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Cognitive Theory—An Element of Design for Arts Education

SANDRA KAY

As perception is basic to intelligence, the arts are basic to education.

My recent trip to Australia prompted the president of the local college to ask, "What impressed you most about Australia?" Without hesitation, I answered, "The eloquent, almost choreographed movements of the aboriginal people." The surprised reaction elicited further response.

Perhaps it was the performance at the Kurunda Aboriginal Theatre that heightened my sensibilities to the fact that the movements of these people exhibited exceptional muscle control. Even outside the theatre and in other towns, I would see an aboriginal standing and talking and watch as only one muscle would move in the face, eliciting a response from the other person. Or I would catch the graceful way that another aboriginal would change his position—not directly as we do, but in a series of steps that almost rippled down the body. The theatre experience brought an awareness of the tight bond that still remains between these people and their natural environment—a possible cause of the exceptional quality of movement I had observed. The college president smiled, stating, "It takes an artist to notice things so carefully."

For two reasons, that comment still haunts me. First, observation is as much a tool for scientists as it is for artists. Was it not Darwin's copious notes of botanical and animal observations—taken on a voyage around the world—that brought his thoughts to theory? Whether we are traveling in the laboratory or in the classroom, for that matter, is it not careful observation that guides our thoughts or insights?

It took me longer to realize the second reason for the haunting effect of that comment. Ten years spent as a high-school art teacher and six years in elementary education has brought—among the countless moments of joy—moments of concern and despair. At the high-school level, art is considered a discipline. Although not often thought of as an *academic* discipline, art is considered to have merit as a career avenue for those with ability or as a course offered to allow students an opportunity for creative expression—substance for the soul rather than for the mind, so to speak. At the elementary level, schools fortunate enough to have an art and/or music teacher often schedule arts classes to allow the classroom teachers the preparation period required by contract. This structure, as well as various other examples, reflects the underlying value system placed on arts education in society. The arts are not considered basic to education by those outside our world. This cry is not new. But in an attempt to understand why this is so, a historical perspective based in psychology—the global parent of all educational practice—may provide some useful light.

Most art educators have a basic awareness of psychology. Most become aware of developmental psychology through Viktor Lowenfeld's work and of the gestalt psychologist's palette through the work of Rudolph Arnheim.[1] Yet, most arts educators do not have an in-depth historical perspective of the field that guides many decisions in our present educational system. This knowledge base and its language, woven with the knowledge that we art educators usually own, may provide the fabric necessary to form a better future for arts education. This paper outlines major aspects of the psychological knowledge base, defines a critical policy issue for art education, and suggests the next steps for higher education in addressing the cognitive theory and art education connection.

Practice and Theory

The haunting quality of the college president's comment about "noticing" led me to realize that present educational practice dismisses perception as a requisite skill for learning—except in arts education.[2] In fact, it seems that the emphasis on visual, auditory, or kinesthetic perception is what distinguishes arts studies from other studies. At the midpoint of a child's first-grade year, the curriculum has already begun to lean more and more heavily on verbal material, quite often foregoing other kinds of sensory learning. Any first-grade teacher will admit that the demands of the curriculum lessen the time available for artistic activities.

The use (and misuse) of intelligence quotient (IQ) scores is also part of the problematic picture. Originally, intelligence tests were designed to measure abilities classified as verbal (a facility with words); qualitative (a facility with numbers); and spatial (a facility with visual, auditory, and tactile perception). Today, if the three elements represented in the IQ test are reported separately, they are classified as verbal, quantitative, and nonverbal scores. Words such as *figural*, *kinesthetic*, *perceptual*, or *spatial* were used to describe the "nonverbal" abilities measured by the early tests. Although the intelligence tests of today contain portions that assess perceptual skills such as spatial relations or visual acuity, the term *nonverbal* is used to describe all perceptual, spatial, and any figural subtests. The abilities defined within nonverbal intelligence are an area of concern (or interest) for art teachers. The term *nonverbal* itself indicates an educational bias. Fortunately, this bias is currently under scrutiny.[3] Let us look further at what is currently called nonverbal intelligence with a view to seeing its connection with policies for art education.

The bridge between cognitive theory and practice in art education must be built with several materials. First, a brief historical perspective of the research conducted about nonverbal intelligence is necessary. Then I will consider the link between cognitive research and art education in the light of knowledge about perception. Many researchers in psychology are intrigued by the perceptual nature of spatial ability and the role that perception plays in thought processes. In presenting a framework of information on cognitive theory, this article promotes a multilingual approach to the preparation of educators in the arts. Knowledge of the psychological language that is used by all others involved in education (both research and practice) encourages communication. With a historical perspective of what has been, we are more capable of appreciating where we are as well as determining where (in the educational picture) we want to be. When we use our knowledge in combination with psychological knowledges and languages, we are equipped to develop wise policy.

Aristotle, Plato, and their successors identified imagination as separate from both sensory perception and intellect.[4] Early theoretical attempts to demonstrate a relationship between perception and cognition were unsuccessful.[5] Charles Spearman's work provided the initial empirical support for making a strong link:

> Concordantly with this analytic result, the correlations which we have been meeting in this chapter would seem to demonstrate that sensory perception even of the simplest kind—such as the bare discrimination of tones—does beyond all doubt involve g.[6] And this is all that for the present we need to know. As to whether anybody chooses to admit—or still to deny—that sensory perception involves "intelligence,"

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this seems to have become a mere matter of words.[7]

Spearman did not, however, contribute to the current belief in a relationship between mental imagery and perception or intelligence. In fact, he thought the faculty of imagination was highly overrated.[8] The first reference to visual imagery as a factor in perception is found in the work of A. A. H. El Koussy.[9] Through observations and introspective reports, El Koussy found some of the spatial tests to involve a previously unexplained factor: "Thus the ability to obtain and the facility for utilizing visual spatial imagery provide the explanation for the *K* factor."[10] The *K* factor was considered to be a perceptual factor. El Koussy found evidence to support the belief that "those spatial tests that involved a group factor over and above their '*g*' content" defined this group factor.[12]

Spatial Ability as a Factor in Intelligence

The difference between the study of spatial perception and the study of spatial ability has been attributed to the respective differences between the disciplines of experimental and differential psychologists.[12] The basis for the thread of agreement currently existing between the two is an acceptance of the fact that without spatial perception, spatial ability would not exist. As noted earlier, this has not always been the case.

Historically, the concept of spatial ability as a factor in intellectual ability has had many theoretical as well as operational definitions. The schism between the general-ability (*g*) view of intelligence proposed by the British (e.g., Spearman) and the characteristically American distinction between separate abilities (e.g., Thurstone) reflects one of the many issues that prevents a common interpretation and definition of spatial ability.[13] The misconception that a figural test, by its nonverbal format, would necessarily qualify it as a spatial measure adds to the confusion in the early literature. Continuing our review, let us consider three phases of research history concerning spatial ability.[14] Phase 1 established the existence of a spatial-ability factor over and above a general-ability factor. Seeking distinctions between different spatial abilities defined a second phase of research activity. The third phase was characterized by efforts to identify the significance and relationship of spatial ability within the context of other abilities.

Phase 1 (1904–1938)

The identification of a spatial factor over and above the *g* factor had a tumultuous beginning that is perhaps best understood in light of the magnitude and value placed on Spearman's contributions to our knowledge of intellectual abilities. Spearman defined spatial ability in terms of spatial perception, specifically the perception of spatial relations. His contribution to the acceptance of perception as an integral part of general ability should not be underrated.[15] However, this was the extent to which Spearman viewed the contribution of spatial ability.

A greater understanding of the complexity involved in separating a spatial factor from a general factor can be obtained by reviewing the formats of the tests used to measure abilities during this early phase of research. Even slight changes in testing format can alter the factorial composition of a test.[16]

A simplified explanation of the research method known as factor analysis may help the reader who is unfamiliar with the psychometric technique often used to analyze tests. Factor analysis is a statistical method of separating subtests or test questions into categories called factors. A factor represents (or contains) items that have the same underlying structure. If done well, the underlying structure of the test (or tests) being analyzed will reveal the cognitive ability required by the test.

A factor analysis is often used to determine if the questions on a test (or a combination of subtests) actually measure the ability that they are supposed to measure. Sometimes it is used to determine what abilities are measured by the test. If an examiner alters the directions given to a subject taking a test (or changes the format in some other way), the examiner could easily, yet unknowingly, change the ability being measured. Most analyses yield more than one factor. A change in the format of the test could change its composition so that the test falls under a different factor than the factor that it would be categorized with if the original directions had been followed.

Three different formats characterized intelligence tests. Because the ability to read and write were (and are) highly valued as the basis of scholarship, most subtests employed a verbal format. Nonverbal or figural subtests were considered useful as a means of measuring perceptual skills or as an alternate format for determining an ability to educe relationships.[17] Performance tests in which a subject copied or constructed an item were also considered measures of *g*, although more unreliable than the other two test formats.

The first evidence to support the concept of a space factor was provided within the context of El Koussy's study. El Koussy recognized the confusion resulting from the fact that, depending on the researcher, the same tests were identified as measuring different abilities.

> Tests, involving spatial fundaments and probably spatial relations, are sometimes used as tests of "general intelligence," while at other times they are used for measuring "form sense," practical ability, imagination and inventiveness. Some industrial psychologists, on the other hand, construct such tests with the object of measuring special ability of spatial perception, presumably a factor of great importance in mechanical and other abilities.[18]

El Koussy conducted a comprehensive study by administering a battery of seventeen spatial tests (with nine reference tests for verbal, perceptual speed, and pitch and loudness discrimination) to 162 boys ranging in age from eleven to thirteen. The results implied a tendency for only some of the spatial tests to form a group factor in addition to the *g* factor. He labeled this group factor *k* (for kinesthetic) and defined it as "the ability to obtain the facility for utilising visual spatial imagery."[19] The definition was based on introspective reports from research subjects indicating that they employed mental imagery as the problem-solving technique, imagining the solution through mental pictures. Unfortunately, El Koussy had assumed that because these tests were all figural, (i.e., relating to objects noticeable only as a shape or form), they were necessarily spatial in nature. Further research confirmed the inaccuracy of this assumption.[20]

Confirmation of a factor that involved visual imagery emerged from Thurstone's classic Primary Mental Abilities (PMA) study.[21] Fifty-six tests were administered to 218 adult volunteers. Of the twelve rotated factors produced from the factor analysis, Thurstone labeled nine. Ordered by clarity of interpretation, the factors identified were: Space, Perceptual, Verbal relations, Number, Memory, Word fluency, Induction, Reasoning, and Deduction. The space factor was defined as a "facility in spatial or visual imagery."[22] The perceptual factor was defined as "a readiness to discover and to identify perceptual detail."[23] Questions concerning the nature of this perceptual factor involved issues of whether perceptual speed or perceptual accuracy defined the factor.

This led Thurstone to conduct another study in which twenty-seven timed tests were given to 215 students at a technical high school.[24] In his initial investigation, Thurstone assumed that the ability to visualize images was different from the "space reasoning factor."[25] The factor analysis negated this first assumption, causing Thurstone in the second study to assume "that visualizing flat space, visualizing solid space, and visualizing movement in solid space were different abilities."[26] The tests were constructed to test this assumption. Again, the a priori assumption was not supported by the results of the factor analysis. Similarities in factor loadings of the tests used in both studies strengthened Thurstone's belief in the existence of a space and perceptual factor. Thurstone's PMA study is of major importance to the work in spatial ability. It established the position that the phenomenon of visual imagery was a part of a spatial factor (in the United States; researchers in England took another position).

Phase 2 (1938–1961)

Acceptance of a spatial factor led to "investigations into the extent to which spatial factors differ from each other,"[27] which characterize the second phase of research on spatial ability. Several large-scale investigations and many new pencil-and-paper tests were designed during this stage. The tests resulted in far more confusion than clarity. Most of this activity occurred in the United States. Once a spatial factor was acknowledged in Britain, it was designated at a second level in British hierarchical models.[28] Cyril Burt's work in distinguishing between *g* and practical factors placed practical abilities as central to intellectual functioning (the term *practical* described abilities assumed and write were (and are) highly valued as the basis of scholarship, most subtests employed a verbal format. Nonverbal or figural subtests were considered useful as a means of measuring perceptual skills or as an alternate format for determining an ability to educe relationships.[17] Performance tests in which a subject copied or constructed an item were also considered measures of *g*, although more unreliable than the other two test formats.

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In the United States, the onset of World War II brought a need for new measures to screen large numbers of people for classification in military assignments. A concern for the identification of personnel capable of flying and maintaining aircraft led to many new tests and the largest set of investigations into the nature of spatial ability.[32]

In 1951, John W. French reviewed the military research and earlier investigations on visual and spatial factors.[33] Although that body of research led to many different conclusions, French found evidence to support the existence of at least three separate spatial factors: (1) a spatial relations factor that involved the ability to perceive and compare spatial patterns accurately; (2) a spatial orientation factor that, although in need of further classification, appeared to represent an ability to remain unconfused by the presentation of various orientations of an object; and (3) a visualization factor that represented the ability to manipulate objects in the imagination or to comprehend imaginary movement in three-dimensional space.

Although similarities implied an underlying structure in French's review of the research, researchers differed on the number and nature of the abilities. Confusion as to the specific nature of spatial abilities had reached a peak.

Phase 3 (circa 1961–present)

The unsuccessful attempts to specify the distinction between spatial abilities when singled out for study may have been the cause of the third phase described by John Eliot.[34] This phase is characterized by efforts to identify the status of spatial abilities within the context of their relationship to other abilities, a decline in the number of large-scale investigations conducted, and a focus on studies aimed at determining possible sources of variance in performance on spatial tests.[35]

Research in the area of spatial ability is just beginning to demonstrate the lack of knowledge, as well as the implied importance that new knowledge will bring to an understanding of this domain of intelligence. The term *spatial ability* is now often used to represent a complex group of abilities that are not clearly defined and whose interrelationships are unknown.[36] With this historical survey as background, let us now turn to what is known and thought about spatial ability and how this knowledge relates to art education.

The Perceptual Nature of Spatial Ability

We know that perception plays a role in the construct of intelligence. This fact was established about sixty years ago.[37] Although not yet clearly delineated, that role does appear to share a relationship with the intellectual abilities classified as spatial abilities. A closer look at scientific perceptual theories will return us to a more familiar knowledge base—although from a slightly different perspective.

Theories of Perception

Three different perceptual theories contribute to the description of visual perception in our natural environment. (The theories do not concentrate on the perception of pictures or of two-dimensional media, which is slightly different. These theories are biological in nature.) A review of these systems will precede a discussion of group and individual differences in perception.

Direct registration. The first complete system of perception is attributed to J. J. Gibson,[38] who noted that perception relies on memory and past experience for interpretation of current perceptions. Gibson also identified thirteen varieties of perspective that, like the vowels and consonants of our vocabulary, describe elements of "sensory shifts" that contribute to our perception of the visual environment.[39] Each observation consists of a number of these elements that work together to provide information.

Edward T. Hall classifies Gibson's theory into four distinct categories: (1) perspective of position (texture, size, and linear perspective—all of which change as a function of distance); (2) perspective of parallax (binocular and motion perspective); (3) perspectives independent of the position or motion of the observer (aerial perspective or the perspective of blur); and (4) depth at a contour (completeness or continuity of outline and transitions between light and shade exemplify this category).[40]

Noting that artists use these elements to relay information about the natural world on a two-dimensional surface, Gibson believed that these elements of perception were equally informative in translating both our pictorial and our natural environments. In fact, he conducted an experiment to see if a picture could fool the eye and appear to be real. He found support for his hypothesis. The technique used by Gibson is known in art as *trompe l'oeil* and has a history of success that can be traced to Michelangelo's work on the Sistine Chapel in 1508.[41] Critics of this perceptual theory found many problems with Gibson's experiment, as well as with the objective (nonsubjective) nature of this theory.[42]

Constructivist. Basically, constructivist theory states that all perception is subjective, that "our brains make the images that we think we 'perceive.'"[43] The concept of "unconscious inference" as a mechanism for deciphering the limited information that reaches the retina of the eye is attributed to Hermann von Helmholtz, a nineteenth-century German physicist and physiologist.[44] Perception is viewed as a subjective interpretation or a matter of guesswork on the part of the observer. It is previous knowledge of what has been seen or what is expected that directs the perception upheld by the viewer. The perceiver projects this past knowledge onto the present situation.

"Perception is not determined simply by the stimulus patterns; rather it is a dynamic searching for the best interpretation of the available data."[45] Experience is believed to affect perception. Optical illusions support this theory. Images that can be viewed several ways illustrate how different perceptions can emerge from the same pattern of stimulation. The alternating figure-ground images—such as the well-known Necker Cube or the image that can be read as a white urn alternating to an image of two black heads (profiles facing each other)—serve as supporting evidence to these theorists.

Cultural differences in the perception of pictorial representations are attributed to this theory, for the representation in a picture is also laden with the visual language of a particular culture.[46] As the direct registration theory focuses primarily on the objective qualities of perception, constructivist theory relies heavily upon a subjective focus on perceptual skills.[47]

Gestalt

> In the essay that gave gestalt theory its name, Christian von Ehrentels pointed out that if each of twelve observers listened to one of the twelve tones of melody, the sum of their experiences would not correspond to the experience of someone listening to the whole melody. Much of the later experimentation of the gestalt theorists was designed to show that the appearance of any element depends on its place and function in an overall pattern.[48]

In more familiar terms, the whole is greater than the sum of its parts. Rudolph Arnheim extended gestalt theory to include the perception of pictures, but gestalt principles of perceptual organization have been acknowledged as a major contribution to perceptual theory.[49]

The most noted of these organizing principles, the principle of simplicity, depicts the tendency for the perceptual system to group objects into simple units or patterns. For example, an evenly spaced row of six dots has a simpler gestalt than the random placement of four dots.[50]

As implied by the previous examples, the gestalt theory of perception combines an objective reaction to the information obtained by the senses with an organizing set of principles. These work together to shape the knowledge one obtains in a given situation, even a novel one.

Group differences. Whereas scientific theories of perception seek similarities between the rules governing the perception of the natural environment and pictorial representations, anthropological research has focused on the perceptual differences found between groups, especially with regard to pictorial representation. Although perception is considered a part of mental abilities

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Group differences. Whereas scientific theories of perception seek similarities between the rules governing the perception of the natural environment and pictorial representations, anthropological research has focused on the perceptual differences found between groups, especially with regard to pictorial representation. Although perception is considered a part of mental abilities by psychologists, most anthropological studies take the position that perception is actually guided by one's physical and cultural environment, therefore defining perceptual habits as culturally discrete.[51]

Specific environmental characteristics of several groups have led to the conclusion that the natural environment does dictate perceptual organization. Studies of people living in dense forests find that, because of the density of their natural environment, perceptual clues of distance are not well understood. When removed from their environment and shown distant objects, these people perceive that the objects are small rather than far away.[52] As another example, the world of the Zulus contains few sharp edges or straight lines. Huts and doorways are round and gardens are plowed in curves. Because of this dearth of examples, Zulus lack understanding of a linear orientation toward perspective.

The pictorial qualities of ability measures and educational materials are of great concern to anthropologists because pictorial cues are perceived and organized differently in different cultures.[53] These cues must be picked up correctly if pictorial material is to communicate its original intent. For example, size reduction in Western cultures is used as a clue for depth or distance. In pictorial representation in many African cultures, size is relative to importance, not distance. As a result of an anthropological study that identified this difference in perception, industrial health and safety poster designs were revised to communicate their information to Bantu workers in South Africa. Various representational conventions have been examined by anthropologists, including depth perceptions and foreshortening, symbolism, object position, shadow and texture effects, details, art style, and multistage pictorial art. Different cultures see and interpret these things in different ways.

Also noteworthy is the fact that the perception of space differs significantly between Western and Eastern cultures. The most pertinent example is cited by Hall: "In the West, man perceives the objects but not the spaces between. In Japan, the spaces are perceived, named, and revered as the ma, or intervening interval."[54] Space around an object is not ignored in western perception; rather it is considered "negative," as the space containing an object is considered "positive." A subtle difference in value is implied in the terminology, a significant difference is found in the actual perception of space.

Although more research could be cited, this summary confirms that the act of perceiving sensory information is a complex process; that for most species, perception is a tool of survival; and that the biological, cultural, and personal characteristics of an individual appear to affect his or her sensory receptors, creating the potential for individual differences to occur from the most basic to the broadest cultural level. Most important, the connection between the reception of information obtained by the senses and the role of perception in intellectual ability must be considered. This is a fertile area of research for a field well equipped with a visual language and an interest in learning.

The Visual Arts and Perceptual Skills

> At first blush it would seem to be an exaggeration to think of artists as being engaged in the Study of Psychology. And yet, even though artists do not pursue psychological research in laboratories, or perform experiments, or report data, they explore the mysteries of the mind by other means. . . .
>
> Most schools of art are not based on a single discovery, but on a number of advances in the science of engendering particular experiences in the viewer by visual means. Some of these advances are in the realm of perceptual processes (such as the discovery of perspective by Bruelleschi and its formalization by Alberti, or the discovery of pointillist color mixture by Seurat . . .).[55]

The visual arts have informed the world of science on the nature of perception throughout history. The work of visual artists has been acknowledged and used as exemplars by scientists to define or support perceptual theory.[56] Artists must master the visual language to guide viewers' perceptions eloquently. As artists, we strive for this mastery. Yet as art educators, we do not adequately translate from a visual to a verbal language. We are thus not well understood by other educators. We have insufficient training in the verbal language (or concepts) of psychology—which remains the foundation for policies and practice in education.

Several trends in current research and practice indicate that the present holds an opportunity to advance communication between psychology, the visual arts, and art education. In research, many are attempting to answer questions regarding spatial ability. (The hypothesized link between creative thought and spatial ability fuels this fire.) Too few are equipped with a background in figural language (articulately communicating with a form that is not within the symbol systems of letters or numbers). Current research on renowned creative scientists and their backgrounds in art supports the position that the thought processes employed in the making of art are not unlike the creative thought processes employed in other disciplines.[57]

At a more elementary level, there is a return to a concept of learning that considers perceptual skills integral to all academic advancement. Note the emphasis on learning mathematics with manipulatives, science labs, and a whole-language approach to language-arts curricula currently underway in elementary education.[58] For an even more direct application, see the New York State curriculum for adaptive physical education, a remedial program developed to assist students with gross-motor and auditory perception difficulties. The rationale of this curriculum delineates the link between these perceptual/motor skills and academic progress. The fine-motor and visual perception skills developed in a basic art curriculum should be recognized, acknowledged, and acted upon. What is needed to make this happen?

The Educational Policy Issue

Let us begin with a quote from Arnheim: "Much of the later experimentation of the gestalt theorists was designed to show that the appearance of any element depends on its place and function in an overall pattern."[59] If we consider art the "element" and education the "overall pattern," then art (along with music, dance, theatre, literature, etc.), in terms of its function as defined by cognitive theory, has a strong intellectual and academic standing. Philosophers have long recognized art as thought,[60] yet this idea does not have much presence in educational practice. And so, the educational policy issue needs to address the relationships between psychological research, philosophical understanding, and educational practice. When this relationship is maximized, art education is empowered to make a significant contribution to the general education of students and to the remediation of problems in the educational delivery system.

The Role of Higher Education

Higher education has a special role to play in the connection between psychology, art, and art education. When the need to develop purposeful communication with other educators is recognized, suggested recommendations will concern the areas of teacher education, curriculum development, research, and educational policy development.

Teacher education

Three recommendations can be made in this area. All three involve directing the coursework of potential art educators toward a more comprehensive understanding of their role (including their potential contributions) in the field of art education. First, the history of art education could be taught within the context of general education. Teacher preparation that focuses only on an isolated historical perspective of art education does not serve as a commonality between art educators and all others in the field of education. Second, a course in the language and customs of educational psychology is highly recommended. General knowledge in the psychology of learning and thinking should be a requisite for everyone preparing to teach. For art educators, the course must emphasize the domains of spatial ability and nonverbal intelligence. Familiarity with the history, theories, and measurements (IQ tests, etc.) that color the educational world will help art educators to communicate with educators/administrators outside the field. Most importantly, art educators would have a common paradigm in which to view cognitive development through education in the arts. Third, a course on perception should be required of all art education students. A course combining a visual-arts, biological, and anthropological perspective on the topic of perception would be valuable and interesting for many individuals. I suggest it is essential to art educators. Whether dealing with the issues related to the cultural diversity of perception or with the many issues of learning that are embedded in the visual perception of both images and words, the content and procedures that take place in an art room lend themselves to a position of leadership in the education and/or development of these skills.

Curriculum development

Equipped with the background knowledge outlined above, art educators (especially those in higher education) may take leadership in at least three directions with regard to curriculum development. First, units of study that directly address skill development in the area of spatial ability lend themselves to an elementary art curriculum. The nonverbal aspects of cognitive ability, such as spatial ability and perception, are prerequisite skills to successful explorations in making art.

Second, there are gaps to be filled in the development of curricula that address both remedial needs and situations that call for acceleration and enrichment. An "adaptive art" curriculum can take a form similar to the adaptive physical education model described earlier. Similarly, the field of gifted education requires (and has requested) assistance in identification procedures and program needs for the artistically gifted.

In a third direction, the topic of perception applies to curriculum development in the area of multicultural diversity. As we head in the direction of a global society, we need to address the underlying similarities and differences among different cultures. The communicative power of fine art is not bound by the time period in which it was conceived or by the culture from which it evolved. This quality, combined with a scientific perspective on perception, can make art education a major contributor to future trends in education. More specifically, providing evidence of the cultural variations of perception that influence the aesthetic of a culture would give art educators another valuable expertise. Through informed involvement, art educators could demonstrate the value of art as a means of appreciating the multicultural diversity that is integral to a global society and affects individual learning—issues critical to all aspects of growth in the field of general education.

Research

A focus on what is known about cognition will highlight the areas that remain uncharted. Responsibility for research is considered one of the roles of higher education. Classroom art educators who are equipped with a very basic awareness/understanding of scientific research methods can assist those in higher education to collect important information from their classrooms. Art rooms are generally untapped as a resource. They hold a wealth of information regarding learning theory (including the development of creative thought) and cognitive development (especially in the realms of perception and spatial ability). A recommendation for those in higher education is either to become involved in assisting others or to become equipped to explore these uncharted areas scientifically. Dialogue between scientists and artists has a history, yet this does not apply to those involved in education in these disciplines.

Educational policy development

Whether intentionally or not, education in the arts is differentiated from that in other disciplines by the underlying paradigm that guides attitudes and instruction in art education. No doubt the differences are critical and noteworthy. The position proposed here, however, also includes in our paradigm the foundation of similarities between general education and art education. As the affective needs of an individual are met by experiences in art and address a critical difference between art education and general education, the intellectual or cognitive development of an individual is also addressed by art education and serves as a bridge (or similarity) between our field and general education.

If these similarities are comprehensively attended to, the position of art education in the world of education could be changed. As perception is basic to intelligence, the arts are basic to education. Although we know this, our field has had difficulty in communicating the knowledge to others. By attending to the issues merely outlined in this paper, those in the field of art education could develop fluency in a language that can be heard and understood by others.

Notes

1. Viktor Lowenfeld and W. Lambert Brittain, *Creative and Mental Growth* (New York: Macmillan, 1957); Rudolph Arnheim, *Visual Thinking* (Los Angeles: University of California Press, 1964); and Idem, *Art and Visual Perception* (Berkeley: University of California Press, 1974).

2. Although recently early childhood education has reemphasized the value of developing perceptual skills.

3. The current work of Howard Gardner refutes this perspective, as do the writings of I.M. Smith and J. Dixon.

4. Charles Spearman, *The Abilities of Man* (New York: Macmillan, 1927), 32.

5. Alexander Bain, *The Sense and the Intellect* (London: John W. Parker and Son, West Strand, 1855).

6. *g* is Spearman's symbol for a general intellectual ability. He felt that the separation of abilities was unnecessary—that verbal, quantitative, and nonverbal subtests measure the same general ability—just in different ways.

7. Spearman, note 4 above, 184–85.

8. Spearman, note 4 above; and Idem, *The Creative Mind* (New York: Appleton, 1931).

9. A. A. H. El Koussy, "The Visual Perception of Space," *British Journal of Psychology* (Monograph Supplement) 20 (1935): 1–80.

10. Ibid., 84.

11. Ibid., 86.

12. John Eliot and Anna Hauptman, "Different Dimensions of Spatial Ability," *Studies in Science Education* 8(1981): 45–66.

13. Spearman, note 4 above; and L. L. Thurstone, "Ability, Motivation, and Speed," *Psychometrika* 2(1937): 249–54.

14. Eliot and Hauptman, note 12 above.

15. El Koussy, note 9 above; and Spearman, note 4 above.

16. David F. Lohman, *Spatial Abilities: A Review and Reanalysis of the Correlational Literature* (Technical Report No. 8, Aptitude Research Project) (Stanford, Calif.: Stanford University, School of Education, 1979).

17. Spearman, note 4 above.

18. El Koussy, note 9 above, 6–7.

19. Ibid., 84.

20. Lohman, note 16 above.

21. L. L. Thurstone, "Primary Mental Abilities," *Psychometric Monographs* 1(1938), 1–121.

22. Ibid., 80.

23. Ibid., 2.

24. L. L. Thurstone, "The Perceptual Factor," *Psychometrika* 3(1938), 1–17.

25. Ibid., 11.

26. Ibid.

27. John Eliot and Ian Macfarlane Smith, *An International Directory of Spatial Tests*, vol. 8 (Windsor, Great Britain: Nfer-Nelson, 1983), 3.

28. Eliot and Hauptman, note 12 above; Lohman, note 16 above; and Ian Macfarlane Smith, *Spatial Ability* (San Diego, Calif.: Robert R. Knapp, 1964).

29. Eliot and Hauptman, note 12 above; and Smith, note 28 above, 54.

30. Philip Ewart Vernon, *The Structure of Human Abilities* (London: Methuen, 1950), 39–40.

31. Smith, note 28 above, 299–300.

32. Eliot and Smith, note 27 above; Lohman, note 16 above; and William B. Michael et al., "The Description of Spatial Visualization Abilities," *Educational and Psychological Measurement* 17(1957): 185–199.

33. John W. French, "The Description of Aptitude and Achievement Tests in Terms of Rotated Factors," *Psychometric Monographs* 5(1951), 1–287.

34. Eliot and Hauptman, note 12 above; Eliot and Smith, note 27 above.

35. Eliot and Smith, note 27 above.

36. Dennis E. Egan, *Characterizing Spatial Ability: Different Mental Processes Reflected in Accuracy and Latency Scores* (Research Report No. 1250) (Pensacola, Fla.: Naval Aerospace Medical Research Lab, August, 1978); Idem, "Testing Based on Understanding: Implications from Studies of Spatial Ability," *Intelligence* 3(1979): 1–15; Eliot and Hauptman, note 12 above; and Lohman, note 16 above.

37. El Koussy, note 9 above; Spearman, note 4 above.

38. Edward T. Hall, *The Hidden Dimension* (Garden City, N.Y.: Doubleday, 1966); Ulric Neisser and Nancy Kerr, "Spatial and Mnemonic Properties of Visual Images," *Cognitive Psychology* 15 (1973): 138–50; Michael Potegal, ed., *Spatial Abilities Development and Physiological Foundation* (New York: Academic Press, 1982).

39. J. J. Gibson, *The Perception of the Visual World* (Boston: Houghton Mifflin, 1950).

40. Hall, note 38 above, 179–82.

41. Ralph Mayer, *A Dictionary of Art Terms and Techniques* (New York: Thomas Y. Crowell, 1975), 404.

42. Ellen Winner, *Invented Worlds: The Psychology of the Arts* (Cambridge, Mass.: Harvard University Press, 1982), 86–87.

43. Gregory Bateson, *Mind and Nature* (London: Fontana, 1979), 38.

44. Winner, note 42 above, 89.

45. R. L. Gregory, *Eye and Brain* (New York: McGraw-Hill, 1966), 11.

46. Nelson Goodman, *Languages of Art* (Indianapolis: Bobbs-Merrill, 1968), 39.

47. Winner, note 42 above, 98.

48. Arnheim, note 1 above, 4.

49. John R. Anderson, *Cognitive Psychology*, 2d ed. (New York: W. H. Freeman, 1980); El Koussy, note 9 above; Gregory, note 45 above; Karl Z. Lorenz, *The Role of Gestalt Perception in Animal and Human Behavior* (Symposium on Aspects of Form) (London: Lund Humphries, 1951); and Winner, note 42 above.

50. Winner, note 42 above, 96.

51. Hall F. Duncan, N. Gourlay, and William Hudson, *A Study of Pictorial Perception among Bantu and White Primary School Children in South Africa* (Johannesburg: Witwatersrand University Press, 1973), p. 5.

52. Gregory, note 45 above, 161–62.

53. Duncan et al., *A Study of Pictorial Perception*, note 51 above; and Ruth H. Munro, Robert L. Munro, and Anne Brasher, "Precursors of Spatial Ability: A Longitudinal Study among the Logoi of Kenya," *Journal of Social Psychology* 125(1):23–33.

54. Hall, note 38 above, 70.

55. Michael Kubovy, "The Visual Artist as Avant-Garde Psychologist of Perception," in *Aspects of Perception: Art and Cognitive Science*, ed. Michael Jones (Richmond, Va.: Anderson Gallery, Virginia Commonwealth University, 1982), 48.

56. Bain, note 5 above; Bateson, note 43 above; Gibson, note 39 above; Gregory, note 45 above; Howard E. Gruber, "Emotion and Cognition: 'Aesthetics and Science,'" in *The Arts, Cognition, and Basic Skills*, ed. S. S. Madeja (St. Louis, Mo.: Cemrel, 1978); Hall, note 38 above; Julius Hockberg, "Visual Art and the Structures of the Mind," in *The Arts, Cognition, and Basic Skills*, ed. S. S. Madeja; and Charles Spearman, *The Creative Mind* (New York: Appleton, 1932).

57. Robert Scott Root-Bernstein, "Visual Thinking: The Art of Imagining Reality," *Trans-American Philosophy Society* 75 (1985): 50–67; and "Education and the Fine Arts from a Scientist's Perspective: A Challenge" (a "White Paper" written for the College of Fine Arts, University of California, Los Angeles), 1987; and Eugene Ferguson, "The Mind's Eye: Nonverbal Thought in Technology," *Educational Horizons* 57(1978):42–46.

58. For a direct link between art and writing, see Janet Olsen, "Drawing to Write," *School Arts* (September 1987): 25–27; or Idem, "Envisioning Writing: Toward an Integration of Drawing and Writing" (Ed.D. dissertation, Teachers College, Columbia University, 1989).

59. Arnheim, note 1 above, 4.

60. Arnheim, note 1 above; Bain, note 5 above; Thomas Ewens, "Discipline: Science and Art as Reflective Activities," *Design for Arts in Education* 90(1989): 2–14; Maxine Greene, *Landscapes of Learning* (New York: Teachers College Press, 1978); Susanne K. Langer, *Feeling and Form* (New York: Charles Scribner's Sons, 1953); and Philip Phenix, *Realms of Meaning* (New York: McGraw Hill, 1964).

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