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## How Holographic Environments Will Work

by [Kevin Bonsor](#)

If you've ever watched "Star Trek," you may remember seeing the crew of the Starship Enterprise live out their fantasies in a room called the **holodeck**. The holodeck was a giant, holographic projection room that allowed the crew to touch and interact with projections as if they were in a big [video game](#). Scientists today are developing a new communications technology that will allow you and your friends to interact inside a simulated environment even if you are thousands of miles apart.



Tele-immersion will allow us to manipulate holographic projections as if they were real objects.

Most of the basic components for this network are already in place to allow the development of **tele-immersion**. Tele-immersion is the scientific community's answer to the holodeck. By combining cameras and Internet telephony, videoconferencing has allowed the real-time exchange of more information than ever without physically bringing each person into one central room.

Tele-immersion takes videoconferencing to the next level. It will create a central, simulated environment that will allow everyone to come together in one virtual room, and no one will have to leave their physical location to do so. In this edition of [How Stuff Will Work](#), you'll find out how employees in Los Angeles, New York, Tokyo and Paris will soon meet in a tele-immersive environment and shake hands with holographic images of their co-workers.

## Beyond Videoconferencing

In the office of the future, you won't call people with a phone. You will command your [computer](#) to call a particular person. "Computer, call Joe at the London office." Suddenly, one of your office walls will flicker and Joe will be sitting across from you as if he were right there. On the other end, Joe will experience the same immersive connection. That's the idea behind tele-immersion: bringing two or more distant people together in a single, simulated office setting. Business travel will be practically unnecessary.

This type of communication will take us beyond the limits of videoconferencing. Have you ever used a Webcam to teleconference with another person? If you have, then you've seen that videoconferencing via the Internet is not a perfect form of communication. The image is close to real time, but there are delays that cause a jerking video. Also, if someone walks out of view of that one camera, you can no longer see them. With tele-immersion, people can't walk out of the view of the camera. In fact, you can peer around their office just by looking at the display screen from different angles. It's like having a window to look through.

Holographic environments will be generated by computers with computing speeds thousands of times faster than your PC. There are several steps to constructing a holographic environment:

- The computer recognizes the presence and movements of people and objects.
- Those images are tracked by the computer.
- Those images are then projected on a stereo-immersive surface.

There are several groups working together on the [National Tele-immersion Initiative](#) (NTII) to bring us all together in these virtual environments. In May 2000, researchers at the [University of North Carolina](#) (UNC), the [University of Pennsylvania](#) and [Advanced Networks and Services](#) reached a milestone in developing this technology. A user sitting in an office at UNC in Chapel Hill, N.C., was able to see lifelike, three-dimensional images of colleagues hundreds of miles away, one in Philadelphia and the other in New York.

Tele-immersion may sound similar to virtual reality, but there are key differences between the two technologies. Virtual reality allows you to move in a computer-generated 3-D environment, but tele-immersion, for now, can only create a 3-D environment that you can see -- you can't interact in it. The next step is to merge tele-immersion and virtual reality to allow users to alter the scenes that they see.

The applications for immersive holographic environments are endless. Imagine a video game free of joysticks, in which you become a participant in the game, fighting monsters or scoring touchdowns. Instead of traveling hundreds of miles to visit your relatives for the holidays, you'll simply call them up and join them in a shared holographic room. Eventually, you will even be able to hug other people using this technology. Doctors and soldiers could use tele-immersion to train in a simulated environment.

## Building a Holographic Environment

The early prototypes of tele-immersive displays require users to wear special goggles, and a head device that tracks the viewpoints of users looking at the screen. On the other end, the people that appear as 3-D images are being tracked with an array of seven ordinary [video cameras](#), and two other video cameras that capture real light patterns projected in each room to calculate distances. This enables the proper depth to be re-created on the screen. So, if viewers move their heads to the right, they can see the corresponding images that would be seen if the viewers were actually in the room with the person on the screen.

Images on the screen are split and polarized to create a different image for each eye. The goggles then combine these images so that the brain recognizes only one [3-D image](#). This process is similar to how those old 3-D movie glasses work. Early experiments, like the one at UNC in May, have experienced some glitches, similar to those of normal video-conferencing. The scenes being projected are only refreshed three times per second, which creates a jerky image. If that rate could be improved to 10 frames per second, it would create a seamless projected image that would be like looking through a window at another person. Scientists are developing new technologies to support this type of communication, including:

- Internet2, which will replace the current Internet infrastructure. This new network will have a higher-bandwidth and speeds 1,000 times faster than today's Internet. This high-bandwidth, high-speed network is necessary to transfer the large amounts of data that tele-immersion will produce.
- Display technologies, such stereo-immersive displays, that can present a clear view of the scenes being transmitted.
- A future addition to tele-immersion will be haptic sensors that will allow people to touch projections as if they were real.
- Desktop supercomputers will be needed to perform the trillions of calculations needed to create a holographic environment. Another possibility to support these environments would be a network of computers that share power.

Tele-immersion will blur the lines between real and computer-generated images. It will be the ultimate tele-commuting technology, almost entirely eliminating the rush hour drive to work. Instead of commuting, people could attend those board meetings by projecting themselves into the company's conference room. And if your job requires you to travel, you could still be home for the family dinner by tele-immersing yourself into the family kitchen. Because this technology is still in the early stages of development, the possibilities are truly endless.

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