Articulate Images: Bringing the Pictures of Science and Natural History into the Art Curriculum
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meaning. This postmodern aesthetic theory is described by Freedman (2003) who states "... in an increasing body of contemporary theory, meaning is inherent to aesthetics and interested interpretations are not only expected, but promoted" (p. 33). Postmodernism challenges the modernist belief that objects and images derive their aesthetic significance from their rarity or separation from everyday life (Gablik, 1984). Rather, it finds a foundation of contemporary aesthetics in the ordinary, the everyday (Hickey, 1997). This is a radical redefinition of the aesthetic experience and it opens art education practice up to scrutinizing (and appreciating) the images we live with every day.

**James Elkins’s Examination of Informational Images**

Art historian James Elkins explores the realm of non-art images. He critiques the practices and focus of art history, and by extension, art education. He argues that the movement to engage visual culture in art history, in focusing primarily on popular culture, design, fashion and advertising, is circumventing a considerable class of images that also reflect and shape contemporary life. These images constitute a whole panorama of non-art images, of which scientific images are a subset. He refers to these images as informational images.

In general, art history tests its boundaries by working with popular culture, medieval and non-Western images. But the domain of images is substantially larger. In particular there is a group of images that seems to have neither religious nor artistic purpose, and that is the images principally intended ... to convey information. (Elkins, 1999, p. 4)

Elkins maintains that we encounter informational images more often than other images. He states, "informational images are arguably the majority of all images. If pictures were to be defined by their commonest examples, those examples would be pictographs, not paintings" (Elkins, 1999, p. 4). Encountering informational images directly allows us to collapse the conventional barriers between fine art and other images. Elkins has no less an agenda than to do this—to break down "the wavering distinctions between art and non-art, expressive and non-expressive that have been obstructing the way to that wider panorama" (Elkins, 1999, p. 46).

Elkins’s case rests on repudiating two basic misconceptions about informational images: a) their textuality and content make them lesser than other images, and b) they are not intrinsically expressive. His analysis reveals that informational images are important, interesting, complex and worthy of consideration for art history for three critical reasons:

... [T]hey engage the central issues of art history such as periods, styles, meanings, the history of ideas, concepts or criticism, and changes in society; ... they can present more complex questions of representation, convention, medium, production, interpretation, and

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reception than much fine art; and finally, that far from being inexpressive, they are fully expressive and capable of as great and nuanced a range of meaning as any work of art. (Elkins, 1999, pp. 4-5)

Elkins makes another critical conclusion: All images harbor information and therefore can be deciphered or interpreted on some level as text. Crucial to Elkins's argument is his belief that no image is pure—purely informational or purely expressive. He argues that convention, not reality, directs us to think in terms of pictures (visual images) in opposition to text (writing or numbering). This construct establishes a dichotomy between reading (a text) and viewing (a picture) in which reading and viewing are seen as separate and irreconcilable modes. He finds the division between reading and viewing too simplistic and reductive, and contends that interpreting all visual images involves a synthesis of viewing (sensing indeterminate meanings) and reading (decoding unambiguous meanings).

Any sufficiently close look at a visual artifact discloses mixtures of reading and seeing. Everyday reading and everyday looking (say reading this page, and watching images on television) are not pure acts, and so their "opposition" cannot comprise a binary pair. (Elkins, 1999, p. 84)

Elkins comes to the conclusion that all images, including fine art, should be grouped into one all-encompassing domain. However, Elkins does not discount differences. He develops a detailed analysis and categorization of images, placing them into seven distinct categories arranged on a continuum from the most readable forms, such as allographs (calligraphy), to pictograms (pictorial scripts), to emblemata (images linked to text), to schemata that put information in pictorial form (maps and graphs). Sprinkled through these categories are examples of fine art categorized by degrees of textuality.

Elkins's categories reinforce his contention that all images contain information on some level and in some degree of legibility. Elkins cites Egyptian hieroglyphs and Giotto's frescos as two examples of images often categorized as art that are coded and directly legible. On a less literal but still decipherable level, he finds paintings (that are always categorized as art) by Robert Rauschenberg and Jasper Johns, which feature recognizable symbols doubling as abstract forms. Alluding to and obscuring information also occurs in art. Elkins cites as examples collages by Picasso and Braque with their torn texts. More contemporary versions of this hide-and-seek with information are found in the artworks of Julian Schnabel, with their obscured and layered symbols, or the charred texts of contemporary artists, Anselm Kiefer and Ann Hamilton.

We get a better sense of the kinds of information art contains by looking at images from the history of Western art. For example, Fra Filippo Lippi's *Madonna Enthroned* (1437) shows us how early Renaissance spirituality is embodied in human female form. This is an illustration of a story and it is full of religious iconography that we can decode. It also gives

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us a sense of the naturalism and perspective of the Renaissance that supplant all the flatness and stylization in medieval art. An even clearer example is The Letter (1666) by Vermeer. With all its detailed visual information, this painting presents a glimpse into Dutch life in the 17th century. It also provides clues to Vermeer’s interest in light, perspective, and space, and the contemporary technology used in depicting them. Information in art can take many forms; it can be about life at a certain time, it can be about the concerns or interests of the artist, it can be about values, ideals, issues and problems of a culture, to mention a few.

Elkins (1999) observes that scientific images are more restricted by convention and conventional symbol systems than art and they can be seriously restricted by graphic customs. He suggests that the primary purpose of scientific images—to convey information clearly—is the defining feature that separates them from art. However, this purpose does not only make these pictures distinctive, it shapes their aesthetics; the articulacy that makes them informative also renders them beautiful and elegant. Clarity and completeness give the scientific image visual impact and, as Elkins contends, scientists value and attend to this visual impact both for the purposes of communication and for aesthetic reasons. “[T]hey (scientists) are intensely concerned with their ‘scientific’ images because they want to make them as clear, unambiguous, simple, graphically elegant, and useful as possible” (Elkins, 1999, p. 10).

Images of Science

The pictures of science embrace a broad range of visual material from diagrams that show quantitative data, to maps that delineate patterns and systems, to schematics of theories and concepts, to renderings of the living world (Kevles, 1992). These pictures vary in form according to their purposes. For example, maps of concepts are necessarily abstract; renderings of the perceived world are supremely naturalistic or realistic.

The level of viewer interpretation provides a critical distinction between art and informational images. Since the goal of a scientific image is to inform, to be clear and thorough, interpretation by the viewer is primarily limited to understanding the information intentionally communicated by the maker of the image. In contrast, the intent of an art image is less didactic. The art image, therefore, is often less literal and the meaning of the work more open to varieties of viewer interpretation.

The difference between image and illustration is another issue we encounter in examining the images of science. Stafford (1996) suggests that the term image signifies all forms of visual representation. She makes a distinction between two kinds of image: expressions which are “untranslatable constructive forms of cognition” and illustrations which are “images equivalent to discourse” (p. 27). Stafford argues that an illustration is essentially the rendering of an existing text, while an expression generates new discoveries or meanings in the process of its creation.
The term *illustration* is often used for the images of science (and especially for natural history illustrations) because these images are considered descriptions of a priori knowledge or existing natural phenomena. But, as Stafford (1996) contends, often these images are more than mere illustration; the process of their creation generates new insights and constructs new meanings. They are 'constitutive' expressions. Although the images of natural history have historically been referred to as illustrations, it is the constitutive aspect of images and image-making that are central to the discussion here.

**Scientific Images as Visual Culture**

Sturken and Cartwright (2001) locate the images of science in visual culture.

The term “visual culture” encompasses a wide range of forms ranging from fine art to popular film and television to advertising to visual data in fields that we tend not to think about in terms of the cultural—the sciences, law, and medicine, for example. (p. 279)

Scientific images present a particularly useful form of visual culture for art educators; when unpacked and analyzed as cultural expression they can reveal many things about the time and place in which they were produced. As Kevles (1992) states,

... these illustrations reveal the evolution of discourse about nature and the conventions—cultural and artistic as well as scientific—in which the discourse was conducted. They open windows into the historical interplay between science, art and culture. (p. 11)

The license to look at these works of science as cultural expression comes to us from Thomas Kuhn (1970), who suggested that science, as a human endeavor, reflects not just a persistent and objective progressive search for truth separate from human predispositions and practices. It is subject to cultural biases, habits, interests and needs. Kuhn used the word *paradigm* to describe the foundational attitudes and cultural factors that shape theories, methods, and findings of science. When we think in terms of paradigms and understand that particular expressions of a culture, such as art, artifacts and non-art images, embody the hidden foundations of these meta-systems, we can see the value of natural history images as graphic clues to a larger culture.

Sturken and Cartwright (2001) echo this idea. They suggest that scientific images need to be interrogated in the same way as other cultural artifacts. This is especially true because these pictures carry with them the mantle of truth and objectivity. “Because scientific imagery often comes to us with confident authority behind it ... we often assume it represents *objective* knowledge ... scientific looking is as culturally dependent as other practices” (p. 279).

Contemporary scientific images, especially the high-tech pictures produced by MRI’s, CAT scans, and PET scans have immense power in
shaping how we think of ourselves and the world. On micro and macro levels, they show us natural phenomena previously unavailable to us and they are increasingly common in the popular media. The technological scientific images of today have a history. They are descendants of earlier, hand-made or printed images (natural history illustrations) and their privileged position has a long history stemming from the Renaissance when the technologies of the microscope and telescope allowed scientists to enter into new worlds, and printmaking (and, therefore, bookmaking) made these images wide-spread and popular (Stafford, 1996; Blum 1993). We now turn our attention to these ancestors of contemporary images of nature.

Natural History Illustrations

Natural history illustrations represent one genre of scientific imagery. As graphic studies of living organisms, they consist of drawings and paintings of plants and animals. Historically, natural history illustrations have been influenced by concurrent developments in fine art painting (Blum, 1993) and often they inhabit the boundary between the two genres. However, natural history illustrations are different from fine art paintings; they have styles and pictorial conventions particular to them. Many illustrations display an entire organism, often in profile, with certain parts magnified or specific structures more fully displayed in peripheral drawings. Some show many animals or plants presented in rows or grids. Some take the form of pictures of animals in their habitats; some show the life cycles, habits and activities of those animals in many drawings within one picture. Many are highly technical and explicit, some more interpretive (Blum, 1993). All are pictorial renderings that display narratives in some way. As such, they represent a kind of graphic storytelling.

To make the story and the information fully explicit and complete, natural history illustrations are often combined with explanatory text (Elkins, 1999; Kevles, 1992). This combination of text and image is one reason for categorizing these images as illustrations. It also adds a compositional element not commonly found in Western fine art paintings prior to the 20th century. In their dependence on text, natural history illustrations have closer ties to Medieval manuscript paintings and book illustrations (Blum, 1993). Today, however, the link to fine art is more apparent; as art appropriates styles and modes from popular culture (comic books, posters and graphic novels—and the images of science) mingling text with images becomes a popular practice in making art.

Examining the heritage of natural history illustrations further explicates and deepens our understanding of the forms and ways of the genre. Stafford (1994, 1996) suggests that the 18th century has “much to teach the twentieth century about presentation, construction and interpretation of graphical messages of all sorts” (1996, p. 24). In her examination of the
cultural foundations of the Enlightenment, Stafford finds five factors that were critical to 18th-century practices in natural history. Two of these foundational concepts, a) the world-wide exploration of nature and discovery of new species, and b) a scientific focus on understanding and codifying the natural world, are examined here in the context of the lives and work of four naturalist-illustrators whose work embodies significant concepts and movements in natural history.

Maria Sibylla Merian

Worldwide exploration of nature began prior to the 18th century and was in full swing by the mid-18th century, with the journeys of Captain James Cook to Australia and the South Seas, and the mid-19th century, with Charles Darwin’s trips on the Beagle and Alfred Russel Wallace’s visits to the Amazon and Malaysia (Rice, 1999). An artist-exemplar of this era of exploration was Maria Sibylla Merian (1647-1717). Merian was an early participant in the effort to document the animate world outside of Europe, an illustrator of notable artistic merit, and an extraordinary woman. Merian traveled with her daughter to Surinam in South America in 1699 to document the metamorphosis of exotic butterflies. There she produced lyrical watercolors and etchings of insects in their native environments. These illustrations are distinctive in the way they depict stages of life through a series of drawings within a single picture, much like Medieval narrative paintings tell stories graphically (Kemp, 2000; Rice, 1999). Although her images are true to nature, they are charming, playful and poetic.

Merian’s illustration, Thysania Agrippa Moth, provides a clear example of her style. In it we observe a moth flying freely above the branches of a plant. Its wings are fully spread to reveal in detail its symmetrical wings covered with scallop patterns. On the branch of the plant is a long segmented caterpillar over a hanging, oval cocoon. Another fully-grown moth alights on the branch and shows us the underside of its wings while it munches on a leaf. We see in detail the veins of the leaves, the texture of the plant’s stem, the delicacy of the moth’s legs and antennae. Although this is a meticulous visual document of a moth, its life and environment, the documentary aspects of the picture seem secondary to its expressiveness and visual interest.

Merian’s work stands in contrast to later natural history illustrations, especially the work of Swedish botanist Carolus Linnaeus (1707-1778). Schiebinger (1998) sees the work of Merian and Linnaeus as indications and illustrations of a shift in cultural values, worldview and intent that took place in Europe with the advent of the Enlightenment. Merian’s compositions reveal her attention to the native environment of her subjects and display a touch of exoticism and romance not seen in the cool, analytical compositions of Linnaeus.
Georg Dionysius Ehret for Carolus Linnaeus. Classification of Plants by Sexual Characteristics (1737)
Engraving Courtesy of The Natural History Museum, London.
Carolus Linnaeus

Linnaeus went beyond observation, recording, and romance with nature to analysis and an imposition of order on what he observed. His work best illustrates Stafford’s (1996) second factor at play in the Enlightenment—the scientific effort to understand, order and codify nature. Best known as the father of modern Taxonomy, Linnaeus’s major accomplishment was his simple but comprehensive system for identifying and organizing plants based on their morphology. Another achievement was his system for naming organisms in Latin (binomial nomenclature) by which all living organisms are categorized and named today. According to Schiebinger, Linnaeus’s analytical approach and his system of naming (which discounted native names) contrasted with Merian’s approach and were indicative of the rational orientation and Euro-centrism of his time (Schiebinger, 1998).

The Classification of Plants by Sexual Characteristics is one of Linnaeus’s signature images. Although the image was drawn by artist/illustrator Georg Dionysius Ehret, it displays Linnaeus’s ideas and is therefore often associated with Linnaeus. It is a detailed visual catalogue of the reproductive parts of 24 classes of flowering plants that Linnaeus delineated according to the number and arrangement of stamens. The individual specimens are numbered 1 to 24, suggesting that there is a key to the image that identifies each one. The documentary purpose of this picture is evident in its layout; the grid makes comparison easy.

Georges-Louis Leclerc, Comte de Buffon

Linnaeus was not alone in his efforts to discern order in a chaotic and diverse natural world. He shared center stage with his rival, Georges-Louis Leclerc, Comte de Buffon (1707-1788), who championed an antithetical conception of the underlying patterns in natural life. Buffon was not interested in the systematic categorization of animals. His focus was on how and where these creatures lived, and their relationships to other organisms. (Blum, 1993).

For the study of how meaning is manifested in visual images, the pictures of these two titans of natural history, Linnaeus and Buffon, present excellent case studies; their philosophies and intents directly determined the content and shaped the composition of their pictures. Linnaeus’s organizing principle called for clear, precise, explicit and comprehensive drawings, often composed in flat, spare, and grid-like patterns devoid of any reference to environment. The images used by Buffon dwell less on the physical attributes of animals and more on portraying the habitat and habits of animals. His subjects are animated, dynamic, and integrated into the landscape.

The Flying Dragon by J. E. DeSeve, an illustration from Buffon’s Histoire Naturelle, illustrates these ideas. In this image, DeSeve portrays an exotic reptile straddled between two branches of a gnarled tree. His
patagonium, folds of skin supported umbrella-like by elongated ribs, is stretched open to reveal how the reptile navigates from one tree to another. While the morphology of the dragon is clearly and comprehensively depicted, DeSeve also imparts life into his subject. We get a sense of the spirit of this creature and a glimpse into the hot humid rain forest it inhabits (Kastner, 1991).

John James Audubon

With the end of the 18th century came the age of Romanticism, no naturalist-illustrator exemplifies this time better than John James Audubon (1785-1851). Audubon, perhaps America’s most famous naturalist, was a Romantic pantheist whose paintings, mostly of birds, are less concerned with precision and systematic scrutiny than with capturing the essence, vitality and drama of his subjects (Kemp, 2000). His powerful paintings portrayed undomesticated creatures in their wilderness habitats as noble, unfettered models of natural perfection. Audubon saw animals in their natural state as apt metaphors for the best of human qualities and aspirations. His mythologizing of nature is evident in his portrayal of the White Headed Eagle. In this painting, Audubon presents his subject as a ferocious

bird, posing in heroic profile with his shoulders and white head thrust forward and his eyes keenly focused and bright. Standing far above a valley floor he seems ready to fly and attack as he digs his sharp powerful talons into the corpse of a fish, his latest conquest. The background is painterly but the image of the eagle, as romantic and expressive as it is, is painted in precise detail. Here we see a true mixture of naturalism and expressiveness.

Audubon saw himself not as a scientist but as an artist (Kemp, 2000). This self-definition gave him the license to make his images personal and expressive and to layer them with metaphorical allusions, while maintaining fidelity to reality. Because he captured the spirit of a new frontier and the imagination of a young nation that identified with the forces of nature, he was a popular hero in America. Also, Audubon’s multi-colored engravings were widely distributed. They became a popular “democratic” art form displaying inspirational and iconic images for middle-class American walls (Blum, 1993).

The works of these four practitioners of natural history demonstrate how worldviews are expressed visually. The paradigms they illustrate become clearer when the images are compared and contrasted—especially in the case of Linnaeus and Audubon who present us with such overtly different sensibilities and agendas.

Two Contemporary Artists and the Traditions of Natural History

The styles and conventions of natural history illustration are finding new life and new purpose in the work of some contemporary postmodern artists. These artists not only cross disciplinary lines to bring the vocabulary of natural history to their work, but they cast a knowing, critical eye on the practices that produced these historical images. Two artists, especially—Cornelia Hesse-Honegger and Walton Ford—stand out as heirs to the modes of picturing used in natural history. These artists use the visual protocols and styles of traditional natural history illustration to address the effect of humankind and technology on nature (Hesse-Honegger) and to comment on the nature of human culture (Ford).

Cornelia Hesse-Honegger

In the Linnaean tradition we find Swiss artist Cornelia Hesse-Honegger. A former science illustrator, Hesse-Honegger approaches her subject, the deformed organisms she finds near nuclear power plants, with a systematic rigor usually associated with scientific research. She maps and counts the specimens she finds and creates naturalistic watercolors. These paintings are “scientific”—they are so clear, precise and meticulous that they read as evidence. But they also have a disquieting agenda. This intention defines these images as art and the appropriation of science illustration style and notation (with its ambition to clarity and dispassion) provides these pictures with the veracity, authority and gravity they need to make their point (Kemp, 2000).
Cornelia Hesse-Honegger, *Four Seed Bugs, Lygaeus equestris*. From Tubre and Santa Maria Madona Italy, 1994-95. Watercolor, 47 x 55 cm. Courtesy of the artist and Pro Litteris, reproduction photographer Peter Schalchli, Zurich.
In *Four Seed Bugs, Lygaeus equestris*, Hesse-Honegger illustrates four specimens she found near Tubre and Santa Maria Madonna, Italy, two sites of nuclear power plants. These bugs are four among 182 insects she found and examined at these locations. The specimens are arranged in a line so we can observe and compare deformations, especially white spots on the wings. Hesse-Honegger annotates this illustration in the manner of a scientist and reports that she discovered similar damage in insects near nuclear test sites in Nevada. This finding supports her conjecture that the anomalies on these insects are evidence of damage due to exposure to nuclear radiation.

While Hesse-Honegger’s drawings and paintings take their visual vocabulary from Linnaeus, his rational approach also shaped Hesse-Honegger’s thinking. She states, “Linnaeus’ order made me aware of the disorder we are creating today” (Hesse-Honegger, 2001, p. 31). With this observation, Hesse-Honegger reveals the power of image making (and the ordering of images) to reveal underlying patterns, to catalyze insight, and to raise social concern.

**Walton Ford**

In contrast to the “objective” display of evidence found in Hesse-Honegger’s work, Walton Ford’s images have the air of passion, myth and metaphor—and a large portion of ambiguity. Coming out of the Romantic tradition, Ford uses natural history illustration as a metaphorical vehicle to comment on contemporary post-colonial global culture. His work harkens back to the dramatic mythological paintings of John James Audubon, whose style he uses as a code for a worldview and as a framework for his commentary.

In contrast to Audubon and in sync with the irony and cynicism that are characteristic of postmodernism (Barnard, 1998), Ford has a skeptical view of humankind, and his use of Audubon’s style is sardonic; his animals allude to human foibles and evil ways. Ford’s paintings are huge, colorful, detailed and exact watercolors of exotic Asian animals, complete with descriptive texts and notations. Close examination of these seductive images reveals a disturbing vision. These animals are predators or victims. Their anguished or malevolent faces reveal where they stand on the food chain.

In *The Orientalist* (1999), Ford targets one human foible particular to Western culture, the tendency to pigeonhole and exoticize others from different cultures. In this painting, he portrays a Bandar-Rhesus monkey measuring and analyzing a human skull. The skull is the object of rational scrutiny; the fullness and complexity of its former being is reduced to bone and formulas.

Ford also paints his subject in a very detailed and precise style. He clearly labels the subject (and the painting) in the upper right-hand corner and places text beneath it and at the bottom of the painting. His quotation of a familiar genre and use of recognizable symbols leads the viewer to
Walton Ford, *The Orientalist* (1999). Watercolor, gouache, ink and pencil on paper. 60" x 40". Courtesy of Paul Kasmin Gallery and the artist.
draw conclusions about human (scientific or colonial practices and attitudes), but his message is somewhat ambiguous and open to interpretation.

**The Linkages between Natural History Illustrations and Art: Implications for Art Education**

Natural history pictures and science images in general offer us key insights into learning, creativity, image-construction, and the working of symbols and codes. These illustrations can be understood in relation to learning in two different ways, first, in terms of the learning process involved in making them, and, second, in terms of the learning that occurs during examination or decoding. Blum (1993) acknowledges both the informative function of the scientific image and the learning or problem-solving aspect of their creation.

Acceptance of pictures as conveying authentic information about nature lies at the heart of scientific practice. The process of translating nature onto paper, however, requires a sequence of steps that imply major conceptual leaps. (Blum, 1993, p. 3)

In their role as conveyers of authentic information about nature, images of natural history and science are pictures that teach the viewer. They communicate knowledge and lead to understandings about nature (and, when we dig deeper, culture). Encountering and deciphering them is a learning experience.

Furthermore, natural history images, in their direct linkage to discovery and learning, provide insights into intellectual history and reveal the frontiers of scientific knowledge at a given time. At first glance, historical pictures of nature may seem dry, dated and intellectual, but when viewed in the context of the escapades, explorations and discoveries that generated many of them, they take on an aura of adventure. Witness Maria Sibylla Merian’s maverick expedition to South America and you will see spirit, curiosity, bravery, perseverance and adventure. Contextualizing natural history images in this way can invigorate students’ notions of learning and inspire them to see research and the quest for knowledge as exciting ventures into the unknown. As Kevles (1992) so aptly states, “Unlocking the meaning [of these images] can bring about the exhilaration of a shared intellectual passion, a passion that has animated the scientific community throughout history of mankind” (p. 10).

Learning takes place not only in encountering these images but also in making them. I have already noted the constitutive function of image-making described by Stafford (1996) in discussing the distinction between illustration and expression. Hesse-Honegger (2001) brings the voice of the artist to this discussion and verifies the importance of process in her work. She understands observation and drawing as research practices and ways of coming to know. She distinguishes between discovery through the production of images and technical reproduction of visual information (which she...
calls illustration). She sees her work in the first category. In this way, she reaffirms the point made by Stafford.

… I believe that painting and drawing can still be a fundamental source of knowledge, rather than mere illustration. In my own development it has been the pictorial process that has led me to understanding the subject. (Hesse-Honegger, 2001, p. 7)

Hesse-Honegger’s insights have profound implications for art education; they affirm the role of image-making as a vital and distinctive form of research—a hands-on, exploratory way of learning.

The mechanisms of creativity in art and science are deeply connected to the generative aspects of image making and they, too, can be accessed through the study of scientific images. The creation of these pictures in both science and art employs practices that are common to most creativity: observation, analysis, and connection making. For example, the imaginative problem solving that Linnaeus performed in the development of his system of botanical categorization involved close observation, rational analysis, making conceptual leaps and divining underlying connections. These analytical processes have an artistic counterpart in the process Hesse-Honegger described. In a different vein, Walton Ford’s paintings provide insight into the uses of metaphor—the creative application of an image, symbolic system or style to a subject not usually associated with it to generate new connections and insights.

Furthermore, Hesse-Honegger’s and Ford’s engagement with natural history also sheds light on the role of the artist as an observer of cultural constructs and practices. It highlights the ways artists use forms and structures to frame their subjects in different ways and how they are free to play—to use and apply images and signs imaginatively. Artists are not bound by the structures and strictures of scientific disciplines in the way scientists are. Their roles and ways are different. While scientists are ultimately restricted to describing nature truthfully (as they understand it), the work of the artist does not have this constraint (although he or she may be pointing to a truth). The artist is ultimately an outsider, a student of scientific practice, not a scientist. This position as lay observer frees him or her to have the perspective and the license to highlight and comment on the assumptions and implications of science (or any other subject), to extend concepts to make a point, and to go beyond literal statements to ambiguity and metaphor (to be subjective and not to worry about proof).

Conclusion

If principal goals of art education are to instill in our students a more comprehensive and acute visual literacy, to build understanding of the ways all visual images reflect ideas, shape thought and embody conceptions of reality, and to help students understand how images are created, then exposing students to the entire domain of visual images, including the images of science and natural history, is critical. Becoming visually literate
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(or learning) involves two fundamental processes: a) **mining** images to ascertain their many layers of meaning, and b) making connections between images to realize their interrelationships. Pictures of science and natural history—and the postmodern art that quotes them—make excellent teaching tools to use in both modes of inquiry.

The images of science and natural history teach us about the informational role of images in general. On a most basic level, these images are educational because they convey information. We can use them in discussing how and what we learn when we look at pictures. Furthermore, the images of science represent learning that is thorough and deep; they are the products of extensive inquiry, and they invite intense scrutiny on the part of the viewer.

The postmodern art discussed in this paper is educational as well. It represents a deep probing inquiry that looks critically at ideas and issues. Furthermore, it investigates the broader implications of images by making connections and crossing disciplinary boundaries—juxtaposing forms and ideas from areas outside of art to reframe them in a critical light. Above all, postmodern art often constructs connections that are surprising and novel—bringing the viewer to new insights and new knowledge. In this way, it is particularly educative. Postmodern quotations of natural history illustrations are equally driven by ideas and, because they self-consciously focus on the ways ideas are represented, they make the concept-driven character of these images even more explicit.

As for creative process, the pictures of science teach us that images are constructed through a process of observation and analysis, and that they are often shaped by an artist/illustrator’s biases or purposes. Postmodern art teaches us further about the ways images are constructed. It illustrates how new ideas are built upon (or are variations of) ideas inherited from the past. This generative role of extant images and ideas in the creation of new forms and concepts is a primary lesson of postmodern art.

I refer to the images of natural history, science and the postmodern art that quotes these images as **articulate** images in order to emphasize their ability to convey information and their subsequent capacity to educate. Although their ostensible content may be different (one focuses on nature, the other on culture in relationship to nature), they both provide us with tools for explicating many complex concepts related to art—from the informational or textual content that is inherent in all images to the ways cultural pictorial conventions shape meaning. For these reasons, they can be valuable teaching tools and should be a fundamental part of the art curriculum.
References


