

# Art and neuroscience converge to explore disorders of the brain

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Art created by people with neurological disorders and diseases offers a window into the brain—and the art itself can sometimes be a means to grapple with neurological change. The works of artist Katherine Sherwood, who suffered a brain hemorrhage at the age of 44, are a case in point. Image credit: “Transports Instantaneously,” 2007 mixed media on canvas, Katherine Sherwood, Sixth Street Studios.

When illustrator Lonni Sue Johnson contracted viral encephalitis in late 2007, the infection attacked her hippocampus and almost killed her. Johnson had been a professional illustrator for 31 years, made many *New Yorker* covers, and painted pieces for the White House. With her hippocampus suddenly destroyed, Johnson couldn't form new memories, let alone recall many old ones.

Yet, in published studies of her memory after the viral attack, researchers found that, despite profound amnesia, Johnson retained some of the artistic knowledge that she'd built up over a lifetime.

She and other artists have become, by virtue of their art and their illness, participants in cognitive studies that

highlight how the brain changes as a result of disease. Other painters and illustrators suffering from neurological damage have turned to their own experience for artistic inspiration and even personal solace. Some artists have set out to communicate the impacts of their conditions through their art. Whether artist or researcher, all have looked to art as a window into the mysteries of the brain, its complexity, and its fragility.

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## Personal Revelations

For contemporary painter Katherine Sherwood, neurological damage changed the course of her artistic life. Sherwood suffered a massive cerebral brain hemorrhage in 1997 that paralyzed the right side of her body and left her unable to walk, talk, read, or use her dominant right hand. Physical therapy helped her talk again, but two decades later, Sherwood hasn't regained the use of her right hand or arm, so she paints left-handed.

In the early '90s, years before her stroke, Sherwood was a relatively obscure artist working as a professor at the University of California, Berkeley. She routinely sampled MRI brain scan images in her abstract paintings. Sherwood's earliest interest in using brain imagery, she wrote in a 2012 article for *Frontiers in Human Neuroscience*, was inspired by Michael Talbot's theory that objective reality does not exist; the universe is instead a hologram or simulation (1). Pairing MRI images from the UC Berkeley bioscience library with small holograms as a nod to the theory was "visually successful," Sherwood wrote in 2012, "and led me on my way." After her stroke paralyzed the right side of her body, "my life caught up to my art," she wrote.

A few months after the stroke, Sherwood had an angiogram brain scan. The squiggled and swirling scan images reminded her of 1,000-year-old drawings from the Southern Song Dynasty in China, as well as the Chinese Taoist text "The Secret of the Golden Flower," which she had visually and metaphorically referenced in a series of earlier works. Sherwood remembers thinking that the connection was eerie, then sitting up on the gurney and saying "I need those images" to her doctors. "Everybody started laughing, which I don't understand why, and I said, 'No, I'm an artist, and I need those.'"

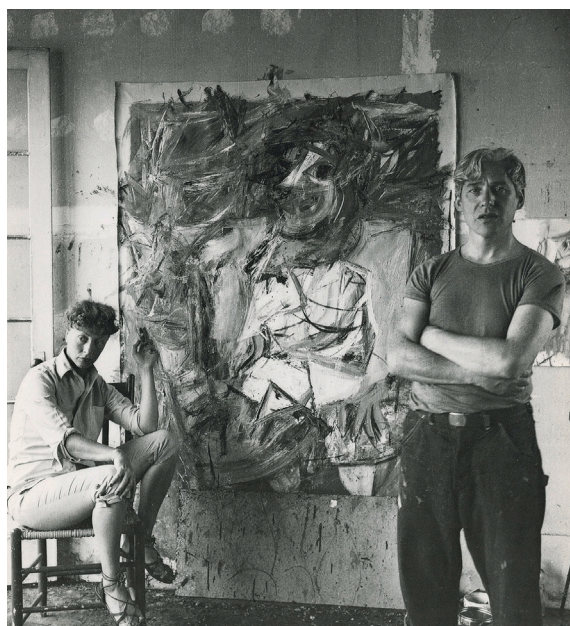
A doctor gave her the angiogram images on the spot, which she used from 1998 to 2010 in a series of works that

made Sherwood better-known in art-collector circles. Compensating for the switch to painting left-handed, Sherwood began working on larger canvases, which required fewer fine-motor skills. She also switched to larger brushes and found that her painting process became less of a struggle, freer and more enjoyable than it had been in the past. Describing the meaning of her work today, Sherwood says it's both a celebration of her survival and persistence and a "holder for whatever I, as an artist, want to put in it."

Two of her large abstract works, featuring those angiograms, appeared in the Whitney Museum of American Art's Biennial Exhibition in New York in 2000. Lawrence Rinder, then a curator at the Whitney, said in a *Wall Street Journal* article (2) that, after the stroke, Sherwood's work became "radically transformed" and that her pieces were "instantaneously impressive" and "fresh and powerful."

In other cases, art may serve as a window into pain. The late British artist Bryan Charnley suffered from schizophrenia, and his work reflects his tumultuous psychology. One series from 1988 called "Bondage Heads" features paintings of human heads in profile, wrapped in huge blindfolds. Each blindfold is covered in frenetic images of cities, roads, homes, nature, crowds of people, and other everyday scenes that seem to be overwhelming and trapping the person underneath. Describing the series in a 1988 statement available on his website, Charnley wrote, "in the bondage pictures I am suggesting that schizophrenia is a form of bondage which blinds us to reality."

Charnley is no longer here to explain his subjective experience, and it's difficult to know exactly what he meant. But people with schizophrenia often feel trapped by the gulf between their experience and reality. Associate professor of art therapy Juliet King, at The George Washington University in Washington, DC, says she can see hallmarks of psychosis in Charnley's work. Wave forms around the mouth imply a



The style of artist Willem de Kooning—pictured (Left) in 1953 in front of a canvas with his wife Elaine, also an accomplished painter, and paired with one of his most famous paintings, *Asheville* (Right)—may have changed as a result of Alzheimer's. Image credits: Hans Namuth/Science Source (Left); and spatuletail/Shutterstock (Right).

deterioration of boundaries between the internal and external, for example, and floating figures, including eyes and mouths, frequent the art of people with psychotic disorders, she says.

Not all of Charnley's work was so chaotic. Between 1966 and 1991, Charnley used his skill to capture still-life paintings of realistic lotus flowers, irises, apartment buildings, bridges, and kitchen scenes. But his later work turned allegorical. A series of oil self-portraits from 1991 began with realistic images of his face, but progressed into abstract and frenetic portraits. Charnley's mouth is on his forehead in several of the paintings, and colors and patterns stream across his canvases. Before he died by suicide that year, Charnley wrote about the purpose of his work while reflecting on another troubled painter, Vincent Van Gogh (3). "From the torture chamber of his insanity," Charnley wrote, "he scratched out in paint his essential humanity."

## The Mind Window

Other artists, including illustrator Lonni Sue Johnson, did not set out to communicate their personal experience through art, but have piqued the interest of neuroscientists keen to understand how brain damage affects cognitive function.

In studies led by cognitive scientist Barbara Landau at Johns Hopkins University after Johnson contracted encephalitis, it became clear that Johnson could remember some highly technical details of her craft—for instance, how to make a watercolor wash, a diluted layer of paint often used to build up a background (4). "We highlighted what remained," Landau says. "There were certain things retained."

Over 6 months of testing, Landau's team asked Johnson to practice simple memory tasks, such as learning the brand name associated with a cereal box. Despite weekly testing, there was virtually no improvement in learning the new information, as is typical of this type of hippocampal damage. Each time the research team visited, Johnson didn't remember them, either.

Hence, it was surprising, Landau says, to find that although Johnson's amnesia prevented her from remembering everyday things, she could still explain the techniques required to make art. Researchers have known for decades that there are multiple kinds of memory, some of which are "procedural" and help with performed actions, such as riding a bike, whereas others are "declarative" and help with the recall of facts and details. Johnson's case is unusual because she retained knowledge of such specific skills despite broad and deep deficits in more general knowledge. It "illustrates that even in the face of severe hippocampal damage and loss of

many memory functions, there is still some preservation of certain aspects of knowledge that involve an expertise she developed before the illness," Landau says.

Studying the art of people with a range of brain injuries can lend insights into "the different ways the brain engages in creative activity," King says. Use of color, realism versus abstraction, and changes in other formal elements over time can hint at the deterioration of specific brain structures, she says. (Art therapy has become a popular therapeutic approach for addressing posttraumatic stress disorder in military veterans and others. See ref. 5.) Perhaps the most famous artist to exemplify this is expressionist Willem de Kooning, who likely suffered from Alzheimer's disease at the end of his life in the 1980s. de Kooning painted until his death in 1997, and his style became increasingly simplified and abstract. Some critics have argued that the change was a distillation of his essential style, while others argued that it was a consequence of neurodegenerative disease (6).

If Alzheimer's drove de Kooning's simplified style, what might have been happening in the artist's brain? People suffering from Alzheimer's first lose their "episodic" memory and then their meaning-making "semantic" memory, such as their ability to recognize relatives or significant places (both are types of declarative memory). Without associations between form and meaning, "what they're left with is pure form," explains cognitive neuroscientist Anjan Chatterjee at the University of Pennsylvania, "and that ends up being expressed as abstractions." He notes that this contrasts with frontotemporal dementia, which affects the front of the brain (7). People with this form of neurodegeneration often become obsessed with representational images—for example, making repetitive artworks of the same object, Chatterjee says.

Contemporary painter Sherwood is among the artists Chatterjee has studied to understand how art changes after a stroke in the left or right side of the brain (8). The prevailing expectation, which "seems to have a persistent hold on the public imagination," Chatterjee says, is that the right hemisphere is privileged for artistic production. That notion "is simply wrong," he says. "If that were the case, you'd think [that in] someone like Sherwood, who had a left hemisphere stroke, not much should change. We think that, as a general idea, is not correct."

In all of these cases, artwork gives people a kind of visual voice, King says, allowing them to continue to communicate, despite states of severe stress or neurological illness that can hamper other forms of speech. As a result, the ways that an artists' work changes prediagnosis and postdiagnosis, or new artistic interests that arise after a stroke or other brain injury, are "very compelling to the health sciences and medicine," King says. "We're wondering, 'what's happening here?'"

1. K. Sherwood, How a cerebral hemorrhage altered my art. *Front. Hum. Neurosci.* **6**, 55 (2012).
2. P. Waldman, "Tragedy turns a right-handed artist into a lefty—and a star in art world" *The Wall Street Journal* (2000). <https://www.wsj.com/articles/SB958084527693822095>. Accessed 31 October 2022.
3. Bryan Charnley Artist's statement 1991. <https://www.bryancharnley.info/statement/>. Accessed 31 October 2022.
4. E. Gregory, M. McCloskey, Z. O'vans, B. Landau, Declarative memory and skill-related knowledge: Evidence from a case study of amnesia and implications for theories of memory. *Cogn. Neuropsychol.* **33**, 220–240 (2016).
5. C. Beans, Searching for the science behind art therapy. *Proc. Natl. Acad. Sci. U.S.A.* **116**, 707–710 (2019).
6. J. Carroll, "APEX OR DECLINE? / The great painter Willem de Kooning has Alzheimer's disease. As a major new show opens at SFMOMA, debate continues over the quality of his late work" *SF Gate* (1995). <https://www.sfgate.com/entertainment/article/APEX-OR-DECLINE-The-great-painter-Willem-de-3022569.php>. Accessed 31 October 2022.
7. A. Chatterjee, The neuropsychology of visual artistic production *Neuropsychologia* **42**, 1568–1583 (2004).
8. A. Chatterjee, B. Bromberger, W. B. Smith II, R. Sternschein, P. Widick, Artistic production following brain damage: A study of three artists. *Leonardo* **44**, 405–410 (2011).