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# The Mapping Metaphor

Teachers around the world are often mystified by the mismatch between their perceptions of students' thinking and classroom performance. These perceptions may be positive, as offered in the following statements you may have heard yourself say:

- "I know that he has great ideas, but he can't seem to get them out in his writing! His writing is always a jumble."
- "She has amazingly creative ideas but has a very hard time articulating them."
- "I give my students the information, but when they come back with it—if they can remember it—it's a disorganized mess! They are smart, but they simply don't know how to organize their ideas."
- "I tell them the steps, and I know they can do it, but they often have to be told over and over again to get it right."

The perceptions may also be dangerously negative and detrimental, as some educators work from a deficit model, especially with students of color, students who are learning English as their second language or discourse (Mahiri, 2003), and students who come from families living in poverty. Here are some examples that I have heard over 25 years of working in urban schools with a high percentage of children of color, many of whom also live in poverty:

- "These children just can't think."
- "I ask them to tell me what they are thinking and they just don't say anything. I ask them to write and the words are a jumble."
- "Well, you know, look where these children come from. They just don't have the prior knowledge to make it."
- "How can they think if they don't have any vocabulary?"

These very same concerns may be heard in the workplace as well, as supervisors recognize the talents in people yet are perplexed by the quality of work produced or don't recognize the talents of people because of cultural mismatches or institutional structures.

Our educational system seems baffled by these disconnects, and one of the keys to resolving this disconnect is to move beyond an antiquated view of isolated information and knowledge and realize, in the research and in classrooms, that we are working with a very different mindset and set of student expectations than what existed 50 years ago. We are teaching to a generation of *digital natives:* Web-based, dynamic, visual-spatial-verbal media-savvy futurists who *see* and can visually represent the world in a much more connected way than we show it in classrooms. But in classrooms, many teachers still talk while students passively listen (as John Goodlad's research showed 20 years ago), students read text blocks and write answers at the end of the chapter, students fill in static worksheets and even static blackline masters called *graphic organizers*, or are led through software programs, all structured like books, just electronically. Our children don't feel lost on the Web because they are comfortable with networks of ambiguous information and unstable knowledge, but I believe that many feel lost in classrooms around the country because knowledge is perceived as primarily static and linear.

From the point of view of how knowledge is represented, there is a fundamental disconnect between how students and educators *see* and understand knowledge, and this is one of the subjects that this book addresses. *The primary reason for this is that most educators, as most educational researchers, are primarily text driven and auditory:* we live not only by the idea of text *books* and *the spoken word* but also that information is valid only when substantiated in linear text *blocks* and *strings of sentence*. To find out something, we read text in books. To find out what students know, we have them write text blocks to us or speak to us in strings of words. This has guided our definition of literacy for longer than we can remember. This is our mindset. One of the main reasons that learners, young and old, often have writer's "block" or their thinking is "blocked" is what I offer as a guiding metaphor for information: the WALL OF TEXT. The linear wall of text does not explicitly show the rich networks and patterns of thinking that the author is presenting implicitly within the linear representations. When visual tools are presented alongside text or used by learners to find the patterns embedded in the wall of text, then the rich foundational structures of knowledge is unveiled.

Now, at the beginning of the 21st century, we know that the linear representation of information, concepts, and knowledge does not reflect how our brains work. Linear representations are, to a certain degree, oppositional to how our minds and emotions work. This is a radical statement, but not so radical when you think about it. Linear lessons are not how we remember information. Linearity is not how we think as we connect information and transform that information into knowledge. Actually, the world around us doesn't work that way either; it works as a dynamic, interdependent, highly complex web of connections—much more like how a map looks.

Recently, I was working with teacher and administrator leaders from a school system in New York State, and after presenting an overview of visual tools within the context of some of the conclusive research and practice presented in this book, the literacy coordinator for the district broke through the paradigm for defining "literacy" in classrooms and dramatically offered this epiphany: "For all these years, I thought it was all about my students speaking and writing, but now I understand

that what I really wanted to know was how my students were thinking." Please read this quote again. This insight is the way into this book: speaking, writing, and numeracy in the forms most often found in classrooms are predominantly ***linear*** representations of students' meaning making, while most thinking processes, content information and knowledge, and emotions are held in ***nonlinear*** associations. There are additional ways, as shown in this book, to represent knowledge that is as "rigorous" as linear text and in a complementary form.

The work presented in this book is not revolutionary as much as evolutionary, as educators who were trained and retrained in the auditory-verbal teaching techniques of the late 20th century enter the integrated visual-spatial-verbal-auditory literacy of the 21st century. *But this is not to suggest that we should discard the wall of text.* We still must live and learn by linear presentations as well as nonlinear and linear visual forms. What we want to do is add visual tools in an interplay with text and thus also bring forth an additional metaphor for how knowledge is represented. As you will see in this book, this breakthrough in how we represent information, ideas, and concepts, which has been occurring over the past 20 to 30 years from the first uses of brainstorming webs for prewriting processes, goes hand in hand with all the linear text that we still hold as important.

## COGNITIVE DISSONANCE IN REPRESENTATION SYSTEMS

This book offers an overview of the need for the explicit shift toward a deeper and more expansive use of visual tools across classrooms, whole schools, and whole school systems for teaching, learning, and leadership purposes. Following is a brief summary of the domains and research that show conclusive evidence of the need for this shift:

**New sciences:** We know that the world is a dynamic, interdependent system or "web of life" that is not linear, that even "time" is not clearly understood as linear, and that in every discipline, including brain research, scientists must map the content knowledge to deeply understand a system.

**Brain research:** We know from research that the brain is dominantly visual and that the real untapped power of the brain-mind capacity is the natural mapping of incoming stimuli, and memory and meaning are greatly enhanced by visual representations. As Pat Wolfe has said: "Mapping is what the brain does."

**Intelligences:** We know that multiple intelligences are based on different representations of information and that emotional intelligences as well depend on the capacity of the brain to create visual-spatial-verbal schemas, or mental models. And we know that we must facilitate a full range of habits of mind and mediate these habits to improve thinking and problem solving.

**Instruction:** We know that nonlinguistic representations blended with verbal forms (dual coding) have a large impact on student learning and that the facilitation of thinking requires the development of habits of mind and metacognitive behaviors. The use of nonlinguistic representations also directly influences content-rich vocabulary development.

**Learning:** We know that the research on the effectiveness of graphic representations is extensive and conclusive, especially for identifying text structures for reading comprehension in every discipline, and that *student ownership* of visual tools based on thinking skills is a key to high conceptual performance.

These domains and the research within each help educators by guiding us to the use of new tools and strategies. Yet I believe that an additional metaphor—the mapping metaphor based in our dominantly visual-spatial relationship to the world—offers the language for integrating and also moving beyond the wall of text metaphor. Let's look at this additional metaphor for *seeing* how we construct knowledge.

## THE ELEPHANT IN THE ROOM

A cartoon by Handelsmen recently published in *The New Yorker* magazine shows an older couple sitting in their living room, reading in their easy chairs. An elephant has picked up the phone by its trunk and is answering: "No, this is the elephant." This plays on "the elephant in the room" idea that we become so comfortable with things as they are, even if they don't work in a changing world, that we come to not even notice the problem. Of course, this cartoon takes it a step further: the elephant is not just a passive bystander in the corner, but has completely taken over the daily life of the couple to the extent that he is taking control of and making decisions about their everyday lives. So let me offer you "the elephant in the living room answering your phone" for educators that is this book's big-picture message:

There is *cognitive* dissonance between the highly constrained linear presentation of information in classrooms as text blocks and the multidimensional mapping of mental models that the brain-mind naturally *performs* when processing and crafting information into knowledge.

This dissonance or disconnect is *the* fundamental barrier to improving students' thinking and teachers' capacities to convey and facilitate basic and complex content and conceptual learning for all students.

This dissonance is like the elephant in the room—so obvious, tangible, and now so comfortable that most of us cannot see it. Teachers are making the transition toward knowledge creation by students' using visual tools and other new processes of teaching, but the cognitive dissonance in the classroom still exists.

The double meaning in the term *cognitive dissonance* is clear: *cognitively* we process beyond the linear mindset, but we ask students to show their thinking primarily in linear terms. This book offers not a replacement of traditional forms of literacy, but an additional way of "showing what you know" that is shifting our perception of knowledge on the most basic level. Why? Because visual tools of every kind, from brainstorming webs and graphic organizers to thinking-process mapping, are all based on the metaphor of the visual-spatial-verbal *mapping of knowledge*. Like any breakthrough technology, this transformational technology of the mind—the mapping of mental models—includes that which came before. The visual mapping of information into knowledge is what the brain does already and what has gone before in the sense of mapping physical space.

## THE MAPPING METAPHOR: *TERRA INCOGNITA*

This book is about the richness of the visual-spatial-verbal mapping metaphor for the 21st century, its central role in helping us understand how visual tools and technologies support learners in their human capacity to transform information into knowledge. Ultimately, this is about power sharing of the construction of knowledge. The gulf between our students' technical expertise and their mental fluency is one of the barriers we must transcend to enact positive change in schools and the workplace. To be sure, we cannot go back to a time when information was so neatly packaged in books resting on library shelves. The mapping metaphor opens up our central dilemma as we step into the new millennium: our students may have the technical link to information, yet few have the mental fluency to craft information into meaningful and relevant knowledge.

The unique representations derived from map making are best expressed through the history of cartography, which reveals that this invention was a turning point for human understanding:

> The act of mapping was as profound as the invention of a number system. The combination or the reduction of reality and the construction of an analogical space is an attainment in abstract thinking of a very high order indeed, for it enables one to discover structures that would remain unknown if not mapped. (Robinson, 1982, p. 1)

This quotation is drawn from James H. Wandersee's insightful analysis of the connection between cartography and cognition (1990). He suggests that cartography links perception, interpretation, cognitive transformations, and creativity. Wandersee states that map making serves four basic purposes:

1. to challenge one's assumptions;
2. to recognize new patterns;
3. to make new connections; and
4. to visualize the unknown.

Map making, or cartography, has always been a central form of storing vital information about our surroundings and distant shores, from the ancient mappings of the earth and sky to solar systems. Humankind has always sought ways to discover and map new frontiers and find our way home by land and sea and, most recently, air. Cartography has been both a science and the gateway to new learning, but until the last few decades the term *mapping* has stayed within the intellectual domains of astronomers and geographers. Actually, from Africa to the Mayan astronomers, maps have been the documents of discoveries and ownership, and then, often, of domination. If a "discoverer" could map a region, then ownership was established. Planting a flag was a symbolic gesture, but mapping the region was the act of establishing physical boundaries and territories.

Of course, the attempt to discover longitude in the 18th century was foremost in the minds of seafarers, traders, and governments, as latitude and longitude lines crossed and established the relationships in space that could guide adventurers

and conquerors alike to unknown lands. The Lewis and Clark expedition across the western region of North America, like any other journeys into new landscapes, was an attempt to map territories unknown to a new republic so that commerce and land holdings could expand. The "map" that Lewis brought back to President Thomas Jefferson was, of course, technical in the geographic sense, commercial in the description of resources, and ethnographic in depicting cultures new to the adventurers.

> Lewis studied maps in Jefferson's collection. He also conferred with Albert Gallatin, a serious map collector; the problem was that west of the Mandans nearly to the coast was *terra incognita*. And the best scientists in the world could not begin to fill in that map until someone had walked across the land. (Ambrose, 1996, p. 80)

Now we send captainless ships to distant planets to map and in some cases "own" new territories off the curvature of the earth. Now the "four corners" of our globe are known, and our technical expertise has seemingly, and some say recklessly, hopscotched over our practical needs. We have access to electronically mapped terrain through GPS, or global positioning systems. We may be in our car with a map on a screen, guiding us around the corner or into another state. Likewise, and using similar technology for networking information, our children, gazing at a television or computer screen or handheld device, access linked data from points around the world, and from different points of view. Those views may range from electronic explorers of knowledge on the Net to mass marketers of goods to exploiters of graphic violence and other morally repugnant materials.

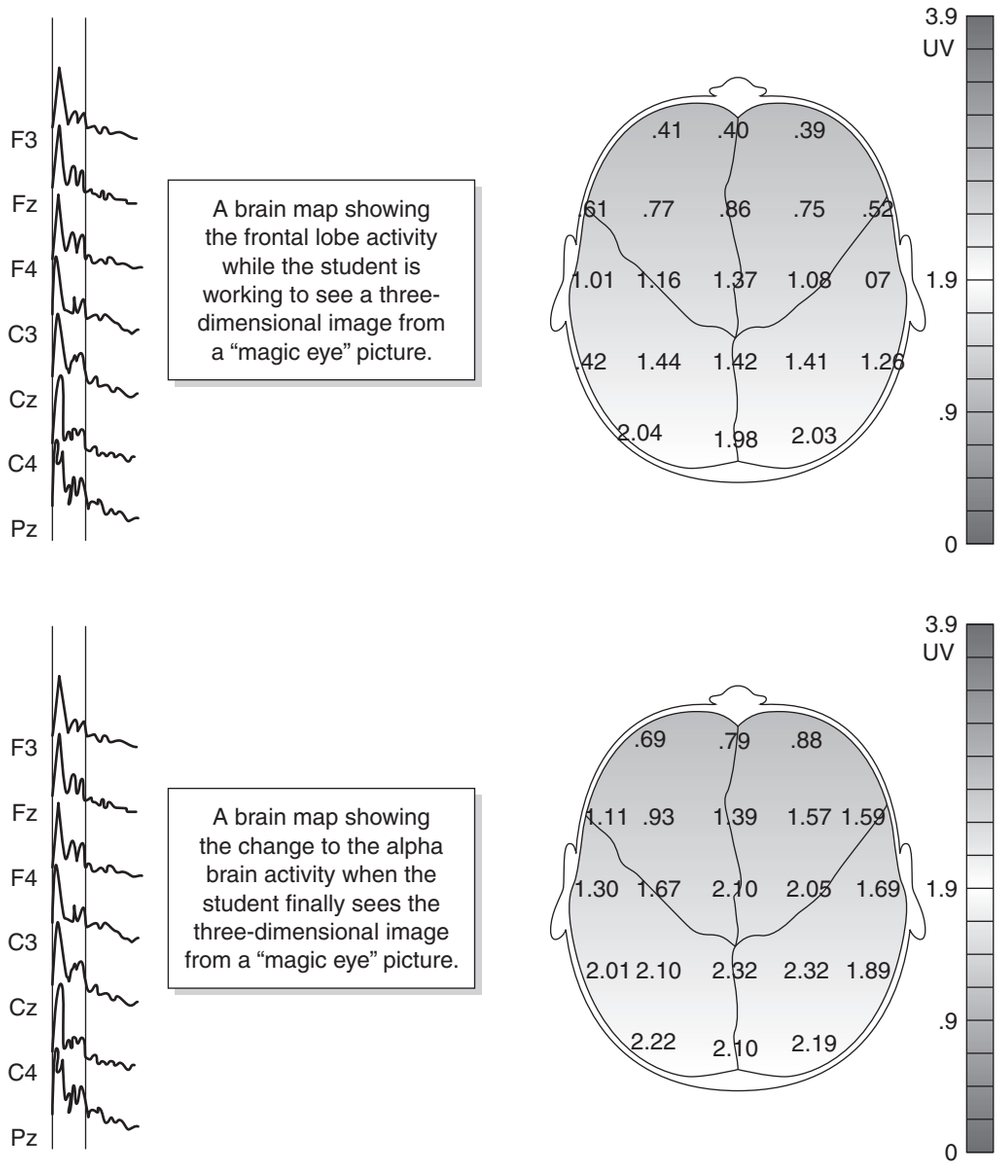
There are no new territories in the lower 48 states: the new territories are of human imagination, interaction, communication. The terms *network, World Wide Web, integrated*, and *Internet* are concrete expressions for what has become the central metaphor of this age: mapping. Mapping is a metaphor for both connecting and overlapping knowledge structures. As we see in this book, mapping is also the name for practical tools for mental fluency. Mapping is a rich synthesis of thinking processes, mental strategies, techniques, and knowledge that enables humans to investigate unknowns, show patterns of information, and then use the map to express, build, and assess new knowledge. If "the world is flat," as Thomas Friedman proposes (Friedman, 2005), then we will need new maps to navigate on this dynamic technological plane for thinking and communicating.

The brain is based on pattern seeking; our minds consciously create patterns, our emotions are driven by layers of interconnected patterns of experience, our media thrive on the communication of patterns, and nature—that which we are a part of and which surrounds us—is a complex weave of patterns. Some of these patterns are linear and procedural, but the foundation of knowledge, from the basic factual knowledge record to decision making borne of evaluative processes, consists of nonlinear patterns. Are thoughts linear? emotions? an ecosystem? our values? Put in the starkest terms, our educational *system* and educational leaders can no longer lag behind the children who sit before a computer and can access and download and then create complex interweavings of knowledge as we stand before them and speak and write and numerate in linear strings of words and numbers.

## MAPPING THE BRAIN

In early studies of the brain, scientists saw two *hemispheres* linked by a bridge; next, *regions* of the brain, specific *locales;* and then the detailed system of neural networks. Figure 1.1 shows how even back in the early days of brain scans, the understanding of brain functioning depended on visual mapping of the contours of activity. In this example, a special camera called a "magic eye" was used for scanning brainwave activity in different regions of the brain.

**Figure 1.1** Mapping Brain Activity




*Source:* Alcock, M. W. (1997, Spring). Are your students' brains comfortable in your classroom? *Ohio ASCD Journal, 5*(2): 13.

One of the most important technological races of the past decade has been the "race" to map the human genome system. In an article about J. Craig Venter, one of the early leaders in this race, the "finish line" is described as

> a map of the entire human genome, the 80,000 genes that are thought to exist within our DNA. Altogether, this means finding more than three billion microscopic pieces of information—nucleotides, or bases, that are the molecular equivalent of letters—then putting them all in the right order and learning how to read them. (Belkin, 1998)

Venter is controversial from a scientific perspective not because he has been attempting to identify every gene (as is the government-sponsored Human Genome Project). Rather, he is trying to extrapolate from a partial sequence of genes in a DNA string that the other genes exist in between—much like making a map of a city with all the streets, but not filling in the details of each storefront. He is also in the center of a conflict from an ethical-commercial perspective: Who will "own" this map, a so-called Book of Life, the complete genetic code for humans? Of course, a power visual representation of our modern age is shown in Figure 1.2: a map of a DNA strand.

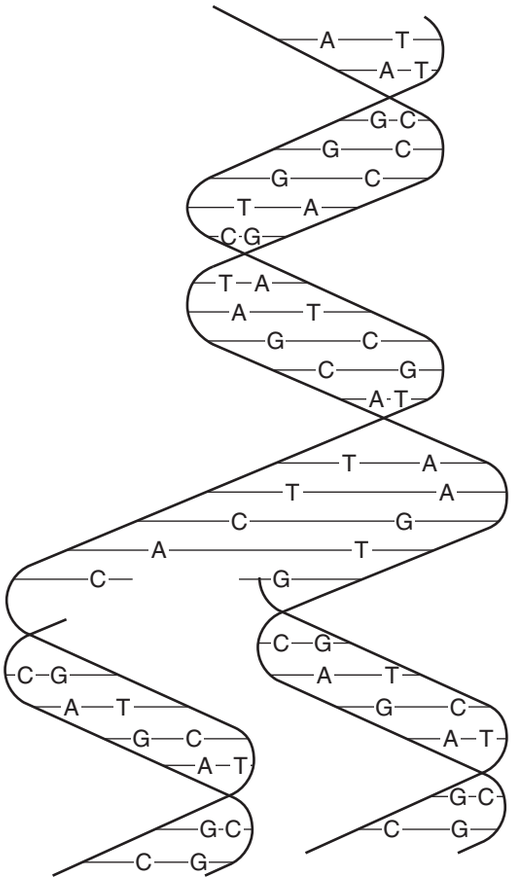
## VISUAL TOOLS FOR MAPMAKING

Maps are primary guides in our lives: road maps, world maps, transit and subway diagrams, maps for exploring a museum or amusement park, weather maps, and even imaginary treasure maps. Of course, as we consider geographic knowledge on a map, we see key representations of the essential connections among mountains, valleys, and rivers. Similarly, visual tools are used primarily to make and represent connections among ideas and concepts.

Visual tools offer a bird's-eye view of patterns, interrelationships, and interdependencies. They provide guides for making our way in books full of text or among downloaded materials from the Information Superhighway. Unlike geographic maps, which show explicit *physical* models of the world, visual tools generate and unveil *mental* models of interrelationships developed by learners, along with the unique patterning capacity of each learner's mind. The significant difference between geographic and mental maps is that geographic maps represent relatively static, physical entities, whereas the maps we are investigating represent internal, mental, flexible, often quickly changing, and highly generative patterns.

Visual tools as evolving maps reflect our capacities to pattern and reorganize relationships. The similarity of purpose between geographic and mental maps, moreover, is clear: Each is based on the visual representation of a region, a mental space (Fauconnier, 1985) that heretofore may have been unknown. Each simultaneously displays a view of both the holistic "forest" and the detailed "trees" and is leading us into a vision of knowledge as holographic and not on the flatlands of the paper page. Additionally, maps are much like paintings: they are drawn from a certain perspective and thus have limitations. This means that each map is made in the eye of the beholder, with the instruments at hand, and within the intellectual and philosophical paradigm of its maker. This is best illustrated by the continuum in our belief system about our own planet, from the "flat earth" map made by our ancestors to the astronauts' perspective from a valley on the moon.

**Figure 1.2** The Complexity of a DNA Strand




*Source:* Lowery, L. F. (1991). The biological basis for thinking. In A. L. Costa (Ed.), *Developing minds: A resource book for teaching thinking* (Vol. 1, rev. ed., p. 113). Alexandria, VA: Association for Supervision and Curriculum Development. Reprinted with permission.

The metaphorical relationship between cartography and mental maps of human cognition is useful, though certainly incomplete. *Seeing should not be construed as believing or knowing.* Seeing is one modality for perceiving, though for most of us it is our primary modality. Visual perceptions balance with auditory and kinesthetic access to knowing. Visual tools for mental mapping need to be integrated with other representational and language systems for reflecting different kinds of intelligences.

## THE FOUNDATION OF THE MAPPING METAPHOR: SEEING

Mapping may help us to understand how the metaphor of "seeing" is the foundation for and central to the success of visual tools. This metaphor "grounds" visual tools in everyday classroom language. Figure 1.3 is a map of some of the everyday

uses of the "seeing" metaphor. This "mapping" as an alternative form of epistemology is easily understood through the metaphor of "seeing." George Lakoff, professor of Linguistics and Cognitive Science, University of California–Berkeley, along with his colleagues has conducted cross-cultural research in the area of conceptual metaphor. Lakoff's most recent book, *Don't Look at That Elephant in the Room,* has caused quite a stir in political circles. His landmark study, aptly titled *Metaphors We Live By* (Lakoff & Johnson, 1980), reveals the centrality of metaphor to cognition, language, and everyday living. Lakoff's work integrates a wide range of cognitive science research and philosophical inquiry into a new framework for understanding human cognition, experience, and action.

As shown, this metaphor does not stand alone, overlapping with other modalities and spatial/physical relationships in the world. As you link these terms and add your own from everyday life, notice the overlapping of visual and spatial metaphors. For example, "perspective taking" draws from standing in a certain position and then seeing from that "point of view." This is one way that painters, photographers, writers, and other artists gain new perspectives and represent insights in everyday life. And, as we will see in this book, our students gain insight into their own worlds when they begin to apply visual tools, look up, and say: "I see what you mean."

In sum, visual tools are for constructing representations of knowledge. In educational terms, visual tools are for constructing and remembering, communicating and negotiating meanings, and assessing and reforming the shifting terrain of interrelated knowledge. We even use maps to rediscover information, ideas, and experiences lost in the recesses of our minds. We use maps to find our way to new information, much like an evolving treasure map of the mind for seeking new meaning in texts and other materials.

This book is about visual tools, which show patterns of thinking, and how they help us and our students make sense of the world, communicate better, and become life span learners. The richness of the mapping metaphor for the 21st century may have a central role in helping us understand how visual tools and technologies support learners in their ancient human capacity to take static information from the modern world of ideas and transform it into active maps of knowledge.

**Figure 1.3** Everyday Uses of the "Seeing" Metaphor