THINKING VIRTUAL

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Although virtual reality (VR) technology has not delivered on some of the futuristic promises imagined at its genesis, recent VR advances provide strong support for psychobiological therapies and improved communications.

Have you asked yourself what it would be like if, as depicted in the Hollywood blockbuster *Avatar*, your mind controlled a body quite alien to yours, in a place quite different? Would you be able to adapt and experience presence, or would it feel more like playing a computer game in a remote and synthetic environment? Current virtual reality (VR) technology makes it possible to trick not only our senses, but also those of other animals—and it is so effective that we do not have to wait for some distant *Avatar*-like future but can do it now.

Among many exciting applications, VR-based experimentation yields new insights into animal vision, helps treat posttraumatic stress disorder and other disorders, and supports novel approaches in cognitive and behavioral research. What was "cyberspace" in 1980s science fiction is today a valuable tool for computer scientists, engineers, psychologists, and biologists.

IN THIS ISSUE

The cover features in this issue come from distinguished researchers in Europe and the US to explore advances in VR approaches in four areas. To view the multimedia associated with these features, please go to www.computer.org/computer/july-2014-multimedia.

In "Transcending the Self in Immersive Virtual Reality," Mel Slater and Maria V. Sanchez-Vives explain how cognitive neuroscience can be applied in immersive virtual environments to trick the human brain into changing perception, attitude, and behavior when slipping into the virtual character's body. Such illusions of body ownership might open up new therapeutic treatment possibilities, such as the relief of pain or discomfort.

Albert Rizzo, Arno Hartholt, Mario Grimani, Andrew Leeds, and Matt Liewer discuss using VR to treat posttraumatic stress disorder in "Virtual Reality Exposure Therapy for Combat-Related PTSD." The authors report on initial clinical tests and case studies involving active-duty US service members and veterans in Iraq- and Afghanistan-based scenarios to address the unique therapeutic needs of servicemen and -women, including combat medics/corpsmen, as well as individuals who have experienced military sexual trauma, which can be a trigger for PTSD.

An interdisciplinary team, including John R. Stowers, Anton Fuhrmann, Maximilian Hofbauer, Martin Streinzer, Axel Schmid, Michael H. Dickinson, and Andrew D. Straw, explains in "Reverse Engineering Animal Vision with Virtual Reality and Genetics" how VR technology can be used with molecular genetics and brain-recording technologies to reveal neuronal circuit processing in animals and how they act on visual information. The team presents results from several experiments applying VR to control the flying pattern of fruit flies and the behavior of hunting spiders.

How VR technology can revolutionize the future of communication is the subject of "Immersive 3D Telepresence" by Henry Fuchs, Andrei State, and Jean-Charles Bazin. Today's teleconferencing technologies do not provide a clear sense of presence when we interact remotely. Holographic appearances of those at the other end—think of *Star Wars*—remain science fiction. The article outlines current possibilities as well as remaining challenges impeding progress toward this vision.

Researchers in many fields who expected VR to deliver groundbreaking solutions to their problems have been disappointed by the lack of progress toward VR's futuristic promises from its first imaginings in the 1980s, and many went on to pursue other, more efficient technological innovations. However, recent experimental results indicate that immersive VR has the capacity to trick the mind by providing sufficiently realistic (mainly visual) illusions. This might be the reason why therapeutic and neuroscience-based VR approaches in particular are so successful and offer great potential value.

As a mainstream technology that is applicable in everyday situations, VR still faces several challenges. Advances in display, sensor, and communication technologies will have the greatest influence and impact on VR's success in other disciplines.

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