

Experiencing Reality in Virtual Reality (VR)
Book Review by Dom Massaro
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Experience on Demand:

What Virtual Reality Is, How It Works, and What It Can Do

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by Jeremy Bailenson

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The dedication that initiates this book is for “Clifford Nass, the kindest genius I’ve ever met.” The Media Equation hypothesized by Reeves and Nash (1996) offered a compelling narrative of how we treat media, ranging from the simplest ATM, to TVs, to computers (smart phones were just emerging over the horizon) as interlocutors in a sense (and all that accompanies such communication exchanges). We engage automatically, socially, and naturally to all media, regardless of its technological sophistication or its artificial intelligence. In this way, the media take on a status that deserves attention, and compels reactions normally present when interacting with our own species. Our interactions are guided by what we perceive are based on the context and a variety of different cues rather than what is actually the case. This is a natural and parsimonious application of our social and communication skills that have been honed over our lifetime. By now, readers will know that the media equation is hidden from us in the same manner as $E=mc^2$.

Virtual Reality (VR) is “media extremist”: It affords behavior that comes closest to behavior in the real world. I remember my early interactions with Baldi, our computer-animated talking head in which it seemed necessary to allow him (notice the personal pronoun rather than it) to finish his utterance rather than cutting him off in mid sentence. Baldi’s name derived from the children who he first tutored, and many of them would greet him, express their feelings, and find it natural to accept his instruction. Friends and colleagues have also made remarks like, “it’s difficult not to say thanks when Alexa does my bidding.” We’ve puzzled about the rights of our intelligent machines since their material inception, and they appear to have some rights because we treat them as others who have rights. This issue surfaced with Westworld’s appeal to many and also generated controversy.

VR is on the verge of blowing us away, at least from RR (real reality). One celebrity cyber enthusiast envisions spending more time in VR than in RR. Bailenson, on the other hand, has a 20-minute rule for his state-of-the-art VR, more or less like the painful tradition of limiting screen time for our children.

VR succeeds at engaging its inhabitants, as I recall from walking the plank over an abyss guided by Jack Loomis three decades ago. Bailenson engages us in the same manner with his introduction to VR through the experiences of a household name Mark Zuckerberg. VR perhaps taps into our two forms of knowing. In VR, your senses are flooding you with information about a virtual scene of you on a platform above a huge pit, and yet you know that this scene is completely fabricated because you also know you are in a normal room where you are completely safe to move about. This second type of knowing is not sufficient for you to discard your sensory impressions, and you react more or less like you would if you were really standing over a huge pit. The technology for VR has tracked the incredible progress of technology more generally, and consistent with cyberfiction authors, it won't be long before VR is as common as smart phones (if humanity buys into it). What ever happened to 3D TV?

Will people spend time in VR? Given the many hours of streaming and binge watching entertainment now so readily available, VR has a potentially huge playing field. Along with it, opportunities will far exceed entertainment for the masses, but will allow personalized experiences at your choice. With advances in speech understanding and dialog systems, you could meet Barack Obama (or your favorite celebrity) for a cappacino or choose some other favorite activity of your choosing. While your discussing Barack's ideas about democracy in his favorite café, you're perfectly engaged notwithstanding another voice in your head murmuring that you're a fool being so easily fooled. I guess that cautionary voice will be only temporary because it is unheard for our current media experiences. For the more active, why not climb El Capitan, swim the English Channel, or simply snorkel in the Great Barrier Reef. All of these vacations and many more will be available on easy downloads from your favorite VR providers.

VR comes in many different flavors and most of us won't have access to the expensive system that Mark Zuckerberg experienced. The easiest entry into VR is viewing VR videos on youtube or using the New York Times VR (<http://www.nytimes.com/marketing/nytvr/>). If you are unencumbered and have only your smart phone, you can experience a fuller world with a large field that has been recorded with VR photography, The scene has been recorded by wide-angle panoramic photographs giving the complete scene as a single image that is viewed from rotating about a single central position. This is accomplished by stitching together a number of photographs as a single image, letting you do everything from putting together a 360-degree video of your kid's soccer game to capturing a holiday dinner with the family. In VR viewing, you travel through this world by moving your device around. You are more engaged because you are essentially the camera and directing where to point it and what to see, rather than passively watching various scenes. Ear buds heighten the experience because you also have stereoscopic sound.

VR creates reality for the inhabitant even though it is virtual. We take reality for granted and are impervious to the efficiency of our navigation. VR should be no

different. First, we have a rich impression of our immediate world, while it is constantly reliably updated in real time while we move about. Thus VR requires *tracking* in 3D space, the essential engine of VR. If you don't know the player's place in the virtual world, you have lost the game. When the player's coordinates are known, then the appropriate scene can be displayed. This so-called *rendering* has to occur quickly and often because we are relentlessly moving beings. Of course, the more fidelity in the display, the closer the virtual is to the real.

Only a portion of the scene is shown at any one time. When you move your smart phone, the device picks up this movement and the appropriate portion of the scene is shown. Because the phone's movements are tracked continuously, you experience navigating through the space that was recorded. When combining the phone's gyroscope with the accelerometer, this combo gives these devices six axes on which it can operate.

A more elaborate experience requires a stereoscopic device such as Google Cardboard (<https://vr.google.com/cardboard/>). Google Cardboard represents the 21st century version of the stereoscope that was mandatory in most 19th century drawing rooms. The stereoscope rested on our two-eyed view of the world in which the slightly different views from the two eyes are fused to give us an impression of three dimensions (3D). Even without the complete repertoire of depth cues, and even misleading accommodation, the impression of 3D is impressive. Our ancestors were limited to a single view of two images, slightly offset to mimic what the two eyes would normally see.

I watched several 3D shorts on Google Cardboard (<https://vr.google.com/cardboard/>). A roller coaster ride was fairly engaging but it was less immersive than it could have been if the front of the car was in view rather than simply the upward and downward tracks. The scene is always more engaging when the camera is placed on the actor rather than when the camera is in some other position.

More recently, I tried out the HTC Vive Virtual Reality System (2018). This VR headset with 110-degree field of view and front-facing camera provides an enhanced visual experience through a mix of virtual and actual surroundings. The system includes two base stations that are placed in a room to track the participant's movements, and two wireless hand controllers for interacting with the virtual world in video games, for example. The monitoring of the user's movement allows the system to render the view that the observer would be seeing from that perspective. Similar to most commercial VR systems, the Vive doesn't track eye movements. It tracks the player's head position and controllers' positions and renders the scene appropriately. I'm not a gamer so initially I wasn't very facile with the two handheld wireless controllers. I wasn't too thrilled with the color drawing program but did enjoy Google Earth's rendering of NYC from multiple perspectives and distances. My experience was well within the

Bailenson's Lab recommendation of no more than 20 minutes within VR. I sympathized with Bailenson's grandfather who completed a demonstrated in VR and remarked, "OK now what?"

As the author cautions us throughout the book, VR has an opportunity to make the world a better place but also has potential downsides. He is optimistic about the potential of VR to dramatically decrease our footprint on Mother Earth. As one example, perhaps VR can be sufficiently realistic to substitute for meetings, vacations, and any activities that require travel. Videoconference calls haven't seemed to significantly reduce travel but maybe VR calls would. One can't even imagine what a VR home run would do to the economies far and wide.

How does one exploit VR to attenuate the footprint homo sapiens imprint on the environment? In this age of comfort, high-end toilet paper is putatively sought out by consumers (who may have been brainwashed by advertisers). The authors learned about this trend from the popular media. (Perhaps daily news stimulates research more than refereed journals?). I learned that the soft fluffy stuff cannot be manufactured from recycled paper. I guess the typical consumer stocking up at Costco doesn't question how much this essential luxury is impacting the environment. Typical toilet paper requires wood, which requires cutting trees, and manufacturing it uses water and chlorine bleach and produces waste impacting sewers and landfills. It's easy to push the cleanliness and comfort boundary, without thinking of the environment. As a guest in a friend's home, my bath towel consisted of two huge luxury towels sewn together, with the purpose of providing more than enough absorption. I prefer Japan where you have a small towel which unsurprisingly proves sufficient.

Motivated by this article, Bailenson and colleagues asked how they could motivate people to understand the consequences of buying non-recycled paper. The upside of VR is that it can heighten a person's experience and therefore have a larger impact on their future behavior. Research in decision making and judgment shows that direct experience has more weight than abstract statistics. (Learning about your neighbor's cancer treatment first-hand leaves more of an impression than the latest epidemiological study reported in the newspaper.) Stanford undergraduates were embedded in a virtual forest of trees with accompanying foliage and birds. They held onto a motorized saw-handle and viewed through their head-mounted display (HMD) their virtual hands holding a chain saw. They approached a tree in VR and were instructed to move it in a cutting motion. The outcome after about two minutes of cutting was a tree crashing to the ground. Control subjects simply read about what it would be like to cut down a tree. All subjects were also told that their lifetime use of non-recycled toilet paper would require the harvesting of two full-sized trees.

To test the impact of this intervention, the pregnant researcher encountered the students 30 minutes later and "accidentally" spilled a glass of water. She pointed to a stack of napkins and asked each subject to help her clean up the spill. The

virtual tree-cutting subjects used 20% fewer napkins than the control subjects. A follow-up study indicated that the VR experience was even more effective on recycling behavior than watching a video of a first-person perspective of tree cutting.

Armed with VR, one could create a cottage enterprise of similar demonstrations and the author's lab has met this challenge. One study involved water use during showers, and having subjects experience eating the coal required to heat the water used less hot water washing their hands than controls.

In an earlier book, Blascovich and Bailenson (2011) provided a convincing case that VR has always been a large part of our species. We dream, zone out without realizing it, and consciously tune out or mind wander (Smallwood et al., 2008). We easily adjust to new forms of experience whether 2D depictions of reality, stereoscopic presentations of offset images that the two eyes would normally see, and even distorting lenses that displace or invert the visual world. Thus, the leap to a head mount display (HMD) is not completely foreign.

Behavioral Science has developed a good understanding of various influences on decision-making, and how these influences are presented might lead the decision maker into making less than optimal decisions. With this knowledge in hand, behavioral scientists have suggested how small changes in the decision-making situation can eliminate or at least reduce less than optimal decisions. Designing the decision-making scenario to encourage more optimal behavior has been called a nudge. One of the most effective nudges is when employees must make a decision about enrolling in retirement programs that place some small part of their earnings in a retirement fund (sometimes partially matched by the employer). Traditionally, the questionnaire form would ask the employee to opt in by checking a box to enroll. A simple nudge can be made in the questionnaire by making the opt-in option the default so that the employee a box must be checked to opt out of the retirement fund. This seemingly innocuous change significantly increases the likelihood of a typical employee enrolling in the retirement program (Clark, Maki, & Morrill, 2014; Thaler & Sunstein, 2008).

Virtual Reality offers another technique to increase enrollment in retirement programs. In this case, the employee views doppelgangers of herself who are depicted at different ages. Before, the questionnaire she sees a few versions of herself gracefully becoming more chronologically gifted. Static versions are usually shown in the manipulation but technology has improved so it is now easily implemented to view her aging a few decades in just a few real-time minutes. Given previous experiments, we would expect a greater enrollment in retirement programs after employees see themselves age. It would be interesting to combine the Opt Out and the Aging manipulations to determine if enrollment could almost unanimous.

Perhaps one of the greatest hopes for VR is its potential impact on education. Recently, a provocative book has made a Case Against Education (Massaro, in press). More generally, few educators and behavioral scientists would feel comfortable in making a strong case for education as practiced today. Education Scientists have substantiated only a few laws for optimizing learning. Two best-known laws are Time on Task and Spaced Learning. Research and applications have consistently revealed the value of time on task so much so that it has become legend. From the initial stages of learning to the attainment of expertise, time spent on focused deliberate practice is essential and the more time spent the more learning (Ericsson et al., 2006). A related effective principle of learning is the value of distributed or spaced practice relative to massed practice (Pashler, Dohrer, Depeda, & Carpenter, 2007). One of the most robust findings in psychology and education research is the advantage of spaced over massed practice (Dempster, 1988, Pashler et al., 2007). Given an equivalent amount of time for learning, it is better to space this practice across multiple learning sessions rather than having fewer sessions of learning.

Could advances in VR catapult it into a law, so that it could be claimed that VR enhances learning relative all other forms of media? There have been a few successful VR lessons, such as Chris Dede's River City Project, a multi-user virtual environment (MUVE). However, its success might simply be a consequence of these learners eager to spend more time learning (Time On Task Law). Studies reviewed by the author have failed to find a benefit for VR or only a very small benefit. One issue appears to separating the experience portion of VR from the necessary accompanying instructional narrative. The user putatively engrossed in the VR domain does not attend to the instructional narrative. As noted by the author, the instructional format should have seamless sequences of experiencing and narration, ideally each engaging and made more so by a synergy between the two.

One of the central tenets of the book is that VR is an ideal empathy machine, and increased empathy (like cutting trees in VR with the purpose of using less fluffy toilet paper) can lead to an appreciation of trees and conservation. With potential upsides come potential downsides, however. Paul Bloom, has condemned empathy as being inefficient and even detrimental in our responses and actions to others (see Heck & Krueger, 2017). An executive, motivated by empathy for the homeless, might spend Sunday morning working in a soup kitchen. This heartwarming volunteering helps very little, when a more rational decision might be to donate to a homeless shelter. We are guided by our spotlight of attention and empathy can direct this attention in nonoptimal ways. VR might direct out empathy down less than productive paths. Jaron Lanier, (2017) a pioneer in VR and now a prominent cyber ethicist, weaves cautionary tales about how VR can be used to our detriment. He believes that empathy can have negative consequences because it can lead to negative behaviors. He gives the example of the movement Black Lives Matter, which supposedly led to normalized racism and white supremacy. I'm not sure I buy his examples but both Bloom's and

Lanier's caveats offer the possibility that VR might promote empathy but the consequences might not always be positive.

As a side note, the book is very positively reviewed on Amazon, which demonstrates one can write a scholarly book, without compromising your message to non-professionals. If the reader is seeking an engaging introduction to VR or would like an update on the state of the art, Bailenson's book is a rational choice.

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References

- Blascovich, J. & Bailenson, J. (2011). *Infinite Reality: Avatars, Eternal Life, New Worlds, and the Dawn of the Virtual Revolution*. New York: HarperCollins.
- Clark, R. L., Maki, J. A., & Morrill, M. S. (2014). Can Simple Informational Nudges Increase Employee Participation in a 401(k) Plan? *Southern Economic Journal*, Vol. 80, No. 3 (January 2014), pp. 677-701.
- Ericsson, A.; Charness, N.; Feltovich, P. J.; & Hoffman, R. R. (Eds.) (2006). *The Cambridge Handbook of Expertise and Expert Performance*. Cambridge: Cambridge University Press, 2006.
- Google cardboard (2018). https://en.wikipedia.org/wiki/Google_Cardboard
- Heck, P. R., & Krueger, J. (2017). Rational Healing Review of 'Against empathy: The case for rational compassion by Bloom, P. Patrick R. Heck, & Joachim I. Krueger. (2017). *Rational Healing. The American Journal of Psychology*, 130(4), 523-526. doi:10.5406/amerjpsyc.130.4.0523
- HTC Vive Virtual Reality System (2018)
<https://www.google.com/search?client=firefox-b-1&q=htc+vive&sa=X&ved=0ahUKEwjNnP2-2rDeAhWoHzQIHcsfDtcQ1QIixAEoAw&biw=1920&bih=889>
- Lanier, J. (2017). *Dawn of the New Everything: Encounters with Reality and Virtual Reality*. New York: Henry Holt and Company.
- Pashler, H., Rohrer, D., Cepeda, N.J & Carpenter, K. (2007). Enhancing Learning and Retarding Forgetting: Choices and Consequences. *Psychonomic Bulletin & Review*, 14, 187-193.
- Reeves, B., & Nass, C. (1996). *The Media Equation: How People Treat Computers, Television, and New Media like Real People and Places*, Cambridge University Press.
- Smallwood, J.; Beech, E.M.; Schooler, J.W.; Handy, T.C. (March 2008). "Going AWOL in the brain – mind wandering reduces cortical analysis of the task environment". *Journal of Cognitive Neuroscience*. 20 (3): 458–469. doi:10.1162/jocn.2008.20037. PMID 18004943
- Thaler, R., & Sunstein, C. (2008). *Nudge*. New York: Penguin