

## The Intersection Between Reality and Virtual Reality: An Interview with Professor Jeremy Bailenson

Sarah Hirshorn  
*Stanford University*



Professor Jeremy Bailenson earned his B.A. Cum Laude in Cognitive Science from the University of Michigan in 1994. He went on to earn his M.S. and Ph.D. in Cognitive Psychology from Northwestern University in 1996 and 1999, respectively. After receiving his doctorate, he spent four years at the Research Center for Virtual Environments and Behavior at the University of California,

Santa Barbara as a Post-Doctoral Fellow and then as an Assistant Research Professor. Bailenson's main research interest revolves around the concept of digital human representation in the context of immersive virtual reality. Notably, he is the founding director of Stanford University's Virtual Human Interaction Lab. Professor Bailenson is also the author of the book *Infinite Reality: Avatars, Eternal Life, New Worlds, and the Dawn of the Virtual Revolution*. In addition, Professor Bailenson's findings have been published in over 90 academic papers in the fields of communication, computer science, education, law, political science, and psychology and the National Science Foundation has funded his research.

Currently, Professor Bailenson is an Associate Professor at Stanford University's Department of Communications and is the Director of Graduate Studies for Stanford's Doctoral Program in Communications. In addition, he is an Associate Professor by courtesy in the Program in Symbolic Systems. Professor Bailenson is also a Senior Fellow in Stanford's Woods Institute for the Environment.

SH: Given your background in cognitive psychology, what initially sparked your interest in the realm of human interaction with the virtual environment?

JB: So I got my PHD in 1999 studying artificial intelligence and running experiments to see how the mind was structured and when people looked at categories—when they did reasoning. And while I loved doing research, I wasn't enamored with that field any longer, so I decided to take a post-doc in a different area. At the time, I was reading a science fiction novel called *Neuromancer*, which is a book written in the late 70's that came out in the early 80's, which really outlined a future of avatars and agents in virtual reality. And that kind of inspired me to think of a different way of applying my skills and I took a post-doc at UC Santa Barbara in the year 1999, where I learned how to program, do the engineering work behind VR, and also to ask social questions about the nature of social human interaction inside virtual reality, about what it means to be a person, a human, and what the self means in the digital age and move forward from there.

SH: I know that just a few weeks ago you had the opportunity to show Facebook founder Mark Zuckerberg a tour of the virtual human reality lab before Facebook paid \$2 billion for the virtual gaming headset company Oculus Rift. Can you tell us more about the Oculus rift technology and your day with Zuckerberg?

JB: So first all just to get the facts straight he came to visit and we spent about two hours together. That was before he bought the Oculus Rift, so he came by and we toured the lab and talked about the pro-social applications that we can use virtual reality for: things like education, teaching about the environment, changing the nature of business, travel, teaching empathy and altruism and all about the type of research that you saw when you got a tour of the lab, we showed him those demos and talked about the pro-social applications of the technology. The company Oculus is a company which makes a very cheap and high quality head knob to display that's a fraction of the cost of the competitors. So the company that he bought implements the system that we have in the lab, but in a way that is much more affordable to them and possible to be a consumer product.

SH: From a cognitive psychological perspective, could you explain what it is like to experience a virtual environment and how an individual's experience interacting with a virtual environment differs from their normally perceived world?

JB: Well, a few ways to answer that. Perception is active. So right now with you across the room from me, I have to do a lot of work, say, to

understand color, and understand depth; my mind is constantly actively working to figure out how to perceive the physical world. What virtual reality does is it substitutes human senses with digitally created senses. So instead of getting light from the physical world that bounces off of your face, I would be wearing, say, a head mounted display that creates light for me in the eyes. Or, instead of hearing that sound come from my pocket, I would have headphones that would differentiate volume to create the illusion that the sound is coming from there. So, from a cognitive psychology perspective, the brain has not yet evolved to differentiate virtual stimuli from physical stimuli. So, we haven't yet gotten to the point as a species where the brain—if there is a simulation that is done compellingly—then the brain treats that virtual stimulus as if it were real.

SH: I've read that you see virtual human interaction has having the potential to promote weight loss by showing individuals avatars of their leaner self. What do you anticipate are other future applications of this technology?

JB: So, the weight loss application is one that, after our study, [it] was published that the National Institute of Health created an entire program around using avatars to treat obesity, so there is [sic.] now a number of labs that are pursuing that application. One of the outcomes that we are most excited about as a lab is teaching environmental awareness. So, by putting somebody in futures where one can experience how human activity is changing the oceans, changing air quality, changing water, it can make the connection between one's action and the consequences less abstract. And what we have demonstrated is that it is a nice tool for changing behavior. Another application that we work on is education. So, if you think about the way Stanford is doing online education with MOOCs, I am working with John Mitchel, the Vice Provost of Online Education, to figure out how can take that to the next level. Can we make—instead of watching a video of a professor, which is technology that was available 30 years ago—can we take that to the next level and build some type of a system where somebody is in a chemistry lab and getting to see and feel all the stimuli that's going on or they are in a theater department and they are actually acting and experiencing all the pedagogy in a way that is more constructive?

SH: Are there any potential dangers with applications of the Virtual Human Interaction Lab's technology?

JB: The primary concern in my mind today is the nature of addiction. So on Stanford's campus right now, when I walk from class to my office, a majority of students seem to be texting and walking and texting and biking. So right now, media is so compelling, even with just words, that people cannot walk without having to check their devices. So, what I'm

doing is I am building applications in which, instead of seeing words from your friend, it is as if your friend is right beside you. So, as the technology becomes more immersive and more compelling, how do we prevent humans from being so absorbed in the virtual stimuli that it changes the way that they should naturally interact in the physical world? There are a lot of people thinking about this addictive nature of the technology. So, when Facebook feels like a party or when online gambling feels like Vegas, if people are addicted to those technologies now, once they become more immersive and compelling managing, the desire to always be in these virtual spaces is something that we are going to have to deal with.

SH: I learned from Cody Karutz during my lab tour that the Stanford Football team has been using your lab's technology to watch 360-degree replays. What advantage do you think they will have over other teams and do you think this advantage will become controversial?

JB: So, the Stanford football team and I have produced a series of videos that shows anybody who puts on the helmet the perspective of running a play from the quarterback position. All we have done is produced that video and we have not even shown it to Coach Shaw yet. All other applications of it will be up to Coach Shaw once we get the pleasure of showing it to him. So, we are not actually doing anything with it yet.

SH: How long do you think it will take before the virtual reality technology becomes readily available to the public?

JB: So, if you think of virtual reality, there's [sic.] three components: it's tracking your physical movements with sensors, updating some digital scene which we call rendering, and then displaying new perceptual information to the eyes, the ears, and the skin. And the big event in my lifetime (and I have been studying this for 20 years)...on tracking is a device called the Microsoft Connect where you don't have to wear anything on your body and it tracks 24 points on your body position and the x y and z position at each point. Connect is—in terms of propelling the technology to the consumer market—has been the most impressive event in terms of tracking. Rendering video game technology has pushed rendering quite well so we can already do graphics very elaborately and very quickly. And the last challenge is display, and with Oculus, somebody has figured out how that helmet that you wore upstairs in my lab is about five times the price of my car. Granted my car isn't a very expensive car. It costs about \$30,000 upstairs. The new helmets that are coming out are just a couple hundred dollars—the same price that you would pay for a video game console. So we are at the tipping point now where the technology is finally getting cheap enough where you can think—actually think—about using this at scale.

SH: What are examples of some books, films, and/or multimedia projects that have been influential on your research and writing?

JB: So first and foremost, the novel *Neuromancer*. I cited *Neuromancer* in one of the first National Science Foundation grants that I wrote which got funded. One can make the argument that *Neuromancer* was partially responsible for me switching fields from cognitive science to learning how to be a VR guy, so that would be number one. A movie that I used to always talk about in class (but now the students are a little bit out of that generation) is a movie called *The Matrix*. So the book, *Neuromancer*, is the bible and the movie, a fun version of that is *The Matrix*.

SH: Do you think that there are any elements of reality that the virtual world will never be able to replicate?

JB: Well...I believe that all reality is virtual in the sense that the human perceptual system the brain has got to interpret the light that hits your retinas, the sound waves that hits [sic..] your ears, and stimuli that your skin feels. And there is a translation that occurs between the actual process of that and what you perceive in your brain as to be an experience. So, given that I believe that a mental experience is simply a set of interpreting all the stimuli that you receive, I believe that it will be possible to replace the stimulation that your body gets from a sensorial standpoint with digitally created versions and absolutely. So, I think it will be a good 10-20 years before it is indistinguishable, but not 100 years.

SH: What advice do you have for undergraduate students as we embark upon our educational careers?

JB: Learn how to program. In this day and age, a student, even an artist, would be well suited by understanding how the programming language works. Do research with a professor. So, classes are fantastic, but unless you are actually doing research with the world-class professors we have at Stanford, you are not getting the full educational experience.

SH: Can you think of an experience of some sort of type of adversity that that you were really able to learn from and emerge as a stronger person?

JB: Well, for me, my path to my career was quite circuitous, so I didn't go to my undergrad knowing I was going to end up a virtual reality guy. And, in fact, when I got my PHD, my dissertation was on how to build a mathematical model of how a human would perceive an argument. I had a third side project, not even my second side project, [which] was a spatial reasoning task. We wrote two papers based around... a bunch of experiments understanding how humans perceive maps. Because I had

conducted those studies, the interview at UC Santa Barbara for my post-doc was to do spatial reasoning in virtual reality, because virtual reality is a medium you can change with the eyes and it is a really good way to see how humans perceive space. I went to the University of California, Santa Barbara to interview for a spatial reasoning job in VR, which I didn't get because there was another candidate much more qualified than I was. But while I was there, I talked to another professor from the virtual reality lab who was doing social psychology as opposed to cognitive psychology, and he and I hit it off (his name was Jim Blascovich). And I ended up getting the job offer not from where I applied, but from the area. I just happened to run into this guy and talk to him. And then four years [later], my post-doc and I were [sic.] lucky enough to get this job at Stanford, and twelve years later, we are having a great time here. So, I guess the tangible piece of advice here is do good work, be involved with research and, for me, I discovered my path without trying to and that sometimes things work out in a way that you didn't plan.