative approach to arts education uses the discussion of art as a means for developing critical thinking and visual literacy skills. Together, Yenawine and Housen have found that VTS catalyzes aesthetic development and encourages critical thinking and cognitive abilities in people of all ages and has been shown to transfer to problem solving in other fields, such as reading, writing, mathematics, and, as demonstrated above, medicine. Their findings reinforce the research that has been discussed thus far, explaining that these processing systems work in concert and mutually reinforce one another over time.

At the same time, research is just beginning to show how incidental development of these cognitive processing systems affects performance and supports professional areas of work. Researchers at the New York Beth Israel Medical Center have demonstrated this in their examination of surgeons (specifically laparoscopic surgeons, who make tiny incisions in the body and use video camera scopes displayed on a monitor to complete the surgery) who played video games more than three hours per week and had 40-plus percent fewer errors in surgery when compared to their nonplaying peer surgeons (Rosser, Lynch, Cuddihy, Gentile, & Klonsky, 2007). This statistic represents the powerful influence of the visual and coordination skills honed by video game playing on professional performance.

### *Diversifying Pedagogies*

What all of this emerging research suggests is the need for *diversified pedagogies and learning environments.* Although we're just beginning to understand how learning environments and experiences shape one's cognitive processing systems over the long term, we very clearly see that there are these three mechanisms that process various content and stimuli differently. While some individuals are able to make do in learning environments that lean heavily on one of these mechanisms, others cannot. That is of real concern to those interested in providing an equitable and fair education to all.

Our current educational system is designed to develop one's verbal processing system capacities. Engaging with new technologies such as simulations and digital games—steadily increasing in today's schools—creates opportunities to develop one's visual-spatial processing system. Making the same provision to engage and develop one's visual-object processing system means creating opportunities in the curriculum for learners to meaningfully engage with static imagery in the context of a learning goal, as is the case in traditional visual arts education environments. For example, just as we are taught the basics of literacy before we are expected to read novels or write persuasive essays, so too should we teach the basics of creating imagery by learning how to draw and construct shapes and figures through analyzing and deconstructing imagery.

Some of these basics may take place in elementary art classes, which are often devoid of meaningful curricular content. Instead, however, students could be asked to closely analyze the slight differences in outline and shape of various cell types or to carefully observe the slight changes in the moon silhouette and document these, as illustrated by Duckworth (1986).

When students are given the opportunity and support to engage with the skills that more broadly align with the visual-object system, along with subsequent opportunities to engage and apply these skills in context, two important things happen. First, students with a natural disposition toward a visual-object processing system are able to engage with and leverage their strength, something each of us longs and needs to do from time to time. Second, all students have the opportunity to engage and develop this processing system in parallel with the others, which may help to more fully develop cognitive capacities that are leveraged in other ways later in life.

More evidence is needed on exactly how these three processing systems interplay with both arts teaching and learning and real-world tasks, but initial examples from current research—like the aforementioned impact of one's spatial ability in physics instruction and performance (Kozhevnikov & Thornton, 2006)—provide the motivation to do so. This evidence alone suggests the need for providing learning materials that align with and support visual-object learners through modalities demonstrated by the visual arts. However, this evidence also demonstrates that strategically targeting learning experiences for the modalities can have a tremendous impact (Kozhevnikov, Hegarty, & Mayer, 2002). Kozhevnikov and Thornton (2006) go on to advise that "an important implication of the current study is the finding that it is possible to improve students' performance on spatial visualization tests by presenting them with a variety of meaningful abstract visual images and giving them the possibility to manipulate and explore such images" (p. 127). Arts teaching and learning provides just such experiences.

We are just beginning to uncover pedagogies that help bridge and mitigate individual ability gaps when learning a variety of content. However, this demonstrates the importance of not only providing content and modalities that support the dominant cognitive processing strengths of all learners but opportunities and experiences that help grow less dominant ones so that learners have increased capacities that support learning across the curriculum. It also demonstrates the need for students to become aware of their dominant cognitive styles and to master them, knowing when to leverage one for appropriate problem solving and communication and when to spend time trying to grow and build another. In fact, there is evidence that the directed effort to supplant and integrate information received in disparate modalities and formats—"active integration"—has been shown to improve learning and long-term recall (Brunyé, Taylor, & Rapp, 2008). These insights build on Paivio's (1986) work in dual coding theory and Baddeleys's (1992) working memory model. Research on the use of multimedia approaches to learning (Brunyé et al., 2008) has demonstrated that engaging with multimodal content (both text and image) enables deeper processing because not only are cognitive resources partitioned to both systems (rather than burdening a single system alone), but the individual must actively process and integrate varied information. This, indeed, is whole-mindedness—and this is where education plays the critical role.

It starts by ensuring that all learners have the *opportunity* to engage with their dominant as well as nondominant learning styles. And for learning environments, that means *balance;* it means opportunities to engage with meaningful activities and experiences that leverage the skills and activities associated with each of these processing systems, from reading and writing literature to designing and constructing a targeted image or graphic or creating a multimedia message that communicates the central idea in the most engaging way possible. These are all part of the ecosystem of our cognitive needs. Arts education, science, literature, media—they all play a critical role in the full development of the individual and of our truest, highest selves.

## Reframing Our Minds

The underpinning research, focus, and framework of whole-mindedness offer a new perspective on how we view the mind and the learner, one that contrasts and aligns with MI theory in many interesting ways worth unpacking and exploring, especially considering the implications for education and the arts.

### *MI Theory in Relation to Whole-mindedness*

Although both are frameworks for understanding the mind, neither whole-mindedness nor MI theory refutes or attempts to replace the other. Whole-mindedness focuses on the cognitive processing systems of the brain, which is a lower-level construct than the “intelligences.” In other words, the cognitive processing systems are mechanisms likely employed by the mind—along with other processes, skills, and knowledge—that are ultimately manifested as a specific intelligence. In reality, an individual likely employs all three processing systems to varying degrees as they are completing tasks that use one or more intelligences at the same time.

Gardner’s (1999a) definition of an “intelligence” offers greater clarity as to the distinction: “an ‘intelligence’ is 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 culture” (pp. 33–34). His definition talks about processing information but emphasizes how this is used to create products of value. This integrates content and domains, such as musical intelligence, with the potential underlying cognitive constructs themselves. As a result, MI theory has helped put the emphasis on the content and the discipline rather than the cognitive capacities themselves. This reinforces one of the greatest myths and challenges that Gardner has outlined: too often MI theory has confused the means with the ends, where an intelligence is not the same as a domain or discipline but is too often interpreted as "if a person is strong in an area, they therefore exhibit that intelligence."

This is also the element that has been the greatest target of MI theory's critics, the argument that one could find an intelligence in almost anything, even "humor" or "memory intelligence" (Willingham, 2004) or "bacon-sandwich-making" (Barnett, Ceci, & Williams, 2006). Willingham (2004) argues that in fact the general view of intelligence held by most psychometricians is a hierarchical model where general intelligence is comprised of verbal and mathematical ability (see figure 3). The verbal and math distinction makes sense, as both have a socially accepted symbol system that can be used to construct assessments. Willingham (2004) also clarifies that

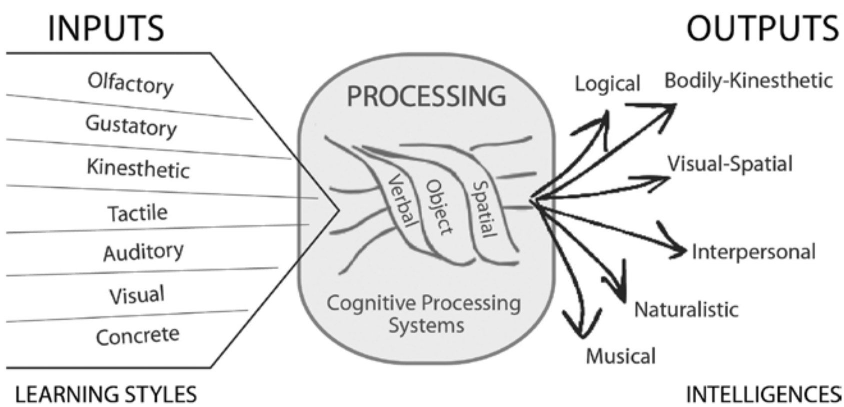
> the hierarchical model described is not a theory, but a *pattern of data* [that] tell us only that there is *some* factor that contributes to many intellectual tasks, and if your theory does not include such a factor it is inconsistent with existing data—Gardner's theory has the problem. (p. 21)

This hierarchical view of the mind aligns with our view of the cognitive processing systems, where verbal and math skills are supported by verbal and nonverbal processing systems (Blazhenkova & Kozhevnikov, 2010), and these may serve as the underlying factors that Willingham is referencing.

There is much more work to be done in understanding the various constructs of the mind-brain; the relationship to intelligences and learning styles offer additional insights on how we are framing the mind. As noted earlier, this is also one of the great challenges Gardner has spoken about: learning styles are not the same as intelligences, even though they are commonly confused and conflated. In an attempt to clarify this, Prashnig (2005) posits that the central distinction between the learning styles and intelligences is that the former give information about how an individual takes in information to process and the latter do not. But, in fact, there is considerable contention in the work of learning styles themselves, with numerous different models and no consensus on a definition (Coffield, Mosely, Hall, & Ecclestone, 2004; Pashler, McDaniel, Rohrer, & Bjork, 2009). Similar to the intelligences, the learning styles discourse is full of confusion and dispute. Despite the fact that there is much more empirical analysis across this literature, a systematic and critical review of research has found seventy-one different models of learning styles organized into thirteen different major models with varying degrees of evidence and support. It also notes that "competing ideas about learning have led to a proliferation of terms and concepts, many of which are used interchangeably in learning styles research" and concludes that despite this critical review there are no clear learning styles implications for pedagogy (Coffield et al., 2004, p. 13).

Those elements make the construct of learning styles not only nebulous but difficult, if not impossible, to implement at all. However, at the most gen-

FIGURE 3 *Conceptual relationship among learning styles, multiple intelligences, and cognitive processing systems*




*Source:* Prashnig (2005).

eral level, learning styles describe the way a person likes or prefers to take in and process information. In this way, learning styles are similar because they also talk about processing information but emphasize the *intake* of that information. In fact, the sensory systems are a key element of the learning styles and are often the way a learning style is described (i.e., a "tactile learner," a "visual learner," an "auditory learner"). Prashnig (2005) explains that a key difference is that "MI does NOT give information about the specific learning needs a student has during the information intake process" (p. 9). This aligns with Gardner's definition of an intelligence, which emphasizes the outputs, or "products," that are possible using one's intelligences.

Collectively, this raises an interesting framing. Learning styles focus on the ways we *intake* information, and MI theory focuses on how we use biopsychological structures to process and *output* artifacts. The work on cognitive processing systems focuses on just the processing itself and the cognitive structures alone. Because this area of research focuses only on these structures as they are accessed and assessed through research instruments, it puts less (if any) emphasis on other constructs, such as the sensory systems that intake that information or the domains and products that represent the manifestation of using those cognitive processing systems. In this way, whole-mindedness has the opportunity to stay focused on the cognition itself.

### *Expanding Our Vision of Education and the Arts*

The focus on the core cognitive processing systems of the mind and on the pedagogical implications of whole-mindedness presents a much different frame of the learner—one that may offer more freedom and empowerment to the arts and their role in education. This framework offers a more streamlined and pointed focus: there are three cognitive processing systems that we all possess, to varying abilities, and there is inherent value in providing learning environments and experiences that support and develop them. While other theories of mind have clearly demonstrated that their application can go awry, it is my hope that, in several ways, this frame might be less susceptible to the challenges demonstrated in the histories of MI theory and learning styles.

*Manageability*. First, whole-mindedness focuses on just three constructs. MI theory suffered from a labeling problem, where students were identified as being strong in one way and then permanently perceived only in that fashion. While whole-mindedness is susceptible to the same challenge, working with a more manageable number of three may reduce this likelihood. Gardner has stated from the beginning that each individual possesses each intelligence but that they manifest themselves differently in each individual; thinking about and managing that dimensionality for each learner is much more difficult with eight constructs than three. Moreover, whole-mindedness as a theory focuses on ultimately developing the synergy among the three processing systems, which may also lessen the "bucketing" threat that limited MI theory.

*Focus*. Second, the whole-mindedness frame doesn't tie up or necessarily include any domains or products. By focusing only on the cognitive constructs, whole-mindedness may avoid some of the challenges faced by previous frames and theories, as described earlier. In this way, learning environments can be designed and promoted to enable and support the development of all three cognitive processing systems while still encouraging the manifestation of the various intelligences. For example, a learning environment might have lessons and assessments that exercise and engage the different cognitive processing systems and, over time, allow a student's strengths and intelligences to be manifest and embraced more organically, without being conflated and contrived as defining *how they learn*. This is an important distinction, because it may actually empower MI theory to do what it intended and support the talents and distinct strengths of individuals. If whole-mindedness can bear the burden of informing the type of learning environments and experiences we create for students, the intelligences are then free to emphasize how these gifts might be manifest in an individual in that environment.

*Theory genesis*. Finally, and perhaps most importantly, the construction and application of the whole-mindedness frame are in opposition to that of MI theory. Gardner's foundation for MI theory is in cognitive psychology and neuroscience; he also has a background in the arts. Prior to the release of *Frames of Mind*, Gardner had published about the arts and learning (1973, 1982) and was a principal investigator at Project Zero, a Harvard-based research group initially dedicated to enhancing our understanding of learning, creativity, and the arts. This created a frame around which the theory was built. In many ways, Gardner's arts background may have set up MI theory to be a substantiation theory that was retrofitted for arts education. According to him,

> The theory of multiple intelligences wasn't based on schoolwork or on tests. Instead, what I did was look at the world and ask, What are the things that people do in the world? What does it mean to be a surgeon? What does it mean to be a politician? What does it mean to be an artist or a sculptor? What abilities do you need to do those things? My theory, then, came from the things that are valued in the world. (Checkley, 1997)

The last sentence of that statement frames the challenge of MI theory so well. The intention is strong, but what happens if the world stops valuing a musician and a painter, a type of intelligence, or any profession? A value judgment is subjective, and a theory of mind derived from subjectivity will have inherent challenges.

But the work on cognitive processing systems and its implications for learning and work environments tackles this problem from a very different perspective. Neuroscientists and cognitive psychologists have explored cognitive processing systems to better understand how the brain functions. Through their research, these scientists have suggested implications for learning, performance, and development that have served as the foundation for whole-mindedness. Thus, the connection between whole-mindedness and arts education is not forged through a question of values per se, but it is part of our understanding of what full cognitive development entails. The connection, then, is not about values but about needs. I suggest that this may prove to be a stronger foundation to use as justification for including arts education in schools.

## Conclusions and Implications

With whole-mindedness as a guide, we can return now to eHow's question about the role of arts in education. According to the analysis presented here, one role of the arts is to be a central modality and mechanism for shaping the cognitive constructs of all learners. Visual-object is one of the core processing mechanisms of the brain, and the visual arts are the primary medium for communicating, manipulating, and processing information in that modality. As a result, the visual arts are a critical means of communicating with learners who are dominant in that cognitive processing channel, which research suggests is a large subset of the population (Chabris et al., 2006). At the same time, because the cognitive processing tasks that come with this system undergird various domains, such as skills in biology, geography, and more, helping to develop this capacity in students is important for everyone seeking to perform at competency levels in these disciplines in their education—but particularly for those who seek to excel at and make careers in these areas.

A central tenet of MI theory, as reported time and time again by Gardner (1997, 1999a), is to demonstrate the diversity of students and that each of us possesses a unique blend of strengths—or intelligences. MI theory took the original theory of intelligence and made it *dimensional*. But it was not enough. In fact, I believe that the failure of these theories to escape frequent misapplication and negative connotations is due to one central reason: they have been applied as labels and have put people into discrete groups, false groups. Labeling and grouping is a natural behavior for humans; it's a tool we use to more easily make sense of the world and to manage complexity. Yet, it causes tremendous problems because it does not allow for the dimensionality of an individual and forces people into "buckets." In reality, Timmy may demonstrate bodily-kinesthetic intelligence, but that does not completely define who he is. He may also be strong at seeing patterns but slower to process auditory messages. In reality, Timmy is many things as a learner.

Whole-mindedness, like any theory, is susceptible to misinterpretation, misuse, and, in this case, "bucketing." One could just as easily cast Timmy as a verbal or spatial or object learner and create a new bucket for him. To that end, I hope the reader sees this as a disclaimer and as a caution against doing so. As Gardner learned all too well, once a theory is available, it is free to be applied however one chooses. Arguably, no theory in education has been so dramatically used to shape learning environments as MI theory—at least not in its time. As such, Gardner did not have the foresight to fervently caution practitioners on the use of MI theory, with his response coming much later. It is my hope that readers, who so choose to engage with, build on, and in some way draw implications from the ideas presented here, decide from the beginning that they will frame the use of whole-mindedness in a way that promotes dimensionality and diversity of experience in breadth as well as in synergy and to try to approach learners as the dimensional beings they are.

In all, the hope of a dimensional view of the learner is not lost. In fact, the research on cognitive processing systems alone promotes a dimensional view of the mind where an individual can be seen to have various capacities on three separate structures (verbal, visual-spatial, and visual-object) in a single cognitive construct (processing systems). The research demonstrating how a person can be strong in one, two, or all three systems, with varying degrees of relationships between them, promotes a dimensional view of the mind in and of itself. However, the relationship of whole-mindedness to the intelligences only expands the breadth of the dimensions. One targets a construct that feeds into and enables the manifestation of the other. How do the other cognitive constructs integrate to produce the profile of intelligences of an individual?

How we create our learning environments, our schools, affects how we engage children *and their minds*. As individuals—and as societies—we need to engage our strengths and develop our *whole* minds. As we strive toward whole-mindedness, learners can be freed from their buckets—and so can the arts in education. The arts not only represent a wide spectrum of crafts and domains valued by society in so many ways, but also represent core modalities that align with cognitive constructs in the mind-brain—constructs that are critical to our development as individuals and to a society that has entered a visual revolution.

Ultimately, teaching for whole-mindedness means seeking not only to identify students' cognitive processing strengths but also proactively cultivating all processing system capacities while at the same time teaching students how they can continue to develop and leverage these capacities in their life experiences. Working toward this end doesn't necessarily require much additional effort. At its most basic level, it means creating learning environments that immerse learners in all modalities; but more importantly, it allows and encourages them to cognitively engage with the different modalities. It is not just the exposure to arts materials and media; it's the active engagement with and manipulation of them (Brunyé et al., 2008). That distinction moves the experience from passive to active and is often the difference between leisure and learning, between entertainment and education.

## Notes

1. Gardner originally presented seven intelligences and has suggested that evidence exists to potentially substantiate several more than eight. For an organized synopsis of the evidence criteria as well as descriptions of the intelligences themselves, see http://www.indiana.edu/~intell/mitheory.shtml.
2. For a listing of critiques of MI theory, see http://www.igs.net/~cmorris/critiques.html.
3. In the survey, 3,839 individuals participated online in return for a $5 gift certificate to Amazon.com. Participants were recruited primarily with online advertisements on Craigslist.com over a period of 18 months. Of these, 130 participated twice; only data from their first session were retained and analyzed, except for assessment of test-retest reliability. The sample included 1,301 males and 2,538 females, ranging in age from 14 to 76 years (M = 26.6, SD = 8.4).

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