Visual Thinking in Arts Education: Homage to Rudolf Arnheim

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The influence of Arnheim’s work on the author’s research began with an experiment on the perception of visual balance. Two later research projects emerged from the profound influence of Arnheim’s stance toward creation in the visual arts as a serious, cognitive endeavor. A series of meta-analyses were first conducted to test the claim that learning in the arts transfers to nonarts cognitive domains, but little evidence was found. Past research on the transfer hypothesis was found to be lacking because of its failure to assess learning in the parent domain. Therefore, a new research project was carried out to identify kinds of learning in the parent domain of visual arts. We identified eight thinking dispositions developed in serious visual arts classes, setting the stage for more plausible transfer studies. This study demonstrates that the visual arts inculcate basic skills in perception and cognition that exist both in the arts and sciences. All of the skills the authors describe can, with some modification, be transferred to the science laboratory. As Rudolf Arnheim has taught us, visual thinking is everywhere.

Keywords: transfer, visual thinking, arts learning

I first saw Rudolf Arnheim when I sat in on his class during his last semester of teaching at Harvard in the middle 1970s. I remember being riveted by his slides. With just a few comments, he was able to transform how I perceived the paintings he was showing. A few years later I met him at a conference. I had sent him a manuscript of my forthcoming book, Invented Worlds: The Psychology of the Arts (Winner, 1982), and I had asked him if he would consider writing the preface. I was thrilled when he turned to me at the conference and said that he liked my book and would write the preface. Thus began a long mentorship and friendship. I often said to him that he provided me with the ideas, and then I wrote the preface. Thus began a long mentorship and friendship. I must admit that I was puzzled, surprised, but stuck to his intuitions. I must admit that despite my failure to “prove” his claims, I remained convinced that his intuitions were sound. Yet, Arnheim was so convincing, and I could not help but see paintings through his eyes once he commented on them. Because the claims were so counterintuitive, I decided, with Arnheim’s blessing, to test these hypotheses. We showed people images of paintings that had more mass on the left side, along with their mirror images, and asked which member of each pair appeared more balanced, and we showed them images of abstract paintings that had more mass on the bottom half, along with upside down versions and asked the same question. We found moderate support for the claim that objects higher up appear heavier than objects lower down (thus, upside down paintings look less balanced) but no support at all for the claim that objects on the right appear to weigh more than those on the left, as there was no preference for the correct versus mirror image painting (Winner, Dion, Rosenblatt, & Gardner, 1987). Arnheim found these results intriguing, and we talked at length about the findings. He was puzzled, surprised, but stuck to his intuitions. I must admit that despite my failure to “prove” his claims, I remained convinced that he was on to something—such is the power of his vision.

While this little study done 20 years ago is the one study I’ve done that is a direct attempt to test an Arnheim claim, all of my work has been infused (even soaked) with the influence of Rudolf Arnheim. I have specialized in the psychological study of the arts, arguing for the centrality of the arts in human psychology, and this is because of Arnheim, as well as my other intellectual mentor, Nelson Goodman, founder of Harvard Project Zero where I have conducted much of my research. I have spent much time researching artistic thinking—again, the result of both Arnheim and Goodman. And I have argued, as has Arnheim, that the arts have been trivialized in our educational system. In this homage to Arnheim, I will describe some of my work in the area of arts education, because this work is fundamentally influenced by Arnheim’s writings, particularly Visual Thinking (1969), where Arnheim wrote about the “widespread neglect of art
at all levels of our education system” (p. 295). “More and more the arts are considered as a training in agreeable skills, as entertainment and mental release... fewer and fewer hours of the week can be spared from the study of the subjects that, in everybody’s opinion, truly matter” (p. 3).

My forays into visual arts education were, in part, a reaction against the all too common instrumental justifications we hear for why children should study the arts. In the 1980s and 1990s, arts educators insisted on justifying arts education by reference to what transferred from the arts to other “more basic” school subjects (Fiske, 1999). For example, a 1995 report by the President’s Committee on the Arts and Humanities claimed that “teaching the arts has a significant effect on overall success in school” and notes that both verbal and quantitative SAT scores are higher for high school students who take arts courses than for those who take none (Murfee, 1995, p. 3). According to these kinds of arguments, the arts should be in our schools because they help students learn to read, because they boost math performance, and because students who take more arts classes do better on their SATs.

In a project called REAP (Reviewing Education and the Arts Project), our research team examined these instrumental justifications for arts education (Winner & Hetland, 2000). We conducted 10 meta-analyses of studies testing the claim that some form of arts education transfers to some form of nonarts learning (e.g., reading, math, verbal/math test scores, spatial reasoning). We searched for studies, published and unpublished, carried out since 1950, examining the relationship between arts study and academic achievement. The only studies were ones that assessed some kind of nonarts, cognitive outcome, and that compared children who received some kind of arts instruction with those receiving either no arts instruction and/or some other form of nonacademic instruction. We found almost 200 studies that met these criteria and then sorted the studies by art form and outcome, and proceeded to conduct 10 meta-analyses.

Our findings were controversial: we found that in most cases there was no demonstrated causal relationship between studying one or more art forms and nonarts cognition. Perhaps the most commonly heard instrumental claim for the arts is that they lead to enhanced standardized test scores, higher grades, and lowered high school dropout rates. One of our 10 meta-analyses was performed on studies testing the relationship between studying the arts (type of art course was not specified) and verbal and mathematical achievement (Winner & Cooper, 2000). In these studies, students were either exposed to the arts as separate disciplines or they received such exposure but were also given an arts-integrated academic curriculum. Unfortunately, few of the studies explained in much detail anything about the nature and quality of the arts instruction, or about what it really meant to study an academic subject with arts integration. Academic achievement in these studies was measured either by test scores, grades, or academic awards.

When we examined the correlational studies—studies that compared the academic profiles of students who do and do not study the arts either in school or in after-school programs, we found a strong general correlation between studying the arts and verbal, mathematical, and composite verbal/math test scores. Thus, students (in the United States) who choose to study the arts are students who are also high academic achievers. But, because the studies on which these meta-analyses were based were correlational in design, they allow no causal inferences. Does art study cause higher scores? Or do those with higher scores take more art? Or, is there a third variable, such as parental involvement, which causes both greater arts study and higher test scores? We cannot tell. Unfortunately, however, studies such as these have often been used to support the claim that studying the arts causes test scores to rise.

When we examined the experimental studies testing the claim that studying the arts causes academic achievement to rise, we found no global effects. These studies compared academic performance before and after studying the arts and included studies that integrated the arts with academics, as well as studies in which students were enrolled in the arts as separate classes. The lack of relationship between arts study and academic achievement held for the 24 studies testing verbal skills and the 15 testing math skills. Thus, we had to conclude that we had found no evidence that studying the arts, including the arts integrated with academic subjects, resulted in enhanced verbal or mathematical skills.

A second of our meta-analyses examined studies testing the claim that exposure to visual arts classes helps remedial readers improve their reading. This is the assumption guiding several programs set up in New York City, such as the Guggenheim Museum’s Learning to Read through the Arts, Reading Improvement Through the Arts, and Children’s Art Carnival, where children with reading difficulties are given experience in the visual arts integrated with reading and writing. These programs consistently report that remedial readers improve their reading scores and then go on to conclude, erroneously, that the improvement is attributable to the arts. However, because these programs did not compare the effects of an arts-reading integrated program with the effects of an arts-alone program, we cannot know whether the reading improvement that undoubtedly did occur was a function of art experience, art experience integrated with reading, or simply of the extra reading experience and instruction.

We, therefore, examined nine studies that compared an arts-only instruction to a control group receiving no special arts instruction and four that compared an art-reading integration treatment to a control group receiving reading only (Burger & Winner, 2000). The first group allowed us to see whether instruction in visual art by itself teaches skills that transfer to reading skills; the second group allowed us to test whether reading integrated with art is more effective than reading instruction alone.

We found no support for the claim that the visual arts enhance reading skills and were forced to conclude that programs that help remedial readers improve their reading through a reading-arts integrated program are likely to work well because of the extra intensive reading training that the children receive, independent of the fact that this training is fused with drawing.

Overall, our 10 meta-analyses showed that, for the most part, there is only weak scientific evidence that arts education leads to better performance in other school subjects. Two clear exceptions to this were that classroom drama improved verbal performance and that music improved spatial reasoning. Does this mean that studying the arts has no effects on nonarts cognition? We believe that the research on transfer to date is too flawed to allow us to draw conclusions. In the words of David Perkins, commenting on the above-described meta-analyses, “it is important to stand back from their findings [about lack of transfer] and ask whether the game is essentially over... Some would say that it had never really begun” (Perkins, 2001, p. 117).
The most glaring weakness in the studies conducted thus far on arts transfer is that researchers have failed to document the kinds of thinking skills learned in the parent domain—learning about the arts. Only once we have determined what students actually learn when they study an art form does it make sense to test hypotheses about transfer. In none of the studies we found for our meta-analyses did researchers analyze what teachers were teaching in the arts and what students were learning. Without knowing what is learned in art class, we cannot possibly guess at what might transfer outside of the arts.

And so we adopted a new approach, one in which we carried out a microanalysis of pedagogical technique in the arts to begin to uncover what is taught (and, therefore, may be learned) in visual arts classes. I, along with my colleagues at Harvard Project Zero, Lois Hetland, Shirley Veenema, Kim Sheridan, and Patricia Palmer, set out to document the kinds of habits of mind taught in the visual arts and to provide the groundwork for better transfer studies by identifying particular kinds of thinking skills actually learned in the arts that might be useful in other disciplines (Hetland, Winner, Veenema, & Sheridan, 2007). Although we were interested in the question of transfer from a scientific point of view, we believed that it was wrong to justify arts education by what they can do for other areas of the curriculum. To justify the arts in this way is to assume that the arts teach no important thinking skills in their own right. Arnheim warned of this in Visual Thinking (1969) when he wrote, “The arts are neglected because they are based on perception, and perception is disdained because it is not assumed to involve thought” (p. 3). But, according to Arnheim (1969), “the arts are the most powerful means of strengthening the perceptual component without which productive thinking is impossible in any field of endeavor” (p. 3).

Arnheim has always argued for a cognitive basis of the arts, just as did Nelson Goodman (1976). Many comments in Visual Thinking elaborate on this point. Art, Arnheim writes, “is born from man’s need to understand himself and the world in which he lives . . . the various other purposes served by art can be shown to depend on this basic cognitive function” (p. 294). “Image-making serves to make sense of the world” (p. 257). “Both art and science are bent on the understanding of the forces that shape existence and both call for an unselfish dedication to what is. Neither of them can tolerate capricious subjectivity because both are subject to their criteria of truth” (p. 300). Therefore, the goal of art is, in a deep sense, the same as the goal of science—both seek understanding, albeit through different methods and resulting in very different products.

In the fall of 2001, we began to document the thinking and motivational dispositions that are developed by serious study of the arts. We worked with five visual arts teachers in two Boston-area high schools at which the arts are taken seriously: a private boarding school (the Walnut Hill School) and a public, urban school whose students’ ethnic, racial, and socioeconomic backgrounds represent the demographics of the city of Boston (the Boston Arts Academy). At both schools, students are admitted by audition in one of four art forms (visual arts, dance, drama, or music), teachers are practicing artists, and students receive over 10 hours of arts instruction per week. During the 2001–2002 school year, we observed and videotaped 38 visual arts classes (some were two, most were three hours in length). After each class, we prepared video clips of what we thought were the most important teaching moments, and then interviewed the teachers to find out what they meant to teach and why they had taught that as they had.

We transcribed all the classes and interviews. We divided up the videotaped classes into interaction units between a teacher and a student. An interaction unit could be one exchange or many, as long as the teacher remained in conversation with a single student or group of students. We then coded each unit for the kinds of thinking dispositions we saw being taught. As we watched the tapes over and over, we refined our category definitions by working with four representative class sessions over a period of 18 months. After establishing 11 working categories of “studio habits of mind” (later collapsed to eight to facilitate ease of use), we achieved interrater reliabilities for coding of the remaining classes of between 0.71 and 0.91 for two independent raters. Each habit of mind is described below. As we try to show, each of these habits of mind is a general and important way of thinking that can, with some modification, be seen as also essential in the science lab.

Craft (Technique)

Craft, or technique, is of course constantly being taught, even when students are watching and listening rather than doing. Craft is not something to be trivialized. As Arnheim (1969) writes in Visual Thinking: "Both art and science require precision, order, and discipline because no comprehensible statement can be made without these" (p. 300).

If you ask someone what students learn in arts class, most would say that students learn technique. This is true, but a truism. We found that in addition to the teaching of the technical disciplines of perspective drawing, shading, proportion, composition, color mixing, shading, centering on the potter’s wheel, glazing, framing, and so forth, teachers were teaching seven other dispositions of thought which we refer to as “studio habits of mind.”

Observe

Two central kinds of thinking skills developed in arts classes are forms of visual thinking. One of these is the skill of observation. Arnheim (1969) noted that children are already paying careful attention to the physical world when they draw, even if their drawings are not realistic. Although a child’s drawing, he writes, “is so highly conceptual, it springs entirely from intense observation of the sensory world and interprets the character of the model without straying in any way from the realm of the visible” (p. 256).

Almost echoing the above words of Arnheim, one of our teachers told us that “looking is the real stuff about drawing.” The skill of careful observation is taught all the time in visual arts classes and is not restricted to drawing classes where students draw from the model. Students are taught, both implicitly and explicitly, to look more closely than they ordinarily do and to see with new eyes. Students are helped to move beyond their habitual ways of seeing and to notice things that might otherwise be invisible. Students are taught to look closely at the world (when they are working from observation), at their own works (the color, line, texture, forms, structure, expression, and style), and at others’ works (whether by their peers or by professional artists).

We saw drawing teachers using the view-finder as an observation tool. Students were given a view-finder to look through so that they could select a composition that they would then draw. As one
teacher said to his students using the view-finder, “Instead of painting what we see, we’re going to see what you would paint.” Looking through the viewfinder is also meant to help students learn to see objects as only lines, shapes, and colors in a frame.

Forget that you are looking at a bucket or a person’s hair, or a table and a chair. . . Forget that these are objects that have any real definition. I want you to simply concentrate on the lines that are created and the depth in what you see.

This teacher then went on to model the skill of observing through the view-finder.

Right here I am paying attention particularly to the way this line goes diagonally across this frame, and then there is another little line underneath it that I can see has a little bit of a distance. It’s a different color, different texture, and the line is thicker because from my perspective this line is a little thinner than this line down here.

We also observed students being encouraged to look closely at the objects or forms from which they were drawing (e.g., “. . . get some of these straight verticals in, like maybe that big pedestal there, or maybe that box down there . . . so you can work these big diagonals against that”), as well as at their drawing (e.g., “Where is your horizon line”). They were encouraged to see the underlying geometry of complex forms.

Whether you’re drawing a person or the most complicated thing in the world, you want to see it in simple terms first. . . If you just think of chest and muscles and arms and everybody’s different shape, it can be overwhelming. But if you think of someone as just a cube and another cube attached, it can really help to simplify it.

In short, students were taught to look in a new way, and this took many forms.

The skill of observation is one that is used broadly, not only when making visual art. As Arnheim wrote,

The discipline of intelligent vision cannot be confined to the art studio; it can succeed only if the visual sense is not blunted and confused in other areas of the curriculum. To try to establish an island of visual literacy in an ocean of blindness is ultimately self-defeating. Visual thinking is indivisible. (Arnheim, 1969, p. 307)

The concern expressed by Arnheim was that visual literacy cannot be developed well if this skill is only taught in the art studio. In today’s schools, visual literacy is hardly taught at all, and probably the best chance children have to develop this skill is in art classes that encourage close observation.

Envision

The second form of visual thinking we saw being developed is the skill of envisioning. Arnheim reminds us of the centrality of envisioning when making art. The artist “is accustomed to visualizing complexity and conceiving of phenomena and problems in visual terms,” he wrote (1969). We observed students being encouraged to envision what they could not observe directly with their eyes.

By envisioning, we mean generating images of possibilities in one’s mind. We saw envisioning taking several forms. Sometimes students were asked to generate a work of art from imagination rather than from observation. For instance, in one class the teacher asked students to paint an imaginary landscape. She asked them to think specifically about the light in the landscape. “Where is the light coming from? Is it day or night? What is the light like? Is it bright or foggy?” Sometimes students were asked to imagine possibilities in their works that are not yet there. For instance, the ceramics teacher told his students who were engaged in making a ceramic tile project, “You need to know what each tile will look like before you start making it.” Sometimes students were asked to imagine forms in their drawings that could not be seen because they were partially occluded. And sometimes they were asked to detect the underlying structure of a form they were drawing and then envision how that structure could be shown in their work.

In all of these cases, students are being encouraged to generate a mental image that will help guide their work. In a similar vein, Arnheim writes, “to make a picture of a human figure or a bunch of flowers is to grasp or invent a generic form pattern or structural skeleton” (Arnheim, 1969, p. 297). And what is the invention of a structural skeleton if not a form of envisioning?

Reflect

Arnheim reminds us that drawing is a form of problem solving: “drawings, paintings, and other similar devices serve not simply to translate finished thoughts into visible models but are also an aid in the process of working out solutions of problems” (Arnheim, 1969, p. 129). Problem solving requires reflection, and the skill of reflection was heavily fostered in the classes we studied. Reflection took the form of thinking and talking about one’s work, one’s working style, and one’s goals, and we saw this reflection take two forms. Students were asked to think about and explain their process, intentions, and decisions, and we refer to this aspect of reflection as Question and Explain. Students were also asked to judge their own work and that of others, and we refer to this as Evaluate.

Question and Explain

Teachers often ask students to step back and focus on an aspect of their work or working process. We often noticed teachers asking students to explain what some part of their drawing depicted, how they had achieved a certain effect, why they had made something the way they did, and what changes they were planning in their work. These open-ended questions prompt students to reflect and explain, whether aloud or even silently to themselves. These kinds of questions help to foster an inner reflection. The ceramics teacher explained to us that posing questions to students helps them become aware of the choices they make as they work. When students say, “this is the way I want it,” he urges them to think about why.

Evaluate

Students in visual arts classes get continual training in evaluating their own and others’ work. Teachers frequently evaluate student work informally as they move around the room while students are working, as well as more formally in critique sessions. Students can learn from these consultations and critiques how to evaluate themselves and others. Students are also asked to make evaluations themselves—they are asked to talk about what works
and what does not work in their own pieces and in ones by their peers. Thus, students are learning to make esthetic judgments and to defend them. Because they are engaged in continuous self-assessment, they have the opportunity to learn to be self-critical and to think about how they could improve.

Express

The study of art teaches students to express themselves. Expressing oneself has a bad press, and some might think self-expression in art simply means anything goes—just throwing paint around to convey one’s emotions. But this is not what artists mean by expression. Expression is elusive, hard to define, hard to pinpoint, but it means conveying a personal vision in one’s work so that the work moves beyond mere skill and technique toward meaning.

As one of our drawing teachers said, “...art is beyond technique...I think a drawing that is done honestly and directly always expresses feeling.” Here is a quote from this same drawing teacher in which he makes it clear to students that the power of a drawing depends far less on technical skill than on how expressive the drawing is. Students are drawing from the model: two people are posing at opposite ends of the room and the task is to capture something about the space between the two figures.

“You’re going to have to include all this space, this empty space. Now that’s going to be a big challenge in your drawing because something is going to be in that space...The strength of the drawing is going to depend very much on the evocative nature of this space.” He focuses students’ attention on the expressive qualities of a Hopper painting to make the point that the evocative power of a picture hits us before the content does. About the Hopper painting, he said, “When they look at it, they don’t think ‘look at the figures.’ They think ‘wow, it’s a late mysterious night...’ That is the subject of the picture. It’s not just a drawing of a figure.”

Arnheim reminds us of the centrality of expression in art, as opposed to science. “...every art work is a statement about something...a proposition which, more or less successfully, makes a declaration about the nature of human existence” (Arnheim, 1969, pp. 296–297). The meaning of a work of art is not necessarily something that the artist is conscious of, Arnheim cautions, and it is not necessarily something that the artist can put into words (and art that conveys a verbal message is rarely great art). Nonetheless, a picture conveys the maker’s conception of the subject, and it is this sense of expression that we saw art teachers trying to instill in their students.

Stretch and Explore

Of course, there is no art without innovation. Even children’s drawings are innovative. “One may have seen thousands of children’s drawings,” Arnheim writes, “but one never ceases to be struck by the inexhaustible originality of ever new solutions to the problem of how to draw a human figure or an animal, with a few simple lines” (Arnheim, 1969, p. 257).

How do teachers foster innovation and originality? We observed teachers do so by encouraging students to try new things, risk making mistakes, and learn to profit from their mistakes. When teachers encourage students to stretch and explore, they do not tell students exactly what to do. Instead, they urge students to experiment, to discover what happens, to muck around, and try out alternatives. Comments such as “See what would happen if...”, “How else could you have done this”, and “Don’t worry about mistakes, be brave” were all ones prompting students to adopt an exploratory risk taking attitude and discover that instead of avoiding mistakes one should capitalize on them. As our painting teacher said, “You ask kids to play, and then in one-on-one conversation you name what they’ve stumbled on.”

Arnheim reminds us that art, even realistic art, always involves interpretation. And whenever there is interpretation, there is creativity and invention. “Since the shapes of art do not primarily bear witness to the objective nature of the things for which they stand, they can reflect individual interpretation and invention” (Arnheim, 1969, p. 300).

Engage and Persist

Teachers in visual arts classes present their students with projects that engage them, and they teach their students to persist in their work and stick to a task for a sustained period of time. Thus, they are teaching their students to focus and develop inner-directedness. They teach them to break out of ruts and blocks and to feel encouraged about their work so that they are motivated not to give up. This habit of mind is taught first and foremost by presenting students with challenging projects that engage them and require sustained work. But, this habit is also taught by reminding students to stay focused, by pushing students to keep going, and by discouraging students from quitting. As one of our teachers said, she teaches them to learn “how to work through frustration.”

Understand Art World

Students in visual arts classes learn about art history and the practicing art world today and their own relationship to the art world. They also learn to see art making as a social and communicative activity. We called all of this learning Understand Art World and broke this learning into two components: Domain and Communities.

Domain

Students are meant to learn about the domain of art. Although art history is not taught in a systematic fashion in studio arts classes, teachers often ask students to look at reproductions of works of art that relate in some way to the project in which students are engaged. Students are meant to learn about their own relationship to the domain of art and consider the similarities between the problems explored in their own works and those explored by established artists. For instance, when students were engaged in drawing two figures standing far apart separated by an evocative lonely space, our drawing teacher asked them to study the same kind of atmosphere evoked by Diebenkorn and Hopper paintings.

Communities

Students are meant to learn about the community of people and institutions that shape the art world—the “field” of art (Csikszentmihalyi, 1988). By this we refer to galleries, museums, curators, and gallery owners. These gatekeepers decide whose
work will be exhibited and immortalized. Students are taught to think about their relationship to the art community and to consider ways that they might fit into this community if they want to become professional artists. They must learn how to present themselves as artists (e.g., by matting and framing their work, making slides, creating a portfolio, or hanging a show). All of these activities are ways in which students learn to become part of the profession of artists, if this is to become their career choice.

The community component of Understand Art World also refers to learning to work collaboratively with peers on group projects, as well as learning from others’ work.

Do the Studio Habits of Mind Transfer?

Many of the habits of mind described above are important in a wide range of disciplines, not only in the visual arts. Students must learn a great deal about tools and materials in a science lab, and this kind of learning is analogous to developing craft in the art studio. As Arnheim (1969) wrote (mentioned earlier), both the study of art and of science require precision, and precision is at the heart of technique. The skills of observation and envision are clearly important in the sciences and Arnheim is a strong voice for the development of these skills so central to visual literacy. The skill of reflection (including self-evaluation) is important in any discipline; and if the arts are a form of problem solving, as Arnheim believes, then reflection must be central to the arts because one cannot solve a problem without the ability to reflect, to become aware of one’s goals, one’s decisions, and without the ability to judge what works and what does not work. Dewey, in Art as Experience (1969/1934), makes a similar point about the cognitive and reflective aspects of art making when he writes that

...because the artist is controlled in the process of his work by his grasp of the connection between what he has already done and what he is to do next, the idea that the artist does not think as intently and penetratingly as a scientific inquirer is absurd. (p. 360)

The skills of what we refer to as engage & persist and stretch & explore are clearly important in any endeavor: students need to learn to find problems of interest and work with them deeply over sustained periods of time, and to experiment and take risks. Perhaps the least general of the eight habits of mind are express and understand art world. Yet, even these might have broader reaches. Clearly learning to express is often important in any kind of writing that one does, even in analytical nonfiction. And understand art world may be more broadly construed as learning to see links between what one does as a student in a particular domain with what professionals in that domain do.

If a habit learned in the arts is a general one that would be useful in other domains, it does not follow that this habit transfers to other domains. The transfer hypothesis remains to be tested, but it is a plausible one. Arnheim warned us to beware of making claims about the effects of the arts on human development without basing these claims on research. “If we hear that the arts develop and enrich the human personality and cultivate creativity,” he writes, then “we need to know whether they do so better than other fields of study and why” (Arnheim, 1969, p. 296). Before claiming that the arts are the best or only way to develop values and creativity, then, we must compare the effects of studying the arts with the effects of studying the sciences. Similarly, we must not make claims that what one learns from the arts transfers to the study of other disciplines, even though it would seem to be so, before really studying whether such transfer happens.

In conclusion, we have argued that the transfer hypothesis has not yet been proven. Better-designed studies, based on what is known about what is actually learned in the parent domain of the arts, and testing plausible transfer hypotheses, may eventually provide support for specific types of transfer. We carried out what we believe is the first necessary step toward better transfer studies, to demonstrate what is learned in the parent domain. The question of whether studying the arts improves nonarts skills is of interest to the cognitive psychologist, but should never be used as a justification for funding the arts in our schools. This utilitarian view is peculiarly American, and is far more rarely encountered in Canada, Europe, and Asia. We believe that our Studio Thinking study demonstrates that the visual arts inculcate basic skills in perception and cognition that exist both in the arts and sciences. All of the skills we describe can, with some modification, be transferred to the science laboratory. And this is Rudolf Arnheim’s (1969) thesis in Visual Thinking: Visual thinking is everywhere.

In an interview in Vogue Magazine (Nov. 1, 1956), Picasso was quoted as saying, “I have a horror of people who speak about the beautiful. What is the beautiful? One must speak of problems in painting! Paintings are but research and experiment. I never do a painting as a work of art. All of them are researches.” Arnheim, too, writes that art making is a matter of continual experimentation and problem solving. This is the essence of what we saw teachers teaching in our study of Studio Thinking. The art teachers we studied were not versed in the writings of Rudolf Arnheim. Yet, the way they approached the teaching of the visual arts was completely consistent with the spirit of Arnheim’s writings. Studying the arts is serious; studying the arts requires visual thinking.

In 1987, I deliberately carried out an experiment to test two of Rudolf Arnheim’s claims about visual balance. By now, over 15 years later and three decades after I encountered the work and person of Rudolf Arnheim, I discover that my research has been fundamentally shaped by his wisdom. When I embarked on my study of Studio Thinking, I did not realize that I was working in Arnheim’s shadow. Yet, in reflecting about what I owe to Rudolf Arnheim, I realize, gratefully, that this research project (along with many others that I carried out), was born from the privilege of having known Rudolf Arnheim in person and in print.

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Received September 14, 2006
Revision received September 14, 2006
Accepted October 10, 2006

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