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Art, Design and Brain Research: Non-Scientific Thoughts about Neuroesthetics

THOSE OF US who were film buffs in the 1960s will never forget that scene in *The Graduate* in which Dustin Hoffman's character, a student named Benjamin, is approached at his graduation party by Mr. McGuire, an entrepreneur and family friend. The ensuing dialogue goes like this:

> Mr. McGuire: I want to say one word to you. Just one word.
> Benjamin: Yes, sir.
> Mr. McGuire: Are you listening?
> Benjamin: Yes, I am.
> Mr. McGuire: *Plastics*.

In the years since first seeing that film, I've often wondered what current term, widely accepted and popular now, would be used if a comparable movie were made. Among the now probable candidates are *globalization*, *sustainability*, *DNA*, and *biotechnology*. But there is also *neuroscience*, including a spin-off now commonly called *neuroesthetics*.

Neuroesthetics, to borrow an ambitious phrase from some of its leading advocates, is "the science of art".[1] More modestly, it is a somewhat bewildering mix of brain research—which is riding a wave from the data retrieved through PET scans (positron emission tomography), CTs (computed tomography), and MRIs (magnetic resonance imaging)—and cognitive psychology, evolutionary biology, art theory, and an elusive branch of philosophy called esthetics. Of pertinence to this research is a major recent book by Eric Kandel (an eminent neuroscientist and a Nobel Prize recipient for his findings about how memory works), titled *The Age of Insight: The Quest to Understand the Unconscious in Art, Mind, and Brain, from Vienna 1900 to the Present*, New York: Random House, 2012. As Kandel makes clear in this wide-ranging, thoughtful overview of art and neuroscience, brain scans do not literally show what information is being conveyed, but they do reveal what regions of the brain "light up" when stimuli are introduced.

[1] See for example, V.S. Ramachandran & W. Hirstein, "The Science of Art: A Neurological Theory of Aesthetic Experience" in *Journal of Consciousness Studies*. Vol 6 No 6-7 (1999), 15-51.

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Like other non-scientists (whether or not they admit it), I benefit immeasurably from scientific discoveries, largely because they contribute so much to the richness of my daily life (although they also enable the most dreadful side effects, like napalm, massive oil spills, and misdirected drone attacks). While others may feel resentful about the encroachment of scientists on land long-claimed by artists, I myself look forward to learning about causal connections between making and perceiving art—and brain research.

Because I know about Eric Kandel (I haven't read his earlier books, but I reviewed a film about his life, *In Search of Memory*, as well as several others in which he was interviewed), when I heard this book was coming out, I could barely wait to buy it. When I finished reading it, I was not in the least disappointed. I think it's a masterful statement about an enormously difficult subject.

Everything is comparative, and maybe that's one of the reasons why I find this book so endearing. In the past, I have sometimes been less than persuaded by art-related writings by neurobiologists and other scientists. Here are a few of my usual concerns:

First, when I read scientists' writings on art, I am often surprised by the errors they make. Most of these are small mistakes, of little consequence, but others are more bothersome. Let me point out one glaring example: In a well-known book of writings on art and evolutionary biology, a scientist, in discussing the consequences of Modernism, mentions (and I quote) "Dubuffet's 'The Fountain' (a mass-produced urinal)"—thereby mistaking Marcel Duchamp (a household name among artists and art students) for a vastly different artist named Jean Dubuffet.[2] In a spirit of leniency, one could ignore this confusion of names. On the other hand, I found this in a reprint of an often-heralded paper that appeared initially in a prestigious scientific journal, no doubt peer-reviewed and presumably carefully monitored by other expert scientists—yet apparently neither the editors nor the journal's readers noticed this blatant confusion of Marcel Duchamp with Jean Dubuffet.

Seven years later, when the paper was reprinted in book form, the error remained uncorrected and it probably still goes unnoticed today. (It's not unlike confusing filmmaker Sergei Eisenstein with physicist Albert Einstein, two very different people.)

Second, as I read books and articles on neuroscience (many of which I find wonderfully thought-provoking), I am annoyed at times by what appear to

[2] The confusion of Dubuffet with Duchamp can be found in Kathryn Coe, "Art: The Replacable Unit—An Inquiry into the Possible Origin of Art as a Social Behavior" in *Journal of Social and Evolutionary Systems*. Vol 15 No 2 (1992), pp. 217-234. It was reprinted (with the same error) in Brett Cooke and Frederick Turner, eds., *Biopoetics: Evolutionary Explorations in the Arts*. Lexington KY: Icus Books, 1999, 263-292.

be lapses in rigor in the questioning by scientists when the phenomenon they address is "art."

If I were a scientist questioning art, I think it would be essential to know what subject it is I'm researching. That said, I think it may be fair to ask two simple questions: How does one distinguish *art* from *non-art*? And what constitutes *esthetic* experience, as distinct from *non-esthetic* experience? These questions are far from new, nor are they easily answered. In fact, as long as art has been written about, I don't think these questions have been adequately addressed. To complicate matters, because of the pace at which "art" has evolved over the past century and a half, they have become increasingly difficult to answer—maybe absurdly or hopelessly so.

In Kandel's book, I think he sidesteps the question(s) of "what is art and what is not." At the same time, speaking as if he *had* defined it, he appears to concur with those colleagues who claim that the category of art is "ubiquitous," and that, throughout human history, "it" (whatever that is) has been "made and responded to" by "all human societies, from the Stone Age thirty-five thousand years ago to the present." Hence, art or "it" (whatever "it" is) must be "critical for human existence."

I suppose that one could argue that Kandel identifies "art" *de facto* because he provides us with a wide array of things that he regards as belonging to that category. To be sure, his book is especially engaging because he writes in a clear and eloquent way (it is almost a conversational voice) about the works of more varied, less typical artists than those whom one would usually see in books on art and science.

In particular, he focuses especially on a trio of Vienna-based painters: Gustav Klimt, Oskar Kokoschka, and Egon Schiele (some of my favorite artists as well). He discusses the work of these artists at considerable length, discussing their lives as well as their work in a vivid and genuinely interesting way. At the same time, I cannot help but notice that all three of these artists made not abstract but pictorial works of art. In fairness, he does mention Piet Mondrian and even reproduces an abstract painting by him, but I believe it's the only example of abstract or non-pictorial art in the entire volume. So of course I was prompted to wonder: Do Kandel's observations pertain only to pictorial art, or do they equally apply to abstract, non-pictorial art?

Today, when I think about defining art (something I usually try to avoid), I am reminded of an old routine that was part of a Monty Python comedy in 1972. It was a parody of an athletic competition, and one segment featured a sports-running contest in which the participants were "people with no sense of direction." In that sketch, the athletes were shown in their starting positions, awaiting the sound of the pistol. When the gun sounded, they all ran off—

not down the track as expected, but instead in a wacky confusion of speeds, directions and running styles.

I see this as roughly equivalent to what has happened to the category of "art" since the emergence of Modernism (from which, I hasten to confess, I have learned so much and of which I am both an admirer and practitioner). In the Victorian Age, an era that is now disdained for its entrenched "academic art," art was in some ways comparable to the way we currently govern sports. The competitors trained, practiced and prepared in advance to compete in the annual juried Salon. In the process of competing, everyone knew the ground rules, including the artists, the judges and the audience, just as occurs in competitive sports (for example, there is a set of requirements for the uneven parallel bars in Olympic competitions as well as in other sports categories). The Salon art competitions were important opportunities because, just as in sports competitions today, those who excelled (or who were at least juried into the exhibitions) were assured of reasonably stable careers as professional artists, albeit most probably functioning as "journeymen" and not (as the Marlon Brando character complains in *On the Waterfront*) as "contenders."

In the past century until now, the paradigm for artists has not been Olympic competitors but rather the clueless contenders in the Monty Python comedy. Anyone can now claim to be an artist (and they do), and artists can do whatever they want (and they do). Not surprisingly, just as the meaning of "art" has dissolved, so has the meaning of "artist," as has been caustically summarized by Brad Holland, an American illustrator:

> "Almost everybody is an artist these days. Rock and Roll singers are artists. So are movie directors, performance artists, make-up artists, tattoo artists, con artists and rap artists. Movie stars are artists… Victims who express their pain are artists. So are guys in prison who express themselves on shirt cardboard. Even consumers are artists when they express themselves in their selection of commodities. The only people left in America who seem not to be artists are illustrators." (Brad Holland: "Express Yourself: It's Later Than You Think", *The Atlantic Monthly*, July 1996.)

To provide a current example, in the region where I live, there is a community-funded arts center that holds an annual art exhibit that is entirely non-juried. Instead, the "artworks" that make up the show are comprised of anything (anything!) made by the first fifty people who line up at the center's door. As disgruntled (experienced) artists have said, the only apparent criteria are the abilities to get out of bed early—and to stand in line.

Like it or not, "art" is increasingly hard to define (I predict it will get even harder, and, in time, will mercifully turn into dust). It brings to mind the efforts by scientists to prevent harmful moths from reproducing. The female moths release a scent (a pheromone) that males can detect from miles away. To control their

populations, scientists have chemically replicated the females' scent, sprayed it widely, and by that prevented the males from easily locating genuine mates. This is not unlike what has happened to art since the 19th century. It is not that anything has disappeared, far from it—it is merely that the category of "art" has grown so diffuse and all-inclusive (because its "scent" is so widely distributed) that there is no longer a reasonable way to distinguish it from "non-art."

My third concern—and I realize it's all but inseparable from the challenge of defining art—is that many (probably most) scientists are either poorly informed or maybe not fully appreciative of what has happened to the category of "art" (as well as the concept of "artist") in the past century. Of course I may be mistaken - maybe they *do* know about these changes but have chosen instead to ignore them in the hope of avoiding perplexities that might complicate or undermine their research.

As to what these changes are, and when and how they originated, there seems to be widespread agreement (at least in the art world) about the importance of two key artworks—one by Pablo Picasso, and the other by Marcel Duchamp—both of which were originally made as protests of academic rigidity and the Salon tradition (as were of course the efforts of the Vienna-based Modernists, which Kandel discusses in detail). While neither of these two keynote works were created by Viennese artists, I still think it peculiar that neither one is mentioned—not even in a footnote—in Kandel's otherwise (usually) credible book.

The first of those groundbreaking artworks is a painting of a group of prostitutes (in alluring "cheese cake" poses) by Picasso, titled *Les Demoiselles d'Avignon*. Produced in 1907 but not exhibited until 1916, it is in part a caricature of academic Salon paintings. It has the "parts" but not the "whole" of a fully compliant submission to the Salon (nude figures, drapery, color, the suggestion of three-dimensional space, and even the token inclusion of scraps from a still-life), but it is so radically stylized and abstracted (especially for that time period) that it could not be considered then as a serious entry. (Picasso's picture can be viewed on http://en.wikipedia.org/wiki/File:Les_Demoiselles_d%27Avignon.jpg).

The other work, completed ten years later, was Marcel Duchamp's (not Jean Dubuffet's!) *Fountain*, a "readymade" or *objet trouvé* that he contrived by purchasing a urinal at a plumbing shop, signing it "R. Mutt 1917," and entering it in an exhibition. It was of course rejected on the grounds that a prosaic plumbing fixture is not a proper work of art or (more to the point) that art is not a mere *pissoir*. Duchamp and his allies claimed that his entry *was* a work of art for the reason that he (the artist) had selected it, displaced it to a new context, and thereby assigned it new meaning. (Duchamp's picture can be viewed on http://en.wikipedia.org/wiki/File:Duchamp_Fountaine.jpg)

Regardless of whether or not you or I (or Eric Kandel) admire Picasso's *Demoiselles* and Duchamp's *Fountain,* few works of art are as widely known or influential. In 2007, an article in *Newsweek* magazine claimed that Duchamp's urinal was "the most influential work of art of the last 100 years," while, three years prior, Picasso's *Demoiselles* was chosen by 500 British art professionals as enjoying the same distinction. Thanks especially to Duchamp, it is now widely contended that anything is "art"—anything—as long as the "art world" accepts it as that. That strange and astonishing "standard" (associated with philosopher George Dickie, and known as "the institutional theory of art") is the current prevailing conception of art among artists and art theorists.[3]

In contrast, in the 19th century, drawing in tandem with vision was thought to be indispensible to the training of an artist. The practice of "visual art" was a rich and longstanding tradition that (in 1960) was ever so masterfully analyzed by the Viennese-born art historian and art theorist, Ernst H. Gombrich, in his influential book, *Art and Illusion: A Study of the Psychology of Pictorial Representation.*[4] Nearly fifty years have passed since that wonderful book was first published, but I still recall how thrilled I was, as an undergraduate art student, when I first read it.

At that point in my intellectual development, Gombrich assuredly opened my eyes. But he was far from alone, because I was also reading then *Language of Vision* by artist-designer Gyorgy Kepes (who acknowledged his indebtedness to the Gestalt psychologists); *Art and Visual Perception* by Rudolf Arnheim (who had been a student of the Gestalt psychologists in Berlin); *The Act of Creation* by Arthur Koestler (whose elegant suppositions about "the conscious and unconscious in science and art," while mostly dismissed by scientists then, now seem to be largely predictive of current brain research); and the laboratory demonstrations of artist and optical physiologist Adelbert Ames II (whom Gombrich repeatedly praised because Ames' ingenious "set-ups" confirmed Hermann von Helmholtz's 19th century notions about vision as a dynamic "transactional" act).[5] At the same time I was also learning about the "appearance of animals," especially deceptive resemblance (mimicry), protective coloration (camouflage), and of course ethology.

Given that context, when I opened this book by Eric Kandel, I could hardly have been more excited to find that he too is interested in "visual art" in relation to

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[3] See Denis Dutton, *The Art Instinct: Beauty, Pleasure, and Human Evolution*. New York: Bloomsbury Press, 2009.

[4] E.H. Gombrich, *Art and Illusion: A Study of the Psychology of Pictorial Representation.* Princeton NJ: Princeton University Press, 1969.

[5] See Gyorgy Kepes, *Language of Vision*. Chicago: Paul Theobold, 1944; Rudolf Arnheim, *Art and Visual Perception: A Psychology of the Creative Eye*. Berkeley CA: University of California Press; Arthur Koestler, *The Act of Creation: A Study of the Conscious and Unconscious in Science and Art*. New York: Macmillan, 1964; and William H. Ittelson, *The Ames Demonstrations in Perception*. New York: Hafner, 1952.

neuroscience. Amazingly, Ernst H. Gombrich's name appears in the index more than 150 times. According to Kandel, the findings of the Gestalt psychologists, whose work was discounted for so many years, were apparently far ahead of their time. Even Arnheim is briefly mentioned in the book. At the same time, inexplicably, the influential accomplishments of Ames, Kepes and Koestler (and others) are entirely omitted—as if they had never existed.

In contrast with Kandel's contentions, today my young art historian friends smile knowingly and tell me that Gombrich's ideas are no longer applicable to the current understandings of "art"—no one reads him anymore. Or, as an artist-teacher colleague said, to teach students to draw in a way that is centered on vision is "a lie," because that is no longer the basis of art. Refreshingly, Kandel's book embraces Gombrich's ideas and explains how they now seem to mesh with the latest findings in brain research. As a result now of a newly entrenched academy, each year fewer artists, art professors and art students are able to draw (not counting such hopefully transient whims as anime, graffiti and bad tattoos).

In addition, a major contributing factor is this: More than a century after Duchamp premiered his porcelain urinal *objet d'art*, that means of youthful rebellion is still commonly thought to be out-of-the-ordinary, innovative, even creative. In truth, it almost never is. More than not, the result is a tiresome vapid cliché, a view sarcastically underscored in *Art School Confidential* by Daniel Clowes, who describes it as the "tampon-in-the-teacup" trick.[6]

Going back to my earlier comparison of 19th century Salon art and current athletic competitions, I find it ironic that artists today are distressed by the imbalance of public devotion to art and athletics, and the seemingly limitless funding that goes to competitive sports in our society. It is typical for an artist to ask: Why isn't such funding given to the arts instead? Why is there so little coverage of art in the news when such excessive attention is given to sports? Why does art have such low priority in public education? In short: Why don't people take art *seriously*? I suspect this is largely explainable by the fact that in art, as widely practiced now, just as in the Monty Python sketch, there is no credible "contest" to watch.

These are of course volatile issues. As non-artists, scientists risk being ostracized by art enthusiasts as reactionary, inflexible or—even worse—as philistines. It would be interesting to learn if Kandel and other neuroscientists even realize that the category of "art" has largely become a non-concept, an empty category, or, to borrow Charles Darwin's phrase, a woefully "entangled bank."

So, like it or not, that is the polluted surrounding in which this fascinating book

[6] Daniel Clowes' satirical account of current art school training originally appeared as a black-and-white comic in Issue 7 of a comic book titled *Eightball* (November 1991). In 2006, it was made into a film.

has risen to the surface (again, I think, refreshingly). As for the book itself, it is not easily summarized—and probably, properly, should not be, because it is so complex, so detailed and so wonderfully engaging. Fortunately, its title and subtitle (*The Age of Insight: The Quest to Understand the Unconscious in Art, Mind and Brain*) are helpful in building a "rough sketch" of the message that Kandel is trying to share.

By "art," Kandel (in part for personal reasons, I think, especially because of his Holocaust-era childhood link to Vienna) is especially interested in a sequence of innovations that took place in Vienna at the turn of the century, in the course of which he zeroes in on the Vienna Secessionists, who were contemporaries of Sigmund Freud, who was also in Vienna then.

By "mind," he is alluding to a rich, largely pre-empirical era in psychology, represented famously by Freud and William James, both of whom made their discoveries through introspection, mostly their own observations and thoughts.

Freud has always been controversial, but, according to Kandel, three of his key ideas still stand: (1) Most of our mental activity is less than conscious; we are only fully cognizant of "the tip of the iceberg" (with apologies for the Freud cliché). (2) We are instinctively preoccupied with sex and aggression, even as children. And (3) there is no sharp division between healthy mental life and mental illness—it is a gradual blend at best.

As Kandel notes, Freud was not the only person to reach these conclusions. Maybe because of a Zeitgeist, there were artists and writers and others in Vienna (including those who had split off from academic art, the Vienna Secessionists) who were drawn to these very same issues.

In the work of artists such as Klimt, Kokoschka and Schiele, there is a significant, radical shift (as Kandel explains) in which artists and others increasingly looked not just at the surface appearance of things (the ordered, outer landscape of the Renaissance), but also at tacit suggestions about a cavern of complex emotions (an inner landscape à la Freud)—sex, aggression and anxiety, in particular. It was this (intermixed with other developments) that assuredly prepared the way for Expressionism—Austrian, German and otherwise.

Appropriately, Kandel plays up the importance of a series of sixty-four bizarre self-portrait busts (the "canonical grimaces") by the eighteenth century Austrian sculptor Franz Xaver Messerschmidt (thought to have been mentally ill), whose work was later analyzed by art historian and psychoanalyst Ernst Kris (Gombrich's teacher). Kandel also makes note of the photographs by Jean-Martin Charcot (with whom Freud had studied) of women patients during episodes of hysteria, in strangely contorted positions.

I don't recall that he mentions the photographs of electrically induced facial

expressions by French neurologist Guillaume-Benjamin Duchenne de Boulogne (the teacher of Charcot), first published in 1862, some of which were reprinted a decade later in Charles Darwin's *The Expression of the Emotions in Man and Animals*. Beyond that, I suspect there were other influences too, including Charles Henry, a librarian at the Sorbonne, who proposed (c1885) an *esthétique scientifique* in which he used an "esthetic protractor" and other methods to calculate colors and angles by which a particular range of emotion might be reliably, purely conveyed.

Throughout this book, there is a welcome civilized tone. Kandel is always respectful of suppositions from the past, and he is especially careful about not "throwing out the baby with the bath water." Instead of completely discrediting Freud—as others are all too willing to do—he persuasively makes the case for the legitimacy of some of Freud's ideas. Likewise, instead of dismissing William James as a gifted essayist who was speaking in an age long-past, he shows how current brain research may support the James-Lange theory, a one-time bizarre proposal that our emotional reactions to an event take place in advance of—not in response to—our conscious awareness of that event.

As a designer, I was especially encouraged by Kandel's reaffirmation of Gestalt theory. When I was in school in the 1960s, the restrictive behaviorist doctrine of B.F. Skinner and others (legitimized by rat research) was in sacred ascendancy, while everything else was in rapid decline. In those days, Gestalt psychology was all but a joke. But as an artist I knew differently, and that now appears to be turning around. In Kandel's favor, he discounts neither the empirical experiments of the behaviorists (also known as atomists or reductionists), nor the inclusive holistic approach of the Gestaltists. He argues that both are defensible views—when considered in the context of current brain research.

In Kandel's book, those aspects of vision that the Gestaltists are typically credited with (Max Wertheimer's "laws of perceptual organization," for example) are described as being hard-wired—they are the "factory defaults" that come "in the box" when our brains are installed. Accomplished through "bottom-up processing," they originate in the retina and the primary visual cortex, and include such well-known functions as figure-ground detection, color vision, and the "unit-forming" biases of similarity grouping, proximity grouping, continuity and so on.

These tendencies are universal, not the result of cultural upbringing. In support of that, they are not only fundamental to art, they are also the "rules of engagement" for camouflage, stage magic, and pickpocketing, all of which are skills and susceptibilities that are not dependent on culture. As a designer, I do not have to be able to read Russian (nor do I have to be Marxist) to appreciate the intelligence of the design of Russian Constructivist book layouts or film posters.

From that holistic point of view (seeing the forest instead of the trees) I can also clearly grasp the structural relations in abstract or non-pictorial forms.

That said, I was puzzled to find that Kandel has almost nothing to say about the structure of art at that level. (It's also interesting to recall that Gombrich, during his lifetime, was said to be dismissive of non-pictorial art, a charge that he tried to respond to, nearly twenty years after the publication of *Art and Illusion*, when he came out with a parallel volume he called *The Sense of Order: A Study of the Psychology of Decorative Art*).[7]

Instead, Kandel (at least when he talks about art) appears to be chiefly interested in a later phase of vision (accomplished through "top-down processing") that is not hard-wired, and is substantially influenced by past experience. In that phase, which (in Kandel's words)

> "… is carried out along the pathway from the primary visual cortex to the inferior temporal cortex…the brain integrates visual information with relevant information from a variety of other sources, enabling us to recognize specific objects, faces and scenes."

It is in the phase that we also make suppositions about observed reality, which may or may not be confirmed. This process of "trial and error" of sorts was famously referred to by philosopher Karl Popper (a friend and mentor of Gombrich) as "conjecture and refutation," from which Gombrich coined the phrase "making and matching" to describe the *pas de deux* between drawing and seeing.

Most of the ideas in Kandel's book have a long pedigree, so that his greatest achievement may be to show us how prior discoveries appear sometimes to dovetail with the findings of neuroscience. For example, the idea that vision is a two-way interactive blend can be traced back to the Victorian-era research of Helmholtz (and others) and, in the twentieth century, to the experiments and writings of Ames, who compared perception to betting at the race track, and endorsed a branch of psychology called "transactionalism." But, as Kandel notes, a related idea can also be found in the writings of Alois Riegl, a prominent turn-of-the-century Viennese art historian who contended that art, like vision itself, is (in Kandel's words) "incomplete without the perceptual and emotional involvement of the viewer." Riegl called this the "beholder's involvement," an idea that Gombrich later revived and renamed "the beholder's share."
In Gestalt theory, the beholder's share is more commonly (and widely) known as closure, a process in which (inadvertently) the viewer becomes an accomplice. As Koestler so aptly described it: "The intention [of ambiguous communication] is not to obscure the message, but to make it more luminous by compelling the

[7] E.H. Gombrich, *The Sense of Order: A Study of the Psychology of Decorative Art.* Ithaca NY: Cornell University Press, 1969.

recipient to work it out himself—to re-create it." This dance-like give-and-take between the observer and the thing observed, Kandel concludes, "underlies all our perceptions of the world" because the very act of seeing is "fundamentally interpretive." For this and other reasons, he writes, "the brain is a creativity machine."

In this phenomenal book, Kandel provides the reader with a detailed yet panoramic view of the vast expanse of brain research—and its potential implications—with far more information than can even begin to be mentioned in a single book review.

That said, I want to dwell momentarily on one other observation by Kandel that I find especially important. Early in the book, he talks at length about the painter Gustav Klimt and the proto-expressionist portraits he made of wealthy, idealized women in Vienna. He notes that, while Klimt's portraits might at first appear to be pictorial representations of the outward appearance of his subjects, their emotional lives are also represented by (among other means) the skillful rendering of their hands.

I could not agree more (it's related more or less to what we call "body language"). In particular, Kandel zooms in on the hands of the subject in Klimt's portrait of *Adele Bloch-Bauer I* (1907)—a deservedly famous portrait that, as Kandel makes clear, is the iconic centerpiece of this book (it appears on the dust jacket, and he begins the first chapter by talking about it). The entangled writhing of the hands is (I think) not so much a "symbol" (Kandel's term) of the subject's emotional complexities, but a gestural abstract equivalent of her innermost passions, her fears and vulnerabilities.

In Gombrich's books, he talked about art as being comprised of two categories: "symbolic" (or pictorial) art versus "decorative" (or abstract) art. Pictorial art (the subject of *Art and Illusion*) emanated from a "search for meaning," while nonpictorial art was based on a "sense of order" (hence the title of the book *The Sense of Order*). But I think those two categories are insufficient, in the sense that they do not appear to include less explicit levels of meaning in art.

For example, if I look more closely at the hands of Adele Bloch-Bauer in Gustav Klimt's portrayal of her, I cannot help but notice that her hands resemble one of two non-pictorial shapes in Wolfgang Köhler's famous book *Gestalt Psychology*, patterns which he juxtaposed with two nonsense words, "takete" and "maluma".[8] One of those shapes is curvilinear and flowing (which, in experiments, subjects almost always paired with maluma), while the other is jagged, geometric and greatly disrupted (which subjects almost always paired with takete).

[8] Wolfgang Köhler, *Gestalt Psychology*. New York: Liveright Publishing, 1947. The images for "takete" and "maluma" appear on page 225.

It is interesting that, according to Köhler, he came to this idea in part because he read a poem by German writer Christian Morgenstern, who observed (in one of his verses) that "All seagulls look as though their name were Emma." I myself may not agree that seagulls look like Emma sounds, but I do agree that there are levels of resemblance that are not dependent on pictures per se. Going further, I think that the more subtle interpretative levels of art are probably dependent on one of the most fascinating discoveries in recent brain research—something that neuroscientists call mirror neurons.

In brief, mirror neurons facilitate empathy in the process of observing things. When we experience empathy, we feel inside as if we ourselves were in the place of the person or thing we are watching. Since childhood, for example, in the process of drawing human faces, I have often caught myself (unawares) taking on the expression of the face that I am drawing. Similarly, in looking at Klimt's painting, I think we mimic in our brains the gestural feeling expressed in the hands of Adele Bloch-Bauer. This becomes even more interesting in light of the discovery that some of the same neurons are activated in the brain when (vicariously) we observe an activity as when we ourselves engage in it. I think this occurs not only in response to pictorial images, but to gestural non-pictorial forms—such as the abstract visual shape that "looks like" and/or "feels similar to" Köhler's nonsense word "takete."

To read Eric Kandel's book is a substantial undertaking, but the experience is largely pleasurable, and the effort is certainly worth it. At more than 630 pages, it is large, wide-ranging and exhaustively detailed. It makes consistently helpful use of hundreds of illustrations (interspersed throughout the text), many in full color, some of which are reproduced more than once so that the reader does not have to stop and search back for an image that was introduced earlier. There are thirty-two chapters, but the text is made more manageable by the brevity of each chapter, most of which are about ten pages long.

More than anything else, reading this book is a pleasure because of the clarity and straightforwardness of Kandel's style of writing about a subject that might otherwise be bewildering, especially to non-scientists. While its content is challenging, be assured that it is also a pleasurable book—for scientists, artists and everyone else who is eager to learn more about the complex operations of the human brain.

Summary

This is an informal discussion (from the view of a non-scientist, an artist and graphic designer) of questions about art and esthetics in relation to recent brain research. It addresses a number of issues about neuroesthetics that arose from the author's reactions to a recent major book by Eric R. Kandel, titled *The Age of Insight* (2012).

Keywords: Neuroesthetics, art, bottom-up processing, empathy, mirror neurons.

Zusammenfassung

Der Beitrag ist eine zwanglose Erörterung von Fragen zu Kunst und Ästhetik in Bezug auf die neuesten Hirnforschungen aus dem Blickwinkel eines Nicht-Wissenschaftlers, Künstlers und Grafik-Designers. Die Auseinandersetzung befasst sich mit einigen Fragestellungen zum Thema Neuroästhetik, zu denen der Autor durch die Lektüre des neuen bedeutenden Buchs von Eric R. Kandel *The Age of Insight* (2012) angeregt wurde.
Schlüsselwörter: Neuroästhetik, Kunst, bottom-up-Prozesse, Empathie, Spielgelneuronen.

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