Virtual reality could make real difference in the environment

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Published 1:57 pm, Friday, August 15, 2014

Extreme weather events are dramatizing the effect we are having on the planet. Yet one of the greatest challenges to staving off irrevocable climate change isn't simply getting buy-in from skeptical politicians - it's getting people to visualize how driving a gas-guzzling car or living in an energy inefficient home is contributing to a problem that may only manifest itself completely in future decades.

It gets even harder when you try to show how your personal carbon footprint contributes to ocean acidification - the process by which the ocean becomes more acidic as it sucks up the carbon dioxide we spew into the atmosphere from our tailpipes and smokestacks. Very few people have firsthand experience diving among the coral and the fish that will eventually disappear if our behavior doesn't change. And even those who do can't see the degradation in real time. The general public is wildly uninformed on this issue. Most have either never heard of ocean acidification or wrongfully assume it is another term for acid rain.

But there's a potential solution for all of this: Use virtual reality, or simulated immersive experiences, to bring people inside of a degraded ocean ecosystem, and show how their behavior is contributing to the problem.

Virtual reality looks, sounds and feels real, but is simulated by technology that feeds computer-generated content to the sensory organs. Instead of watching a nature show, a person is mentally transported inside the natural environment.

In the Virtual Human Interaction Lab at Stanford, we have shown how putting people in virtual reality can get them to save more for retirement, exercise more, show more empathy, and yes, act in a way that is more environmentally sound.

In one study, subjects wore the virtual reality helmet - a head-mounted display that transports them into a virtual world - and cut down a virtual tree. The experience caused them to use 20 percent less paper in the real world on the day of the study, compared to those who only read about cutting down a tree. Moreover, when we surveyed subjects from the virtual reality group a week later their change in attitudes about the environment remained.

In another experiment, subjects took a virtual shower and were forced to virtually eat coal to demonstrate how much energy would be consumed to heat the water. We placed water sensors in real sinks; after the study, subjects who ate the coal used less hot water than those who were given written indications of how much coal they were consuming during their shower.

Across these simulations, we've demonstrated that either reading about a problem or watching a movie affects peoples' behavior less than having a person actually experience it virtually. More articles about climate change or documentary films - while educational - are unlikely to generate meaningful behavior change on a wide scale.

Now we are taking our research beneath the sea with hopes of expanding what is currently a lab experiment to a broader educational outreach program that could raise awareness about ocean acidification and persuade people to curb their carbon output.

We have teamed up with Stanford University marine scientists Fio Micheli and Kristy Kroeker to design a virtual replica of a rocky reef around the island of Ischia off the Italian Coast. Underground volcanic vents have been spewing carbon dioxide at the reef, allowing the researchers to measure the impact on the marine life, and extrapolate what effect our increasing fossil fuel use will have in the decades to come.

"If you look in front of you, you will see a large piece of coral," a narrator says through speakers in our lab as you walk around in the virtual ocean wearing a head-mounted display. "Look to the left. Now look to the right. Finally, look straight ahead to the coral. Please take a few steps forward. Someone will guide you as you step into the body of the coral."

For the next 13 minutes, you become a pink coral among the dark purple sea urchins, sea bream and sea snails that swarm around you. But by the end of the simulation - which fast-forwards to what the reef will look like at the end of this century - those brilliantly varied and colorful species have disappeared and been replaced by slimy green algae and the silver Salema Porgy fish - a species that will likely thrive in the higher acidity. Eventually, your own coral skeleton disintegrates and you disappear. The rocky reef ecosystem has been destroyed. "If ocean acidification continues, ecosystems

The results of our pilot study are preliminary, but powerful. Subjects in the virtual reality group demonstrated more empathy for the environment than those who watched a movie about acidification. When we surveyed them a week later, that change of attitude endured only for those in the virtual reality group.

This experience doesn't have to be limited to academic researchers. Our lab is state of the art, but we are witnessing a revolution in the technology. The Microsoft Kinect, a virtual reality gaming system that tracks body movements, is already in tens of millions of homes. Facebook, recognizing how quickly virtual reality is becoming a mainstream activity, purchased Oculus VR, a company that makes light, inexpensive head-mounted displays, for $2 billion in March. Sony, Samsung, Google and Microsoft are racing with Facebook to be the first ones to put virtual reality goggles in living rooms. Once they do, there's no reason our virtual ocean couldn't be demonstrated in homes, libraries, schools and malls.

In fact, this autumn we are working with Stanford University educational technologist Roy Pea, bringing the system to multiple high school classrooms in the Sacred Heart Preparatory school in Atherton. Moreover, the virtual reality program that teaches about ocean acidification is free to download for anyone who has an Oculus Rift virtual reality headset.

After she stepped down as head of the National Oceanic and Atmospheric Administration a year and a half ago, Jane Lubchenco spoke at a retreat sponsored by the Stanford Woods Institute for the Environment at the Seascape Resort near Santa Cruz overlooking the Pacific Ocean. She rattled off the natural disasters that occurred during her four-year term - the most extreme weather of any four years in U.S. history. Regardless of whether they lived in a red or blue state, Lubchenco said, politicians and citizens who experienced disasters in their hometowns tended to believe climate change was real.

"When people directly experience something, they see it in a different light," she said.

Virtual reality can give everyone, regardless of where they live, the kind of experience needed to generate the urgency required to prevent this environmental calamity. We need to embrace this trend and use the technology to teach people about ocean acidification. Given the lack of public awareness on the issue and the rapid degradation of ocean life, it may be one of the best shots we have at saving the coral reefs for future generations.

Jeremy Bailenson, an associate professor in the Department of Communication, is the founding director of Stanford University's Virtual Human Interaction Lab. To comment, submit your letter to the editor at www.sfgate.com/submissions/#1.