As a uniquely human talent that has evolved from prehistoric cave paintings, art draws on many brain areas responsible for various cognitive processes. The pattern of degeneration in dementia leads to predictable changes in art. The visuospatial deficits in Alzheimer disease lead to less precision and attention to spatial relationships. In some cases of frontotemporal dementia, artistic creativity appears anew as the disease develops. The artwork is approached in a compulsive manner and is often realistic or surrealistic in style. Art in the context of dementia provides a unique window into the cognitive processes of various brain regions and an opportunity for rehabilitation.

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The differential diagnosis of dementia is based on the pattern of cognitive and behavioral decline that accompanies progressive and focal degeneration of specific brain regions. Documenting deficits is an important component of dementia diagnosis, but accurate diagnosis also requires factoring in a patient's strengths. Good memory in the setting of dementia rarely represents Alzheimer disease (AD) but is common with frontotemporal dementia (FTD), while outstanding social skills are unusual with FTD but are routinely seen in AD. Similarly, simple copying is typically preserved in FTD but abnormal in AD. In addition to normal copying skills, some patients with FTD develop a new interest in painting. Remarkably, artistic productivity can increase despite progression of the dementia.

The emergence and evolution of visual creativity in dementia offers a window into the artistic process, while hinting at the extraordinary cognitive flexibility of individuals experiencing progressive loss of cortical neurons. Documenting the artistic deficits or strengths that develop after focal brain injury allows the generation of a map of the cortical regions involved in the different components of visual creativity, helping to distinguish the roles of the dominant and nondominant hemispheres in art. In this review, the brain areas engaged in the production of visual art are described and the implications of these findings are noted as they enrich our understanding of brain function and dementia.

REGIONAL BRAIN CONTRIBUTIONS TO ART: LESION STUDIES

Just as writing relies on language, painting is a predominantly visual process. Two visual streams—a ventral stream involved with the recognition of “what” is seen, and a dorsal stream that localizes “where” an item has been perceived—are essential for art. Visual scenes absorbed over the course of a lifetime are perceived by means of components of the ventral stream that localize to the occipital and temporal cortices. These internally represented pictures of people, animals, objects, and scenes represent the creative soil for many artists and are ultimately reproduced in the form of paintings, drawings, and sculptures. Artistry requires visual precision and uses the dorsal stream to frame the scenes perceived in the ventral stream and place them onto the canvas. Balint syndrome, ocular apraxia, optic ataxia, and simultanagnosia are seen with bilateral injury to the parietal lobes. This syndrome of dorsal stream dysfunction is devastat-
ing to painting, diminishing the ability to localize the canvas or to see a scene as a whole.

The “nondominant” hemisphere is dominant for visual art, and right parietal injury is characterized by profound visual neglect and loss of visuoconstructive skills, devastating any attempt to create art, even in accomplished artists. The inability to visualize or produce art on the left side of a page is well described after right parietal lesions. To a lesser extent, the same deficits occur on the right side of the world with left parietal injury. An extraordinary case study demonstrated that the nondominant parietal lobe was involved with internally framing the internal visual space. Two patients with right parietal strokes were asked to look at a familiar cathedral and piazza in Milan, Italy. When facing the cathedral, they were able to visualize buildings on the right side of the square, but described little detail on the left. When asked to turn away from the cathedral, the patients described the shops and buildings on the left side of the piazza, the side previously neglected. This work suggests that the parietal lobes frame attention in an egocentric fashion; thus, injury to the right parietal lobe affects the ability to organize internally represented images on the left side of the world.

In related work, the evolution of paintings in an artist with dysfunction in her dorsal stream was described. Before the vascular insult, this woman painted rich and complex scenes from her memory. After the stroke, she produced simpler paintings that focused on a single item from the scene, suggesting that the simultanagnosia framed her internal memories into small pieces, dissociated from the whole. There is little research on the brain regions involved with the artistic process, but beyond the parietal lobes and the visual streams, artists use a multitude of cortical and subcortical brain regions in the organization of a visually appealing painting, drawing, or piece of sculpture. For example, many regions in the frontal lobes carry out functions that are likely to contribute to visual creativity. Dorsolateral prefrontal cortex helps with the planning and organization of the artistic effort, while the cingulate cortex modulates drive and emotion. Disinhibition is a feature of orbitofrontal lesions, and discipline is required to learn and sustain the complex craft of an artist. Also, the motor and premotor frontal regions (along with the basal ganglia and cerebellum) carry out the precise movements needed for great art.

Finally, despite the fact that art is a strongly visual process, the language hemisphere is used in most art in the form of symbolic and linguistic concepts. For example, Pablo Picasso’s Guernica is a visually haunting piece that explores the cruelty of war. The political concepts contained in such work are generated in the dominant hemisphere but use images to convey verbally mediated concepts. Kaczmarek described a symbolic artist who created great paintings that relied extensively on symbolism. One such work, Quo Vadis (Latin for “Where are we going?”), explored the move of civilization toward nuclear war by using a few simple symbols. When the artist suffered a dominant hemisphere infarct, he maintained the ability to copy precisely, but was unable to create his symbolic pieces.

Alzheimer disease is associated with progressive loss of visuospatial skills caused by focal degeneration of the posterior parietal and temporal regions that accompany this disorder. Even talented artists decline, often losing the aptitude to paint. In some cases, as the ability to precisely represent the world diminishes, paintings become more surrealistic. In one report, an artist’s realistic paintings became less precise while maintaining artistic quality. Eventually the spatial deficits became profound and the painting ceased. Similar changes were described in the artist Willem de Kooning. The loss of realistic precision does not necessarily lead to a less appealing product. In both the patient with AD and de Kooning, some of the most artistically successful pieces were produced in the setting of AD. The Alzheimer’s Disease Association has generated highly successful programs for patients with AD, many of whom have never previously painted. In general, the art of individuals with AD lacks visual precision but can show appealing use of color and form (Figure 1).

In FTD a different pattern has emerged, and in some instances, spontaneous bursts of visual creativity seem to have been triggered by the illness. Usually such cases involve a specific subtype of FTD, semantic dementia, where focal degeneration is found in the left anterior temporal lobe. Remarkably, some patients have developed a new interest in art and have produced progressively more successful paintings. Generally, the paintings are realistic or surrealistic without a significant symbolic or abstract component. The work is approached in a compulsive fashion, and sometimes the paintings are repeated.
The factors that lead to this late-life burst of visual creativity are undoubtedly complex. While most artists with FTD have been aphasic, they have spared functions in the posterior parietotemporal regions, particularly those in the nondominant hemisphere. Therefore, if they decide to seek out visual activities, they are more likely to be successful than the patients with AD, whose parietal lobes are injured. However, there are other potential mechanisms that may lead to the artistic successes in FTD. In many such patients there is a compulsive need to paint that helps to drive the visual creativity. The constant repetition helps the patient with FTD to perfect his or her craft. Other mechanisms may be important. During a cognitive activity like painting, a specific network of excitatory and inhibitory neurons is activated. With semantic dementia, the left anterior temporal lobe is permanently hypometabolic, possibly releasing a visually oriented right hemisphere with greater capacity to perform art. Finally, in some patients there is evidence of dysfunction of the language hemisphere that begins early in life and is manifested by dyslexia or difficulty with spelling or speaking. Does this longstanding dysfunction in the anterior temporal lobe allow remodeling of posterior brain regions that are needed for painting and other aspects of visual processing?

CONCLUSIONS

The degenerative dementias all have their own distinctive anatomy, devastating specific brain areas while leaving other regions unaffected. New insights into the artistic process have been facilitated by the study of patients with progressive aphasia. In addition, focusing on the artistic strengths of these patients has positive therapeutic value, by encouraging patients to pursue an activity in which they can improve. Future studies using physiological techniques such as functional magnetic resonance imaging should help us to understand the brain regions that are activated during the artistic process in these patients. In an era when powerful therapies are emerging for the degenerative dementias, focusing on the potential of patients with dementia could become a powerful tool for rehabilitation.

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