recognizing emotional qualities cannot be something we are simply hardwired to do. Anger at an insult, for instance, is the result of the belief and the judgment that an insulting comment has been made. Recognizing emotion, then, has cognitive dimensions, too; that is, some kind of inference or interpretation is required. The question then is how inference and interpretation might have qualitative dimensions of a kind appropriate to perceiving emotions or how judging and feeling might go hand in hand.

Scientific discoveries point to some striking new ways to understand expression. In particular, much has been made lately of the identification of mirror neurons in monkeys, which a number of scientists believe have counterparts in the human brain. Located in premotor cortex, mirror neurons are activated not only when an action is performed, but also when the action or its results are observed, even when they are depicted in a painting or photograph. This is said to be the basis for what has traditionally been called empathy, or the ability to grasp the feelings of characters in a scene, and those expressed by an artwork as well. The assumption is that perceived actions can be associated with the feelings that typically motivate them, without leading the perceiver to have them herself. Since mirror neurons do not cause the perceiver to reproduce the observed action, the relevant motor program must be engaged only partially or in a special way. The intention to act is simulated "off-line," so to speak; thus, the emotion associated with it may be had off-line as well. It is experienced, but at a distance, in effect. According to this view, perceivers can empathize with Christ's pain and feeling of being forsaken in Rembrandt's *The Three Crosses* (1653) because mirror neuron activity puts them imaginatively in his place. They also grasp the emotional tone of the picture generally by simulating neurologically the hand and arm movements that might have produced the fine lines radiating down on the scene and the sense of effort or hopeful anticipation that might be associated with actions of that kind. However, the precise function of mirror neurons is a matter of ongoing debate, as is the claim that mimicking movements is, in fact, a way of understanding the emotions associated with them.

This discussion of representation and expression suggests how cognitive science might provide new answers to other controversial questions. How, for example, do we interpret art, or ascribe larger meanings to it beyond simply recognizing the objects that may be represented or the emotions that may be expressed? What is the relevance of the artist's intentions in that regard? How do we evaluate art, and, more broadly, what is the place of aesthetic properties in art, such as beauty, and how are such properties ascribed? What is the nature of artistic style? Thus, by offering an opportunity to apply recent research in science to questions such as these, the works in *Art and the Mind-Brain* open the door to new conversation about the nature and power of art.

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NOTES

1. Semir Zeki, *Inner Vision: An Exploration of Art and the Brain* (London: Oxford University Press, 1999), 2.
2. Irving Massey, *The Neural Imagination: Aesthetic and Neuroscientific Approaches to the Arts* (Austin: University of Texas Press, 2009), 9.

This Teaching Gallery exhibition—on view January 27 through April 16, 2012—is curated by Mark Rollins, professor of philosophy, in conjunction with his course "Art and the Mind-Brain," offered by Washington University's School of Arts & Sciences in spring 2012.

TEACHING GALLERY **Spring 2012**

ART AND THE MIND-BRAIN

"We are at the threshold of a great enterprise… a neurology of aesthetics or neuro-aesthetics … an understanding of the biological basis for aesthetic experience."

Semir Zeki, *Inner Vision: An Exploration of Art and the Brain*, 1999[1]

"In aesthetics … a subjective judgment must be arrived at and justified based on a multitude of variables. At that point, neurology has been left behind."

Irving Massey, *The Neural Imagination: Aesthetic and Neuroscientific Approaches to the Arts*, 2009[2]

The past decade has seen an explosion of interest in the bearing of cognitive science on the arts. Cognitive science is itself relatively new, an interdisciplinary effort that seeks to understand perception, memory, emotion, and thought using the combined resources of psychology, neurobiology, computer science, and philosophy—a science of the mind and its relation to the brain. A number of scientists, philosophers, and art historians have taken this research to open the door to a new field, neuroaesthetics, in which questions about beauty, artistic expression, style, and art history are addressed. The result is an exciting exchange of ideas that provides new ways of thinking about art. By considering select artworks from the collection of the Mildred Lane Kemper Art Museum in the context of this discussion, *Art and the Mind-Brain* brings out novel dimensions of the individual works and acknowledges the special power of art to reveal how we see and think. The exhibition invites critical reflection on the central principle of neuroaesthetics: that the aesthetic and art-historical interest of a work of art can be understood in terms of its power to engage the perceptual and cognitive systems of the mind-brain.

Two issues have been fundamental to philosophical investigations into art, art history, and art criticism: (a) How do pictures represent objects? (b) Does art express emotion, and if so, in what sense? The first question is important because understanding pictorial art depends, at bottom, on being able to identify the objects that a work depicts. Moreover, movements and styles are sometimes defined in terms of the types of objects they typically represent, such as landscapes in the Barbizon school or faces in portraits by Thomas Gainsborough or John Singer Sargent. The second issue has not only philosophical interest, but also art-historical and critical significance. Artists themselves often disagree about whether expressing emotion is a goal of art. These two topics can be taken as illustrative of a wide range of issues on which cognitive science might shed light.

MILDRED LANE KEMPER ART MUSEUM

REPRESENTING OBJECTS

The oldest and most intuitive theory of pictorial representation holds that, unlike words, pictures represent objects by *resembling* them. This resemblance theory has lately been revived in cognitive science, where it is taken to be a claim about perception: we see objects in pictures and, to that extent, our perceptual experience of a picture is like the one we would have if we actually saw the objects face to face. According to this view, Roy Lichtenstein's lithograph *Crying Girl* (1963) represents a crying girl only if we experience it perceptually much as we would a real girl crying (as we seem, in fact, to do). The problem is that, in many cases, the experience of the picture and its object are really very different. Our experience of Georges Braque's *Still Life with Glass* (1930) is not very much like that of a glass on a table, yet the painting pictorially represents a glass on a table nonetheless.

A natural response to that fact is to hold that pictorial experience is a special kind. One prominent view focuses on representation as marked by *twofoldness*: we are simultaneously aware of the content of the picture and its surface or design properties. Thus, what a picture represents depends on what can be seen in it, but the seeing takes a distinctive form. For example, in *Riders in the Park* (1918), Maurice Prendergast uses color and line to represent objects, but in ways that attract the viewer's attention to compositional and other artistic devices. According to this theory, twofoldness is a necessary condition for pictorial representation, and it may be sufficient as well. Non-pictorial artifacts can have design features, and any object might have aesthetic interest due to its surface properties or form. Moreover, any object can symbolize something else. For instance, we can appreciate the craftsmanship or beauty in real boots and saddles, and also take them to stand for the rider to whom they belong. However, their design features do not serve a representational function, and we do not see in them the person they represent, as the twofoldness condition requires—which is to say, to symbolize is not to represent pictorially. The mechanism on which twofoldness depends is the subject of controversy, but according to one account, it is a function of the fact that there are two systems in the brain, ventral and dorsal, that operate in parallel. While these systems also are engaged in everyday life, with art they are employed in distinctive ways. The ventral system is activated by an object's shape and allows us to identify the object. The dorsal stream is used to locate the shape; with art it locates it on the surface of the painting rather than in three-dimensional real space. However, the question of exactly how the two systems might underwrite conscious experience remains unresolved.

A third theory sidesteps the problem of explaining the nature of experience by claiming that what we perceive a picture to represent depends on the output of unconscious, low-level visual processes. According to this theory, the visual system identifies objects both in the real world and in pictures through the activation of special-purpose modules, parts of the brain or sets of neurons that are dedicated to responding always and only to features of a certain type. Different modules are said to perform their functions more or less independently of one another and to be unaffected by the perceiver's acquired knowledge and beliefs. In effect, their function is to sort objects into categories. That unconscious sorting affects behavior, even though perceivers are unaware of the process. In that sense, the visual system sees objects in pictorial art and recognizes what the artwork represents. Thus, this is called a *recognition* theory of pictorial representation. According to it, a picture represents a certain object only if the picture activates the same low-level visual processes that the object would engage. This view is supported, for example, by the fact that the figure of the woman in Romare Bearden's collage *Black Venus* (1968) can be identified very quickly without conscious reflection or thought. Similarly, we see very different images, such as Lichtenstein's lithograph and Joan Miró's *Portrait of Josep F. Ràfols* (1917), as representing faces because they both activate a face recognition module. The problem with this view is that it assumes that low-level visual processes pass information on to higher-order thought but are not affected by the perceiver's conscious cognitive activity, and that the various modules do not interact. There is evidence suggesting that this is not strictly correct.

For example, it might be said that Josef Albers's *Homage to the Square: Aurora* (1951–55) isolates a basic shape in order to drive a more powerful response by the neurons that are dedicated to it (i.e., the modules described above). However, single features can never really be isolated; Albers's square has color as well as form. And, according to the recently developed interactive theory of vision, the systems responsible for processing these various types of information do not operate independently but influence each other. This is one way to understand Gene Davis's *Equinox* (1965). Viewers of the painting report having the illusory experience of motion. One explanation is that the illusion is due to microsaccades, or very small, involuntary movements of the eye. In this case, perceptual experience is explained in terms of primitive perceptual processes, but they involve an interaction between line detectors and motor control. More complex experiences can also be explained in this way. In Childe Hassam's *Diamond Cove, Isles of Shoals* (1908), the illusion of movement of small waves across the surface of the water is the result of two devices that cause various systems to interact. First, the painting juxtaposes a series of strong vertical lines in the rocks along the shore with horizontal features on the surface of the water (with an effect similar to that of *Equinox*, only now in the context of figurative rather than abstract art). Second, the artist made the shapes that are reflected on the surface of the water equiluminant with their background, while using contrasting hues for figure and ground. Because the dorsal system described earlier can only respond to luminance contrast, it is disabled by this technique and so cannot locate the shapes. That function must be done by the ventral system (relying on color contrast and form), and that system is not well-equipped to do the job. As a result, the shapes seem to float and move. This contributes to our understanding of what the shapes are and, indeed, of the nature of the larger scene.

EXPRESSING EMOTION

To address the question of how art might express emotion, we must first ask, of what does expression consist? One answer is that an artwork expresses a certain emotion only if viewers can somehow recognize that emotion in it. As with accounts of pictorial representation, some theories attribute our ability to recognize emotion to basic, unlearned, universal abilities, while others ground it in what the perceiver knows and believes. But there the similarities between perceiving objects and emotions end. For one thing, emotions are not external objects that can be represented directly. We only recognize them through their effects. *Crying Girl* depicts a sad woman, but it does not depict sadness per se. Moreover, there are qualitative dimensions to perceiving emotion. The grasping has a phenomenology, even if the response involves primitive processes—a gut reaction, so to speak. That is not true when objects in pictures are categorized by unconscious processes in the brain. However, the fact that understanding emotion has a qualitative dimension need not be taken to mean that artworks actually cause viewers to feel the emotions that are expressed (although Tolstoy, among others, thought that it did). How then are emotions recognized in art?

According to one standard theory, images express emotions by having features that are like those of people who are feeling the emotions; in the case of sadness, those might involve drooping lines, pallid colors, or dark tones. To that extent, an image can be isomorphic to an emotional human face, no matter what the actual content of the image happens to be. A painting by Jackson Pollock, for example, might be seen as expressing anger, even though it represents no objects at all, because its splatters and drip trajectories are like those that would be produced by the hand and arm movements of an angry person. As a result of recognizing this isomorphism, the viewer understands at some level the affective content of the image without actually having the relevant emotion herself. One explanation, from Gestalt psychology, is that visual configurations have intrinsic emotional qualities no matter where they are found. Sharp edges and angles can seem hostile whether in knife blades, in paintings, or on a person's furrowed brow. However, another explanation is that, rather than responding to common Gestalt principles that apply to shapes everywhere, recognizing emotion in art is an ability that is derived from the more basic biological capacity for recognizing it in faces. In nature, that capacity has survival value. In art, the features that engage it are replicated and it is activated, even though survival is not at stake. So, for example, it has been argued that there are a small number of universal emotions that are reflected in facial expressions everywhere in certain characteristic ways. Just as those are universal, so too is the ability we have acquired through natural selection to identify emotions perceptually. That ability is simply carried over to art. The relevant features are cues, to be sure, but they may also work by way of an affective response.

However, it may be objected that neither having emotion nor expressing it is quite as automatic and primitive as these views suggest. Therefore,