News and Perspectives

How Emerging Technology Is Changing Our Relationship With Memory

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Abstract

Memories can shape our identities and our lives, and new tech can help shape our relationship with them. In this *News and Perspectives* article, JMIR Correspondent Benedette Cuffari reports on how noninvasive technologies are being used to advance posttraumatic stress disorder (PTSD) treatment, as well as their broader potential.

Key Takeaways:

- By combining immersive environments with personal photos and other digital content, noninvasive technologies may help individuals process traumatic memories and reconnect with meaningful life experiences.
- From helping veterans with posttraumatic stress disorder (PTSD) to allowing healthy adults to revisit cherished moments, these technologies are creating new opportunities to explore how we remember, understand, and respond to our past.

Despite recent advances in posttraumatic stress disorder (PTSD) treatment, many patients, particularly those who have served in the military, continue to struggle with symptoms like intense anger and irritability. For one veteran treated by Eric Vermetten, MD, PhD—former head of research for Military Mental Health within the Dutch Armed Forces—anger toward the Taliban remained a defining feature of his response to wartime experiences.

While secured in a safety harness, Vermetten describes, his patient walked on a treadmill toward projected photographs that served as visual reminders of emotionally distressing moments from his past—otherwise known as "hot spots." After several weeks of treatment, his anger gradually subsided, and the photos he selected for these sessions shifted away from combat depictions to photos reflecting more celebratory aspects of his service, like homecoming celebrations and reconnecting with loved ones. During one session, the patient invited his partner to observe his progress, which led to an emotional moment in which both were moved to tears by the breakthroughs he had made.

This veteran's experience illustrates an innovative application of technology in mental health care—helping individuals revisit difficult memories and develop new emotional responses to them.

Why Do We Remember and Forget?

Autobiographical memory, which refers to our ability to remember past experiences, can be further divided into semantic and episodic memories. Whereas semantic information can include personal facts, like where someone was born, episodic information allows you to remember significant life events, such as your first day of school.

"Our brain is the most functional memory machine," explains Qi Wang, PhD—professor of psychology at Cornell University. When we reflect on our past, different areas of the brain involved in processing sensory details, emotions, and language are activated to piece together memories. This process, which is otherwise known as memory reconstruction, allows us to draw on past experiences to guide future behaviors.

Autobiographical memories are not exact recordings of past experiences. Each time we recall a memory, its reconstruction—how we remember and interpret it—varies based on our current emotional state, beliefs, and circumstances. This interplay between memory and emotion creates opportunities for emerging technologies that help individuals revisit traumatic experiences and develop new emotional responses to them.

When Traumatic Memories Become Difficult to Escape

For individuals like Vermetten's patients who experience PTSD, the challenge is not necessarily retrieving forgotten memories but confronting traumatic experiences that remain emotionally stressful long after they occurred. "Patients with PTSD find it very hard to go back to hot spots," explains Vermetten. "They often struggle with cognitive avoidance and drop out of treatment."

At the time, treadmills and digital projection systems were being incorporated into military rehabilitation to simulate real-world environments and help injured service members regain mobility. "When we saw this new technology being purchased by the Armed Forces, we thought, 'that's exactly what we need,'" Vermetten continues. "Veterans need to be active, and walking really spoke to them."

These observations led Vermetten and his colleagues to develop motion-assisted multi-modal memory desensitization and reconsolidation (3MDR). During a 3MDR session, patients are invited to walk on a treadmill toward images projected on a screen. These pictures, which are selected by the patient beforehand, can be anything related to the traumatic event.

While the patient is walking toward the photographs, they are working with a therapist who encourages them to describe the emotions and memories being invoked by the exercise. Questions such as "what do you see in the picture," "what does the picture tell you," and "what do you feel in your body now" allow patients to explore their traumatic experiences, often leading to a strong emotional response.

As the intensity of their anger, grief, guilt, and/or anxiety increases, an oscillating ball appears on the screen and moves horizontally across the triggering photographs. Patients are instructed to follow the ball with their eyes while reading aloud numbers displayed inside of it.

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This exercise, which is adapted from eye movement desensitization and reprocessing (EMDR) therapy, is mentally demanding and, as a result, diverts energy in the brain away from the overwhelming feelings elicited by the photos. This competition for the brain's limited working memory resources may reduce the vividness and emotional intensity of the traumatic memory.

"The last component is reconsolidation," states Vermetten. "Reconsolidation is the way new memories are being stored in a safe kind of way. It's about love, connection, and talking to one another."

Beyond the Clinic: Technology and Personal Memories

Although 3MDR was developed for therapeutic purposes, its use of personalized visual cues raises a broader question: Could similar technologies help otherwise healthy individuals reconnect with meaningful experiences that have faded over time?

Virtual reality (VR) technologies can merge visual elements of familiar environments with sounds, odors, and movement to create a more engaging and realistic experience. This multisensory approach has been shown to increase the accuracy of autobiographical memory recall in a wide range of patient populations, from veterans with PTSD and individuals with depression to healthy adults.

The growing collection of digital records from our everyday lives could provide new opportunities to personalize these immersive experiences. Social media posts, as well as smartphone photos, videos, and voice recordings, preserve visual and sound details that could fade with memory. In the ReLive study, personal videos were transformed into walkable VR environments, enabling enhanced, more vivid recollection for the healthy participants.

Importantly, the digital records used to reconstruct our past are often selective. "Social media shapes how we form our own life stories," Wang explains. "People tend to share more positive memories like vacations, weddings, and graduations than negative ones."

This selective preservation of positive memories is not necessarily harmful and may have its advantages, particularly when it comes to our emotional well-being. "Savoring" these positive emotions has been shown to reduce stress and enhance positive emotions and well-being.

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From helping veterans confront traumatic experiences to allowing individuals to revisit meaningful moments from their past, noninvasive technologies are changing the ways we engage with our memories. As Vermetten's patient's experience illustrates, remembering is not simply about revisiting what happened; it is also about finding new meaning in those experiences and reconstructing our relationship with them and with ourselves.

Keywords: autobiographical memory; virtual reality; PTSD; posttraumatic stress disorder; memory reconsolidation; trauma therapy; EMDR; eye movement desensitization and reprocessing; memory recall; immersive technology; digital memories

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