BETTY A. EDWARDS

The Effect of Verbal/Visual Interactions on Drawing Ability

Ability to draw a realistic image of a perceived form is a rare skill among American adults and indeed among adults from many cultures throughout the world. American children begin around age nine or ten to proclaim that they can't draw and that their lack of skill proves that they have no talent for drawing. These children become the adults who say they can't draw at all, not even a straight line.

A widespread assumption about drawing ability is reflected in the children's proclamations: that skill in drawing depends on genetic good fortune and the inheritance of talent. Since most teachers share this assumption, art classes have as a main objective the possible discovery or identification of talented students, who are expected to be very few in number. Because of the negative mind-set of most students – the conviction that they can never learn to draw well – and because of the difficulty of teaching the visual, perceptual skills of drawing, the assumption becomes a self-fulfilling prophecy. In any given drawing class, only one or two or three students will learn to draw skillfully. Those few are designated as the lucky ones, the gifted ones, and the majority of students move on to some other subject.

For other skills, reading, writing, and arithmetic, for example, we make another kind of assumption: all children with normal brains can learn these skills. The question of talent or genetic good fortune is not considered crucial. We simply expect that the majority of students will learn to read, to write, to deal with numbers, and that only a few will fail to learn the basic skills. The skills are deemed important by teachers, parents, and children because they are regarded as forming the very basis for thinking. Consequently, extensive teaching and testing strategies have been developed, and the bulk of the educational system in America is devoted to training verbal and numerical skills. In the educational hierarchy, nonverbal and noncomputational skills such as drawing are almost always ranked as lower-priority.

Recent research, however, offers possibilities for revising widespread assumptions about the role of talent in nonverbal skills and may help to change educators' views about the teachability and value of nonverbal skills. On the basis of the recent research, and confining the following ideas to my own field of drawing and perceptual skills, I propose some new assumptions:

1. That all individuals with normal brains have the capacity to learn to draw a realistic image of a perceived form.
2. That the nonverbal skill of realistic drawing can be taught by teachers and learned by students through use of specifically designed teaching strategies.
3. That the learning of drawing skills is important because such learning increases perceptual skills: in learning to *see* better, the students learn to gain access to the nonverbal mode of thinking and communication.
4. That long and exclusive emphasis on the verbal mode in education may have the effect of diminishing an individual's ability to make cognitive shifts in information-processing mode as required for specific tasks.
5. That the nonverbal mode is important and must be trained because it forms the very basis for a kind of thinking which is qualitatively equal to verbally-based thinking, but which differs in content and method of information-processing.

I will briefly review some of the relevant research, describe an experiment designed to test a strategy for enabling individuals to make a cognitive shift to the nonverbal mode in order to draw a perceived image, and suggest some implications of the experiment.

LATERALIZATION OF HUMAN BRAIN-HEMISPHERE FUNCTION

Many artists have spoken of seeing things 'differently' while drawing a perceived form. This way of seeing is difficult to describe in words but seems to involve a fading away of awareness of time, a profound attentiveness to the thing seen and observed, a sharp alertness to visual configuration and detail, and a sense of grasping relationships hitherto unnoticed.

The mental state or mode described by artists appears to conform with the findings of brain research during the 1960s which defined two major modes of human brain-hemisphere function (Sperry 1968). A brief review of that research follows.

In the brains of animals, the cerebral hemispheres are essentially alike, or symmetrical, in function. Human cerebral hemispheres, however, develop asymmetrically in terms of function. The most noticible outward effect of the asymmetry of the human brain is handedness.

For the past 100 years or so, scientists have known that the function of language and language-related capabilities is mainly located in the left hemispheres of the majority of individuals – approximately 98% of right-handers and about two-thirds of left-handers. Knowledge that the left half of the brain is specialized for language functions was largely derived from observations of the effects of brain injuries. It was apparent, for example, that an injury to the left side of the brain was more likely to cause a loss of speech capability than an injury of equal severity to the right side.

Because speech and language are so closely linked to thinking, reasoning, and the higher mental functions that set human beings apart from the other creatures of the world, nineteenth century scientists named the left hemisphere the dominant or *major* hemisphere; the right brain, the subordinate or *minor* hemisphere. The general view, which prevailed until fairly recently, was that the right half of the brain was less advanced, less evolved than the left half – a mute twin with lower-level capabilities, directed and carried along by the verbal left hemisphere.

A long-time focus of neuroscientific study has been the functions, unknown until fairly recently, of the thick bundle of millions of nerve fibers that cross-connect the two cerebral hemispheres. This connecting cable, the *corpus callosum*, occupies a strategic location as a connector of the brain halves and gives every appearance of being an important structure. Yet enigmatically, available evidence indicated that the corpus callosum could be completely severed without observable significant effect.

Through a series of animal studies during the 1950s, conducted mainly at the California Institute of Technology by Roger W. Sperry and his students, Ronald Myers, Colwyn Trevarthen, and others, it was established that a main function of the corpus callosum was to provide communication between the two hemispheres and to allow transmission of memory and learning. Furthermore, it was determined that if the connecting cable was severed the two brain halves continued to function independently, thus explaining in part the apparent lack of effect on behavior and functioning.

Then during the 1960s, extension of similar studies to human neurosurgical patients provided further information on the function of the corpus callosum and caused scientists to postulate a revised view of the relative capabilities of the halves of the human brain: that both hemispheres are involved in higher cognitive functioning, with each half of the brain specialized in complementary fashion for different *modes* of thinking, both highly complex.

Because this changed perception of the brain has important implications for education in general and for learning to draw in particular, I will briefly describe some of the research often referred to as the 'split-brain' studies. The research was mainly carried out at Cal Tech by Sperry and his students Michael Gazzaniga, Jerre Levy, Colwyn Trevarthen, Robert Nebes, and others.

The investigation centered on a small group of individuals who came to be known as the *commissurotomy*, or 'split-brain' patients. They are persons who had been greatly disabled by epileptic seizures that involved both hemispheres. As a last resort measure, after all other remedies had failed, the incapacitating spread of seizures between the two hemispheres was controlled by means of an operation, performed by Phillip Vogel and Joseph Bogen, that severed the corpus callosum and the related commissures, or cross-connections, thus isolating one hemisphere from the other. The operation yielded the hoped-for result: the patients' seizures were controlled and they regained health. In spite of the radical nature of the surgury, the patients' outward appearance, manner, and coordination were little affected; and to casual observation their ordinary daily behavior seemed little changed.

The Cal Tech group subsequently worked with the patients in a series of ingenious and subtle tests that revealed the separated functions of the two hemispheres (Sperry 1968). The tests provided surprising new evidence that each hemisphere, in a sense, perceives its own reality – or perhaps better stated, perceives reality in its own way. The verbal half of the brain – the left half – dominates most of the time in individuals with intact brains as well as in the split-brain patients. Using ingenious procedures, however, the Cal Tech group tested the patients' separated right hemispheres and found evidence that the right, nonverbal half of the brain also experiences, responds with feeling, and processes information on its own, using its own mode of information processing. In intact brains, communication through the corpus callosum melds and reconciles the two perceptions, thus preserving our sense of being one person, a unified being.

In addition to studying the right/left separation of inner mental experience, Sperry and his group examined the different ways in which the two hemispheres process information. Evidence accumulated showing that the mode of the left brain is verbal and analytic, while that of the right is nonverbal and global.

New evidence found by Jerre Levy in her doctoral studies (Levy-Agrestí and Sperry 1968) showed that the mode of processing used by the right brain is rapid, complex, whole-pattern, spatial, and perceptual – processing that is not only different from but comparable in complexity to the left brain's verbal, analytic mode. Additionally, Levy found indications that the two modes of processing tend to interfere with each other, preventing maximum performance; and she suggested that this may be a rationale for the evolutionary development of asymmetry in the human brain – as a means of keeping the two different modes of processing in two different hemispheres.

Based on the evidence of the split brain studies, the view gradually emerged that *both* hemispheres use high-level cognitive modes which, though different, involve thinking, reasoning, and complex mental functioning. Over the past decade, since the first statement in 1968 by Levy and Sperry (Levy-Agrestí and Sperry 1968), scientists have found extensive supporting evidence for this view, not only in brain-injured patients, but also in individuals with normal, intact brains.

A good deal of recent research during the 1970s has centered on determining the location and division of the two major information-processing modes within the hemispheres. Since understanding the mode-characteristics is of greater value to educators than knowing the exact physical location of the modes in the brain – location being of great importance to neuroscientists and neurosurgeons – I have used the terms 'L-mode' and 'R-mode' in order to avoid the location controversy and still clearly designate the two modes (Edwards 1979: 37–43). L-mode is a syntactical mode, and in this mode the brain verbalizes, abstracts, analyzes, counts, marks time, plans step-by-step procedures, constructs propositions based on logical, linear thought. R-mode is a global mode, and in this mode the brain processes simultaneously great amounts of incoming data, mainly visual in nature whether by means of imaging and visualization or direct perception of visual information. In R-mode, the brain seeks patterns even though part of the data may be missing, recognizes configurations in a global, synthetic manner, extremely rapidly, and without using step-by-step analysis to arrive at an answer. The mode produces what seems to be an intuitive response – the 'ah-ha!' response. R-mode includes spatial perception, part-to-whole and figure-to-ground perceptions. R-mode does not include counting up, doing first things first, or marking time. Nor does it include naming or symbolizing – those are L-mode functions. In R-mode one sees the thing-as-it-is, the concrete thing, the thing unconnected to a name or a word. In short, in R-mode, one sees as an artist sees.

PERCEPTUAL SKILLS IN DRAWING AND COGNITIVE SHIFT THEORY

Realistic drawing of perceived forms seems to require a cognitive shift from the more usual verbal/analytic mode of information-processing (L-mode) to a less-familiar, less-used spatial/perceptual mode (R-mode). The verbal/analytic mode mainly uses symbols (words, numbers, signs, etc.) as the means of processing incoming information. Drawing in L-mode produces symbolic drawing, using the system of symbols developed during childhood as a language-linked (Paivio 1971) method of communication. In this system, an eye, for example, is a circle enclosed in two curved lines. The sun is a circle with radiating lines. A tree is the familiar lollipop shape. In figure drawing, a sequential system that is quite rigidly structured proceeds from top to bottom in a step-by-step fashion: first a circle for the head, then details of features and hair, then the neck, body, arms, hands, legs, and feet. Each separate observation of the perceived form calls forth the *name* of the part and its corresponding (childhood) symbol (Edwards 1976). Examples of typical symbolic drawings of children are shown in Figure 1 (Gellert 1975).

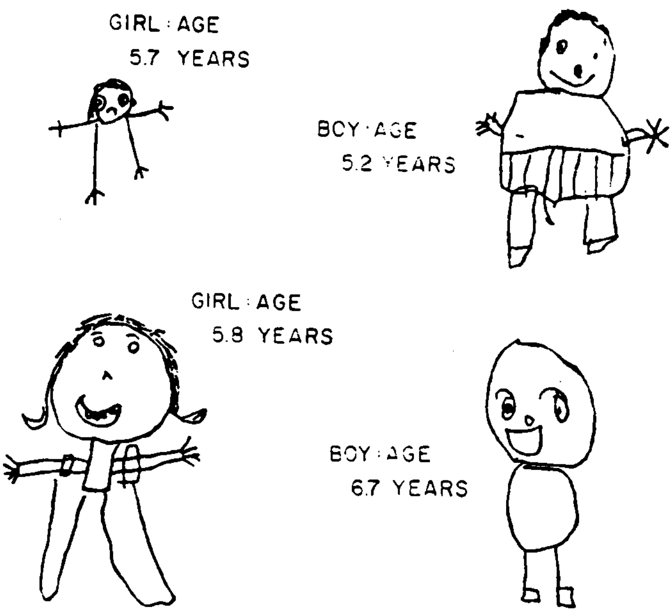

Figure 1. *Typical drawings by young children.* (Reprinted with permission of author and publisher from: Gellert, E. [1975], 'Children's constructions of their self-images', *Perceptual and Motor Skills* 40: 307–324, Figure 1)

Most adults who are untrained in realistic drawing, when confronted with a task of drawing a perceived human figure, are unaware that their usual cognitive mode (L-mode) is inappropriate for the task of drawing, which requires the R-mode of global, relational, spatial/perceptual processing. Their drawings, therefore, consist of the memorized symbols of childhood, and most adults reject these drawings as being awkward, hopelessly naive, and embarrassing. Learning how to draw is discouragingly difficult because the old, embedded strategy of translating visual perceptions into symbolic signs is difficult to set aside (Wittrock 1974). Most individuals soon give up trying, convinced that lack of innate artistic talent is the problem.

Recent work in this area (Edwards 1976, 1979) indicates that lack of talent is not the problem and that most adults – and children over the age of about six or seven – can draw well. Individuals can learn the basic skills of drawing easily if they are taught how to make the cognitive shift used by artists to the appropriate spatial/perceptual mode of processing incoming visual information in order to draw. Teaching strategies which enable individuals to achieve the desired cognitive shift are strategies which minimize or make difficult verbal analysis, naming of parts, or linkage of perceptions with verbal categories and memorized symbols. The following section describes one such strategy.

AN EXPERIMENT IN PERCEPTUAL SKILLS: UPSIDE-DOWN DRAWING

Eighty-four college-age students, none of them art students, were randomly assigned to four treatment groups. About three weeks before the experimental treatments, the students were asked to draw a person to the best of their ability – a procedure similar to the 'Draw-A-Person' test (Goodenough 1926). This procedure was used in order to elicit from each student the pre-existing symbol system developed during childhood for the human figure (see Figure 2).

The experiment elicited two additional drawings from each participant: a copy of Picasso's 1920 pencil-line full-length portrait of the composer Igor Stravinsky (Figure 3); and a copy of a 1920s photograph of the Irish writer James Joyce (Figure 4).

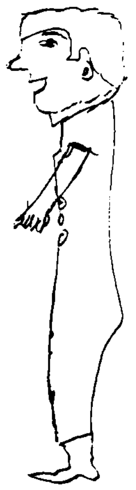

Figure 2. *A typical example of the 'Draw-A-Person' drawings by a college-age student*

Figure 3. *Picasso's drawing of the composer Igor Stravinsky*

The participants first viewed and drew the Picasso drawing. Half of the students viewed and drew the Picasso in the normal, upright orientation; the other half viewed and drew the Picasso upside-down – that is, the students were presented with the Picasso drawing turned upside-down, and were instructed to copy the drawing, also upside-down.

The prediction was that the drawings done upside-down would be judged to be more realistic, that is, more closely resembling the original. Furthermore, the symbols appearing in the Draw-A-Person drawing would appear less frequently in the upside-down drawings.

For the second drawing, the James Joyce photo, all of the students saw the photo right-side up, but the instructions differed. One set of instructions stressed naming and categorizing: 'This is a man wearing a hat. He has a little moustache, and he is wearing eyeglasses, etc.'. The other set of verbal instructions stressed visual relationships, part-to-whole relationships, angles, shapes,

Figure 4. *A 1920s photo of the writer James Joyce. (Reprinted with permission of The Beinecke Rare Book and Manuscript Library, Yale University).*

spaces: 'Notice the angle of this form compared to the edge of the photo. Notice the shape of this space. How wide is this form compared to its length, etc.'.

The hypothesis predicted that the relational, spatial instructions would elicit more realistic drawings with fewer instances of use of symbolic childhood forms.

The drawings were scored by five art teachers on a one to five scale, with five indicating greater resemblance to the original. The interrater reliability for the judges' ratings of the drawings from the two treatments were 0.80 with an s.d. of 0.04 (image orientation) and 0.80 with an s.d. of 0.03 (verbal instructions). Means of the ratings are shown in Table 1.

The results of the data analysis indicated the following.

1. Upside-down orientation of a perceived image significantly increased ($p < 0.01$) accuracy of perception and ability to draw realistically as represented by the drawings.

2. Drawing instruction which stressed relational processing and encouraged attentiveness to spatial, relational information significantly increased ($p < 0.01$) accuracy of perception and ability to draw realistically as evidenced by the drawings. Preexisting symbolic forms appearing in the Draw-A-Person

Table 1. *Means of judges' ratings of the students' drawings (scores for drawings of Picasso's 'Stravinsky')*

Image orientation treatment			
		I	II
Image orientation	Inverted	M = 3.06 S.D. = 1.30	M = 3.93 S.D. = 0.97
		III	IV
	Upright	M = 1.80 S.D. = 0.84	M = 2.68 S.D. = 1.29
Verbal instructions treatment			
		Symbolic/Analytic	Relational/spatial
		I	II
Image orientation combined with verbal instructions treatment	Inverted	M = 2.29 S.D. = 1.16	M = 4.05 S.D. = 1.24
		III	IV
	Upright	M = 1.92 S.D. = 0.98	M = 3.49 S.D. = 1.15

N. B. Participants in each of the four treatment groups were first given the image orientation treatment, using Picasso's 'Stravinsky'. Participants in each group then were given the verbal instructions treatment, using the photo of James Joyce.

Judges' scores were on a 1 to 5 scale, with 1 the lowest and 5 the highest possible score.

drawings appeared less frequently in the differential instruction drawings than in the inverted image drawings, but appeared more frequently both in the verbal-naming instruction drawings and in the right-side up drawings than in drawings from the other treatments.

DISCUSSION

There is an old saying among art educators: 'If you can teach a person to *see*, that person will then be able to draw'. The results of the experiment described above imply that that different way of seeing occurs when the student is presented with visual information in upside-down orientation, or when attention is directed toward visual information not generally noticed, such as the shapes of spaces.

Image orientation has been studied extensively by Irwin Rock (1971). Rock found that mirror-image or side-by-side reversals had little effect on recognition of forms. In a series of experiments on the effect of upside-down and right-side up images, however, Rock and his colleagues found the recognition fell off rapidly when figures, letters, writing, and faces were viewed in inverted orientation. Rock ascribes this to the fact that orientation affects the way the brain processes information about form. Viewing an inverted form triggers an attempt to 'correct' the perception, to mentally turn it upright. If the form is simple, for example a single letter, the correction may be successful and naming is possible, though the form will still look strange. In a more complex form, however, such as a word or a face or a figure, the corrective mechanism may become overtaxed (p. 78).

Jerre Levy (1974) suggests that the cognitive process of object recognition and naming may involve two possibly independent factors: on the one hand, *hemisphere dominance*, defined as the tendency for the major (left) hemisphere to control responding; and on the other hand, *hemisphere capacity*, the ability of each hemisphere to perform certain tasks when the contingencies of the experiment force one or the other hemisphere to attempt the task. Levy states, 'It is as if the left hemisphere simply does not bother to handle information which can be handled by the right' (p. 159). In the upside-down drawing experiment, therefore, that contingency may force a cognitive shift to the subdominant right-hemisphere mode. Since this mode is the appropriate mode for drawing a perceived form, the students apparently could then *see* as a trained artist sees and could therefore draw with a higher level of skill than students working in the usual mode (examples are shown in Figures 5, 6, 7, and 8).

Additionally, a simple change in the emphasis on *what to look at* in the verbal instruction treatment produced a significant difference in how well the

Figure 5

Figure 6

Figure 5 and 6. *A copy of the Stravinsky drawing in normal, upright orientation*

drawings came out. Referring again to Levy's (1974) work, the difference in the drawings implies that dominant L-mode rejected the task when attention was directed toward angles, comparative lengths, shapes of spaces. One could speculate that the left hemisphere may find this visual information 'boring' to the extent that the task of dealing with the information is passed to the subdominant R-mode. Conversely, instruction which names and categorizes *fits* the mode of the left brain, so that it stays with the task and responds with its language-linked childhood symbol system for 'man with a moustache wearing a hat, etc.' (examples are shown in Figures 9 and 10).

To speculate further, training students in the basic perceptual skills required for skillful drawing might proceed more rapidly and with a greater percentage of success if teaching methods stressed learning to gain access to the subdominant R-mode. Talent in drawing then might be redefined as an ability to enter the right-hemisphere mode at will and to use its special capabilities for spatiovisual information processing. It surely seems possible

Figure 7. *A copy of the Stravinsky drawing in upside-down orientation*

Figure 8. *A copy of the Stravinsky drawing in upside-down orientation*

Figure 9. *Drawing of James Joyce: Naming, symbolizing instruction*

Figure 10. *Drawing of James Joyce: Spatial, relational instruction*

that those abilities are present in the brains of the large majority of individuals, latent and viable, ready to emerge when the contingent conditions, as in the experiment described above, facilitate a shift away from the dominant left-hemisphere mode. (See examples of students' drawings before and after instruction: Figures 11 to 16.)

Figure 11. *'Before drawing' by a 19-year-old student, Ken Darnell. A student modeled for the drawing*

Figure 12. *'After drawing' by Ken Darnell (drawn at the end of two semesters). A self-portrait done by using two mirrors*

IMPLICATIONS OF THE EXPERIMENT

The main inference drawn from the results is that instructional conditions and strategies can facilitate a cognitive shift by students to the less usual R-mode of visual information processing which results in increased ability to accurately see and realistically draw a perceived image. The results of the

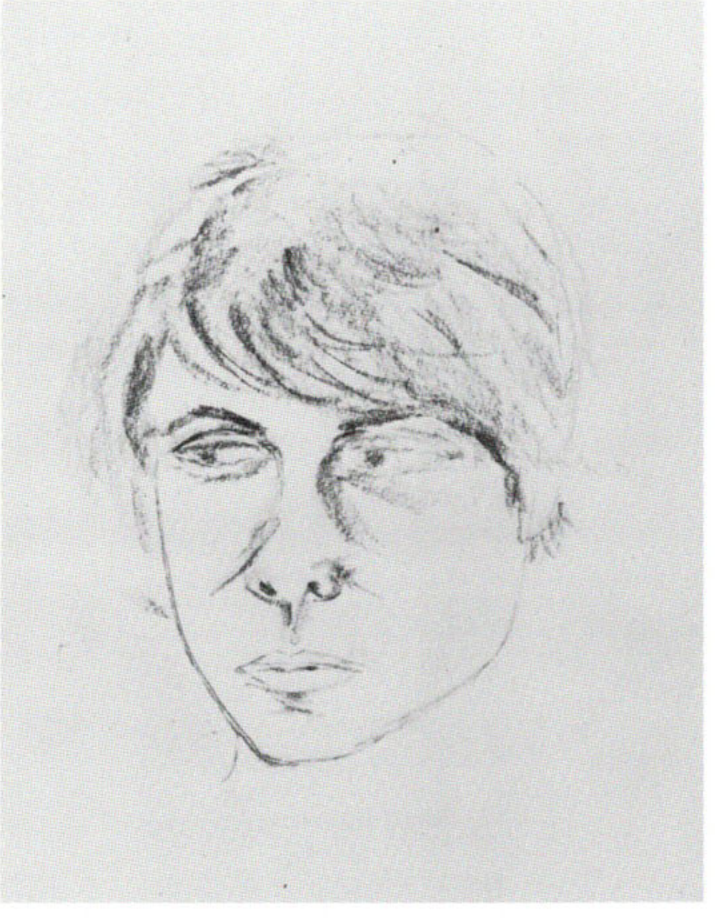

Figure 13. *'Before drawing' by Alice Abel of a student model*

study may also imply that training in art might be used as a means of teaching students to improve access to the less usual R-mode by providing practice in making cognitive shifts in order to bring the appropriate brain-mode to bear on given tasks. The study suggests that cognitive shifts in brain-mode can be influenced by the method of presentation of tasks. Clearly, a great deal of work will be required to extend the directions suggested by the study, and a

Figure 14. *'After drawing'. A self-portrait by Alice Abel after a nine-week course of lessons, one lesson a week*

number of questions are raised. For example, how can we define appropriate brain-modes or combinations of modes for large numbers of learning tasks? How can we teach students to make cognitive shifts at conscious (or sub-conscious) level? Are there examples of other skills (perhaps dance, music, reading, etc.) where capabilities are blocked because of interference or inter-action between the verbal and visual modes? Might learning be facilitated by increased participation of the visual R-mode?

Figure 15. *'Before drawing' by student John Boomer of a student model*

The results ot the experimental study are heartening for the many individuals who have suffered from the ringing pronouncement that they have no artistic talent. And indeed, evidence is accumulating that all individuals with normal learning capacity can learn to draw just as they have learned to read and write. The before and after drawings, Figures 10 to 15, indicate that the basic perceptual skills are available to everyone, given instructional techniques designed to facilitate R-mode functions.

That is not to say, of course, that every individual will become an artist. A great artist must surely have special abilities, must be able to use both brain modes at a high level. Perhaps in the future, R-mode skills such as drawing will be taught routinely just as we now teach reading and writing without necessarily expecting that all students will become writers or poets. In the

Figure 16. *'After drawing' by John Boomer after a nine-week course of lessons, one lesson a week*

future, we may teach perceptual skills to enable students to *see* better, in all the senses of that verb: to see the whole picture, to understand, to grasp relationships, to see what things add up to, to perceive meaning, to intuit consequences, to communicate nonverbally. We are presently teaching verbal/analytic skills to facilitate language-based thinking. New research and new teaching methods encourage equal emphasis on teaching visual/global skills to facilitate relational, intuitive thinking.

In a prophetic essay, written in 1961, Aldous Huxley said,

The most basic of our faculties, to use an old term, is that of perception. Our thought, our feelings, our will – all are based upon perception, and perception may be either good and discriminating or else poor and inadequate. We don't do very much to train perception. We do a lot, I think, in the sphere of music, to train the auditory senses, but we do very little in regard to the other senses. There is a great deal to be said for systematic training of perception and other kinds of awareness, which I would call the nonverbal humanities. We give training in the verbal humanities, and we think this will somehow offset specialization in the scientific field, but what we are actually doing is merely trying to offset one specialization in terms of symbols with another specialization in terms of symbols. I am all for courses in humanities, but I don't think they are enough. I think we require now to add courses in the nonverbal humanities, beginning with the training of perception. (Huxley 1961: 69)

Altogether aside from the inherent value and pleasure of art, instruction in drawing may one day help to fulfill Huxley's plea for training the whole brain.