

## Testing virtual reality in the classroom

**A Stanford University psychology professor is finding that technology can help students perform better.**

**By Tori DeAngelis**

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When Jeremy Bailenson, PhD, lectures to the 400 students in his introductory psychology class, he wants to look each student in the eye—simultaneously.

That ability—created by manipulations of virtual reality—is one of many virtual-teaching applications being developed and tested by the Stanford University cognitive psychologist.

"The Holy Grail of teaching is one-on-one instruction," says Bailenson, who directs Stanford's Virtual Human Interaction Lab. "Virtual reality enables you to amplify what is normally done in a real classroom."

By bending the rules of perception and physics, Bailenson's virtual classroom allows people to see themselves in the third person, occupy a variety of environments, and take on new behaviors and appearances. While he is using VR for basic research on social persuasion, he is most excited about applying it to teaching and learning because of its potential to reach large numbers of people in a way that may improve on traditional classroom learning, he says. These applications will likely increase as a number of factors conspire to make online learning more attractive, Bailenson surmises.

"Car travel is getting more dangerous and expensive, and university classrooms are often crowded and uncomfortable," he says. "Yet because video conferencing and other types of media fall far short of face-to-face interaction, we still burden ourselves with physical commutes to classrooms."

Virtual sites with greater verisimilitude could fix this problem and allow more people to enjoy learning online. In fact, Bailenson successfully taught a class to 80 Stanford students last year that was entirely housed within the online world Second Life, he says.

In a range of studies, Bailenson's team is showing that manipulating virtual versions of the teacher and classroom environment can help students pay attention and perform better. In related research, changing the form of avatars—virtual versions of the self—can motivate people to exercise, and even teach them dance steps and tai chi poses.

### Your perfect role model

Decades of psychological research have shown that people are drawn to—and learn better from—others who look or act like themselves. Beginning in the 1980s, research has found that people tend to synchronize with and imitate each other's speech patterns, postures and even moods. More recently, Duke University social psychologist Tanya L. Chartrand, PhD, found that when a confederate subtly mimics a person's gestures, the person is more likely to view the confederate in a favorable light after the two have performed a task together.

With these findings in mind, Bailenson decided to test this concept in the context of classroom learning—one of the first to rigorously test it in this way. To this end, he has created virtual reality teachers that subtly mimic their students' gestures. On a technical level, here's what happens: Sensing technology records the student's movements, whether it is tilting her head, raising her hand or looking toward the teacher. Meanwhile, the

teacher's computer—already equipped with an avatar of the student's facial features and body shape—receives that information and modifies the teacher's avatar to make it move in concert with the student's movements. All of this occurs seamlessly so that participants feel like they're all occupying the same virtual space, Bailenson explains.

"So students aren't getting one consistent version of the teacher, but 100 different versions, each of which is tailored to the individual student," he says. Because it is automatized, the technology can be applied to any subject matter, for courses of any length, he adds.

Students who receive the individualized instruction are more likely to pay attention to the teacher than those who receive standard instruction. They also learn more and tend to agree more with what the teacher says—all without consciously noticing what is going on, according to research cited in *The Journal of the Learning Sciences* (Vol. 17, No. 1).

For people learning to exercise, the best teacher may look exactly like you, finds research by Bailenson's student Jesse Fox, under review at *Media Psychology*. Again, her work draws on aspects of self-similarity research, which also finds that people are drawn to those who look like them. Some researchers have found that people perceive those who look and act like them as more attractive and persuasive than those who look less similar, for example.

In Fox's study, 80 participants saw either an avatar who looked like them or a same-sex avatar of an unknown person. Those who exercised saw their avatar exercise and lose weight. Those who did not exercise watched their couch-potato avatar pack on the pounds. The participants who viewed a self-similar avatar were much more likely to exercise afterwards than those in the different-avatar conditions, Fox found.

"It truly is a photographic, realistic representation of the self that serves as the effective stimulus," Fox says.

### **Bending physics laws**

In virtual worlds, researchers can tweak other physical limitations to amplify teaching benefits as well. These include playing with the ordinary physical distance between student and teacher, as well as with the constraints of having to sit in less-than-optimal seats in a classroom or other settings.

For those who have trouble learning dance or other physical movements, Bailenson, Stanford graduate student Alexia Nielsen and colleagues at the University of Washington and University of California, Berkeley are demonstrating that it may be possible to learn these moves from "inside" a teacher's body. In a study in press in *Media Psychology*, the team provided students with a self-representative avatar who could step inside a virtual teacher as the teacher demonstrated tai chi moves.

"You'll know if you're not doing a move correctly because you'll see your arm outside of the teacher's arm, for example," he says.

Students who had this ability learned faster than those who learned through the traditional "watch and repeat" method, says Ruzena Bajcsy, PhD, whose University of California, Berkeley lab provided the "teleimmersion" technology that enabled the team to apply the new learning technique.

"People ask us why we don't just use regular video," Bajcsy says. "But we've shown that people learn faster—at least in the physical realm—if they have the three-dimensional ability to see the teacher from any angle."

Bailenson's team added to that ability by enabling the learner to see himself outside of his own body. Because the student can view his virtual representation externally, he can choose to occupy the teacher's exact virtual body space, he explains.

Teachers can likewise bend the laws of physics to improve learning by placing every student in a classroom's "sweet spot"—a location in the room that maximizes learning, usually in the center front. In the article in *The Journal of the Learning Sciences* (Vol. 17, No. 1), the team found that putting multiple students in the sweet spot increased learning by 10 percent.

Meanwhile, Bailenson is also applying research showing the persuasive power of direct-eye gaze to teaching in the virtual classroom. Virtual professors blessed by Bailenson with "augmented gaze"—the technology-aided ability to look each student in the eye for much of a lecture—can improve students' attention and keep them

alert, he is finding.

As a whole, these technologies could have profound implications for distance learning, individualized learning at home, and other applications, Bailenson believes. Consider the advantages of giving thousands of students the ability to see the same great teacher; to consistently sit in the best spot in the class; or to enter a teacher's body to learn physical moves.

"Given careful design and testing," he says, "the use of avatars can be a paradigm-shifting way to think about instruction."

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*Tori DeAngelis is a writer in Syracuse, N.Y.*

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