

THE NEUROPSYCHOLOGY OF VISUAL ART: CONFERRING CAPACITY

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I. Introduction

The effects of brain damage on the capacity to produce visual art stand in sharp contrast to many other human capacities. Diseases of the brain can impair our ability to speak or comprehend language, coordinate movements, recognize objects, apprehend emotions, and make logical decisions. By contrast, while diseases of the brain can certainly alter the ability to produce art, in many instances it is not so clear that the results are “impaired.” Paradoxically, in some cases the art seems to improve.

In what follows, I will review the ways in which neurological disorders can create a disposition to produce visual art, provide artists with a unique visual vocabulary, add to artists’ descriptive accuracy, and enhance their expressive powers. These alterations are, of course, predicated on the brain damage not producing the kind of motor weakness that would make graphic expression impossible. I am not claiming that artists, by dint of their special talents, are exempt from the ravages of brain damage. Elsewhere, I have reviewed ways in which brain-damaged artists manifest deficits, such as achromatopsia, unilateral spatial neglect, visual agnosias, and asymbolias, similar to nonartists, albeit more eloquently (Chatterjee, 2004a,b).

II. Disposition to Produce Art

People with frontotemporal dementias (FTD) undergo profound changes in their personalities. They can be socially disinhibited and disorganized and can have problems with their language, attention, and ability to make decisions. Despite these alterations in comportment and cognition, some people with FTD develop a propensity to produce art for the first time. [Miller and colleagues \(1998\)](#) note that the art tends to be realistic rather than abstract or symbolic. The art is most often visual and highly detailed with an obsessive quality. The patients themselves are intensely preoccupied with their art.

The disposition to produce visual art can even arise late in the course of FTD. [Anterion and colleagues \(2002\)](#) reported a patient who began to draw in an advanced stage of his disease, the point at which he was apathetic and did not follow verbal commands; although he responded to family members with appropriate emotional responses. Despite this severely compromised state, he would draw when pencils were placed in front of him. He produced landscapes, houses, figures of women, and self-portraits.

The artistic output of people with FTD appears to be a consequence of the change in their personalities, for example, acquired obsessive–compulsive traits find expression graphically, and they produce striking visual images as a consequence of their repetition and attention to detail.

Are there other instances of obsessive–compulsive traits brought on by neurological diseases predisposing individuals to produce art? Three examples are consistent with this hypothesis: a person with probably partial complex seizures, a person with a subarachnoid hemorrhage, and a subset of children with autism.

[Sacks \(1995c\)](#) described the remarkable case of Franco Magnani, an Italian painter working in San Francisco. Magnani painted hundreds of realistic scenes of an Italian town, Pontito, where he had grown up. At the age of 31, Magnani had a febrile illness that was probably an encephalitic disease. Following that illness, he began to paint obsessively. Pontito was the only subject of his art, and he painted compulsively. His obsession with Pontito pervaded virtually all his conversations. Sacks speculates that he had partial complex seizures and was in part demonstrating the kind of obsessive “sticky” personality disorder that is sometimes associated with temporal lobe epilepsy ([Waxman and Geschwind, 1975](#)). However, instead of being hypergraphic verbally, as is more common among such patients, he was hypergraphic visually.

More recently, [Lythgoe and colleagues \(2005\)](#) reported the case of a builder with a subarachnoid hemorrhage. He had no interest in art premorbidly but became an obsessive artist after recovery from the initial injury. After the hemorrhage, he had a normal verbal and performance IQ and normal behavior, except for some degree of verbal disinhibition. He did well on most neuropsychological

tasks, except for those that involved task switching. He also began to draw hundreds of sketches, mostly faces. He then moved to large-scale drawings sometimes covering entire rooms but confined his art to a few themes. The authors emphasize his perseverative tendencies as critical to the emergence of his artistic skills.

Finally, about 10% of autistic children have savant-like abilities (Rimland and Fein, 1988). A subset of these children produces striking visual images (Sacks, 1995a). The most detailed description of such a case was Nadia, reported by Selfe (1977). As a baby, Nadia did not respond to her mother, and as she got older she lacked social empathy. As a child, she had an obsessive concern with the presence of other children without establishing any substantial interactions with them. Her acquisition of language was delayed. Despite these developmental abnormalities, she had remarkable drawing skills. By the age of 3, she was drawing life-like horses. She drew intensively for a few moments at a time, always copying images. She also focused on specific kinds of images like horses, of which she drew hundreds of examples. While Nadia's abilities were striking, she was not unique. Autistic children with these striking drawing skills seem to focus on specific subjects and draw them repeatedly.

Thus, it appears that several neurological disorders that produce obsessive-compulsive traits can also dispose people to produce art. These artists seem to produce realistic images and tend to be preoccupied by specific themes. While the neural basis for obsessive-compulsive disorders is not completely understood, it is associated with dysfunction of the orbitofrontal and medial temporal cortices and frontostriatal circuits (Kwon *et al.*, 2003; Saxena *et al.*, 1999; Ursu *et al.*, 2003). Notably, in the cases described, these regions could have been damaged, and posterior occipitotemporal cortices were presumably intact. The preservation of posterior cortices ensures that the neural substrate for recognizing and representing faces, places, and objects is preserved and, thus, available to be the subject of these patients' obsessions.

III. Visual Vocabulary

Artists develop visual vocabularies that they use in their artwork. They acquire these vocabularies from a variety of sources, including formal training and other artists. Neurological disorders, such as migraine and epilepsy, can be associated with productive visual phenomena. People with these disorders may have another source of imagery to enrich their visual language.

People with migraine experience various visual phenomena, including scotoma, phosphenes, scintillations, and fortification spectra. Wilkinson and Robinson (1985) analyzed the artwork submitted to the first National Art Competition

sponsored by the British Migraine Association and WB Pharmaceuticals. Of over 200 entries, 70% showed spectral appearances, 48% showed fortifications, 16% showed areas of visual loss, and 2.5% showed mosaic visions (Chapters 8 by Klaus Podoll and 9 by Klaus Podoll and Debbie Ayles).

The artist Ignatius Brennan, as reported by [Podoll and Robinson \(2000\)](#), eloquently expressed the idea that migrainous auras can inspire art. He had migraine since the age of 11, which he experienced as frightening episodes of visual loss, often with a zigzag cloud obscuring much of his visual fields. As he got older, he saw triangles and rounded forms as well as mosaics. He also experienced macroscopic and microscopic visual distortions. He described the effects of migraine on his art as follows: “I started with pictures of my migraine experiences unconsciously rather than deliberately, when I was in art school. I used to do a lot of drawings of landscapes at that time and often found that I would be drawing clouds not just in the sky, but everywhere, which I think was a reference to the visual voids experienced during visual loss. I also used serrated zigzag shapes in my drawings, symbolizing the experience of a whole being broken up. . . . Clouds, zigzags and other imagery are part of my own personal visual vocabulary, but which certainly has come out of migraine experiences. I’m absolutely sure. I don’t tend to do that deliberately, but when it suits a particular subject, e.g. to represent a feeling or an emotion, I make use of these images in different ways”

IV. Descriptive Accuracy

For centuries visual artists have been preoccupied with rendering objects and the environment accurately. Underlying the problem of depictive accuracy in drawing and painting are the roles of knowing and seeing when apprehending objects. And here, patients with disorders of knowing and seeing might be informative.

Since [Lissauer’s \(1890\)](#) classic descriptions of visual agnosias, object recognition deficits are recognized to lie on a continuum between perceptual and conceptual deficits. Perceptually based agnosias, called apperceptive agnosias, impair the ability to process the visual information into a coherent object. Conceptually based agnosias, called associative agnosias, involve a disconnection between semantic and visual representations or impairments of semantic representations themselves ([Farah, 1990](#)).

One might infer that an inability to recognize objects would be accompanied by an inability to draw that object. This inference turns out to be not quite accurate. [Wapner et al. \(1978\)](#) described an artist with an apperceptive agnosia who had difficulty copying images despite being able to convey depth and shading in drawings that were otherwise fragmented. His preserved semantic

system was of little help in guiding his artistic production. Thus, when asked to draw a telephone, he would construct images by reasoning. "It needs a base for it to stand on, a place to speak into, something to hear with, a wire to plug in for communication and a place to dial." This verbal strategy was not particularly effective in rendering accurate images. Thus, semantic knowledge by itself does not help render objects accurately.

This patient contrasts with two people with associative agnosias (Franklin *et al.*, 1992; Schwartz and Chawluck, 1990). Their agnosias were probably because of an underlying semantic dementia, but at the time this entity was not well recognized. In both cases, when asked to draw objects from verbal labels these people drew crude, simplified images similar to those drawn by a young child. However, with complex visual images, the results were strikingly different. For example, one of these people could copy a portrait originally painted by Botticelli or draw a portrait of a staff worker beautifully (Franklin *et al.*, 1992). These artists' drawings also deteriorated dramatically if the model was taken away suggesting that a visual short-term memory deficit was part of the picture. However, for our purposes, the point is that semantic knowledge of an object is by no means necessary to render it accurately.

Observations of a Polish aphasic artist are also consistent with this point (Kaczmarek, 1991). Profoundly influenced by the events of the World War II, his premonitory paintings were antiwar statements, which often included numbers, letters, and ideograms. Following his stroke, he was nonfluent and only produced a few words. Our semantic system at its core has the ability to abstract and generalize. On this view, the use of abstracted symbols could be considered a marker for a preserved semantic system. Although his semantic system was not tested in detail, one might infer that it was impoverished. His inability to make use of verbal symbols also extended to his artwork. He was no longer able to produce paintings in his previous style. However, he was still able to draw realistic landscapes and portraits quite well. Here again is an example of an individual able to depict scenes and people accurately despite having lost his ability to manipulate symbols.

Does semantic knowledge of an object actually hinder artistic production? The art historian Gombrich (1960) observes that even trained artists bring a set of hypotheses of what they are looking at to bear on their depictions and that these hypotheses sometimes blind them to what they are seeing. It would follow that impaired knowledge of the object of one's gaze, provided the rest of the visual-motor systems are intact, would aid in the ability to depict objects and scenes accurately. Perhaps this is what is happening in the cases of autistic children with savant-like artistic abilities.

Autistic artists like Nadia and Wiltshire needed only to look at an object for a few minutes before drawing them rapidly and accurately (Sacks, 1995a; Selfe, 1977). Nadia's abilities were not an accelerated version of other children's

drawing development. She did not first go through a phase of drawing simple schematic images before learning to draw realistically. Rather her skills were developed at the outset and did not change much over time. She made lines deftly and without hesitation. Nadia drew horses repeatedly. Two observations suggest that Nadia treated these images differently than most people. First, she would start the drawing anywhere on the page. Rather than trying to squeeze the image into the page, she terminated the drawing when she came to the paper's edge, even if it meant only drawing part of the horse's head. Second, most people draw horses by starting at the head. Nadia might start her drawing at the neck of the horse and seemed unaffected by critical features by which we might recognize an object. Her remarkable skill at drawing horses and pelicans appear to have emerged from the obsessive focus on specific objects that were at the same time not obscured by semantic associations that interfere with the ability to "see" the visual object. The history of her cognitive development and drawing skills is consistent with this speculation. As Nadia eventually acquired language, her drawings became more prosaic. Presumably, the acquisition of language reflected the development of a richer semantic system and detracted from her artistic skills.

V. Enhanced Expressivity

Visual art is, of course, not restricted to the task of descriptive accuracy. Perhaps driven by the advent of photography, visual art has diverged into many forms. Among the most intriguing effects of brain damage on artists are a class of phenomena in which the inability to make accurate depictions results in surprisingly appealing stylistic changes in their art. These stylistic changes can occur in the use of color and form, and in the content of images.

Sacks (1995b) described an artist with an acquired achromatopsia following a traumatic brain injury. Before the accident, his paintings were colorful and quite abstract. After the accident everything appeared "dirt gray" to him. His initial attempts to use color were haphazard, and he ultimately resigned himself to black and white paintings. Eventually, he introduced a limited set of colors to his paintings. After an initial sense of helplessness, he began to consider his new way of seeing as a strange gift in which he saw the world as pure form, uncluttered by color. This new way of seeing introduced him to a new range of expressions. For example, when driving he saw a sunrise in which blazing reds were seen as black. He described the scene as "The sun rose like a bomb, like some enormous explosion. Has anyone seen a sunrise like this before?" Inspired by this image, he produced a black and white painting called "Nuclear Sunrise."

Right hemisphere damage can produce left spatial neglect in which patients are unaware of the left side of space (Chatterjee, 2003). Artists with neglect omit

the left side of images that they draw or paint (Blanke *et al.*, 2003; Cantagallo and Sala, 1998; Halligan and Marshall, 1997; Jung, 1974; Marsh and Philwin, 1987; Schnider *et al.*, 1993). As they recover from their neglect, their use of line may still be altered. Two examples show how this change in the use of line can produce art that comes to be regarded highly. Lovis Corinth, an important German artist, suffered a right hemisphere stroke in 1911. As he recovered, he resumed painting. His self-portraits and portraits of his wife showed clear changes in style, with details on the left sometimes left out and textures on the left blended with the background. Alfred Kuhn characterized this work as follows (quoted in Gardner, 1975) “He [Corinth] had become prescient for the hidden facets of appearance The contours disappear, the bodies are often as ript asunder, deformed, disappeared into textures . . . also the faithfulness of portraits had ceased almost entirely With wide stripes the person is captured in essence. Characterization is now exaggerated; indeed, often to caricature . . . Corinth always seems to be painting a picture behind the picture, one which he alone sees . . . at this point Corinth shifted from the ranks of the great painters into the circle of the great artists.”

More recently, in the 1990s, Heller (1994) reported the experience of the artist Loring Hughes, who after a right hemisphere stroke had difficulty in coordinating the spatial relationship between lines. This forced her to abandon her premorbid style of depictive accuracy. Instead, she turned to her own imagination and emotions. Initially, she was too ashamed to display her paintings. Once she became comfortable with her new style, she began to show her work. To her surprise the artistic community responded well to these distorted images. The critic Eileen Watkins described her work as now delivering “an emotional wallop” that was not present previously.

The stylistic changes, when they occur with left brain damage, appear to be quite different than those observed with right brain damage. The specific changes are the introduction of more vivid colors and a change in content. These changes are exemplified in the Bulgarian painter, Zlatio Boiyadjiev, a Californian artist named Katherine Sherwood, and a Swiss painter reported recently by Annoni and colleagues.

Boiyadjiev’s premorbid artistic style was natural and pictorial, and he tended to use earth tones in his paintings. Following the onset of his aphasia, Boiyadjiev’s paintings became richer, more colorful, and contained more fluid and energetic lines (Brown, 1977; Zaimov *et al.*, 1969). The imagery in his work became more inventive and at times even bizarre and fantastical. Similarly, Katherine Sherwood suffered a left hemisphere hemorrhagic stroke, which left her with an aphasia and right-sided weakness (Waldman, 2000). She trained herself to paint with her left hand, and since then her career has flourished. Premorbidly, her images were described as “highly cerebral” incorporating a range of esoteric images such as cross-dressers, medieval seals, and spy photos. After her stroke she felt that she could not produce such images if she wanted. Her new style is

described as “raw” and “intuitive,” with large irregular circular movements. She says her left hand enjoys an ease and a grace with the brush that her right hand never had and describes it as “unburdened.” Finally, [Annoni and colleagues \(2004\)](#) recently described a Swiss landscape painter whose art was described as being “figurative-impressionist.” He had a small stroke in the left thalamo-perforant vascular distribution. His wife thought he had mild emotional dyscontrol after his stroke. He felt that he was more sensitive to the hidden beauty of images and used bolder colors. He switched from impressionist to more realistic images. He thought that he was less likely to use lines, contours, and perspective clearly and was more creative when he used his left than his right hand.

A final stylistic change rendered by brain damage is a move toward simplicity. [Annoni and colleagues \(2004\)](#) also described a person with a left occipital lesion involving areas V1 and V2, resulting in a right superior quadrantanopsia with macular sparing. A month after his stroke he resumed drawing and painting. His new artwork was simplified, stylized, increasingly abstract, and confined to a limited use of colors. It is not known if damage to visual association cortices would consistently result in simplification and abstraction. However, a few artists with Alzheimer’s disease who have continued to paint ([Crutch *et al.*, 2001](#); [Maurer and Prvulovic, 2004](#); [Miller and Hou, 2004](#)) seem to demonstrate a similar pattern.¹ The most prominent of these is the expressionist Willem de Kooning ([Storr, 1995](#)). After the onset of his neurological disease, de Kooning’s ex-wife and some students provided the structure from which he could continue to work. They stretched his canvases and mixed his colors. He was noted to be generally apathetic except in his studio, where he was engaged and lively. Experts generally agree that this late period represents a new and coherent style for de Kooning. His paintings became successively simpler, and he confined his palette to primary colors. Traces of shapes from earlier works are evident, but these are pared down. [Garrels \(1995\)](#), the senior curator at the San Francisco Museum of Modern Art, thought “the vocabulary of forms was retained, but clarified . . . the results are paintings of an openness and freedom not seen before, paintings that are extraordinarily lyrical, immediately sensual, and exhilarating.”

VI. Conclusions

I would like to conclude with a few comments about the nature of the evidence being discussed here. My speculations are based on anecdotes. Extracting

¹My own clinical experience is that such patients are often too disorganized to take an art project to completion. I have cared for several artist-patients that spend hours in their studio puttering around without producing much art.

general principles from anecdotes is risky business. Undoubtedly, some of these claims will need to be modified as the number of such cases grows. The neuropsychology of art has not developed into an experimental science. Such a development will be difficult, given the topic of inquiry, but it is necessary if we are to go beyond the cataloguing of fascinating anecdotes. These rich qualitative accounts need quantitative underpinnings.

In my view, two things are needed. First, we need greater in-depth analyses of artists with brain damage in which both the art and components of their cognition are examined carefully. Such analyses would clarify the relevant questions. For example, the question of whether aphasia affects art is probably ill formed. Art is quite varied and “aphasia” is itself too varied a syndrome to expect any direct mapping of one category on to the other. With analyses of the components of art, we could generate testable hypotheses about how brain damage might impair, alter, or improve art.

Second, group studies are probably impossible (with perhaps the exception of artist with migraine) given the rarity of established artists who acquire neurological disorders. Thus, we will need meta analyses of the case series to generate general principles about the neuropsychology of art. However, such analyses are entirely dependent on the first point, that is, the need for adequately studied individual cases.

Finally, in this chapter I have emphasized the enhancing effects of brain damage on artistic production. These observations are subject to significant selection biases. It is likely that many more artists are devastated by their brain injury, and these cases are not reported. We simply do not know the base rate of the kinds of effects I have outlined. And yet, these examples of improved art following brain damage do point to the multifaceted nature of art. Cases of improved artistic abilities fall into a general class of paradoxical functional facilitations produced by brain damage (Kapur, 1996). Other examples of such facilitation involve relatively simple sensory and motor abilities and automatic processes. The ability to produce visual art is striking in its complexity as compared to these other examples. Art is sufficiently multifaceted that impairments in one component can be compensated by or facilitated by other components. These observations hint at the resilience of the creative spirit, which finds expression even when its habitual outlets are obstructed.

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