

## Lessons Learned as We Begin the Third Decade of Virtual Reality

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**S**INCE WE CANNOT CHANGE reality, let us change the eyes which see reality.” So said Greek writer Nikos Kazantzakis. And virtual reality (VR) is allowing us to do so.

As we embark on our third decade of virtual reality and behavioral health, it is important to recognize how far we have come; from helmet-style head-mounted displays that cost thousands of dollars to a VR headset that clips on your cellphone for <\$200. From FTP, Usenet, and something called the World Wide Web to Facebook, Twitter, and Instagram. Some of us have been involved since the beginning, when what we were envisioning was years ahead of its time ... while others are just now discovering this unlimited frontier.

I’d like to share with you my “top 10” list on how technology has enhanced patient care (and self-care) for the past two decades and continues to enrich our lives.

1. *We can treat so many more conditions with VR-enhanced therapy.* In the mid-1990s, I discussed early case studies that showed that VR *might* have promise in treating those suffering from fear of heights or post-traumatic stress disorder (PTSD).<sup>1</sup> Now, in 2016, we successfully use VR to treat various phobias and anxiety disorders; help to modify the body dysmorphia common in those who suffer from eating and weight-related disorders<sup>2</sup>; provide individuals with relief from both acute and chronic pain<sup>3</sup>; and harden civilian and military first responders with VR-enhanced stress inoculation training.<sup>4</sup>

2. *VR can be used as an assessment tool.* While genetic studies are showing promise and a few studies indicate good biomarkers such as heart rate variability (HRV) can inform us about who will develop a disorder and who will not, a VR assessment may, perhaps, do the same thing. A recent study is using a VR brain training game to predict mild cognitive impairment, often an Alzheimer’s precursor.<sup>5</sup> And a congressionally directed medical research program has now produced results indicating that PTSD severity may be predicted based on HRV. (Unpublished work. Pyne JM, Constans JI, Wiederhold MD, et al. Heart rate variability: an objective pre-deployment predictor of post-deployment PTSD.)

3. *The use of VR is now evidence based.* A 2014 meta-analysis<sup>6</sup> of 30 studies “found an overall moderate effect size for VR interventions. Individual meta-analyses found an overall large effect size against non-intervention wait-lists and an overall moderate effect size against active interventions.” We have amassed a database of 20 years of clinical

studies for cyberpsychology, which we plan to make available online in 2017.

4. *VR can now be used in the home as well as the clinic.* mHealth, or mobile healthcare, is beginning to revolutionize how and where behavioral health services can be delivered. It is now possible to seamlessly deliver care from hospital to clinic to home. Using immersive technologies such as VR, we can augment treatment protocols, and patients can improve their mental health and well-being at home or on the go just by using their smartphones.

5. *The use of VR is now patient driven, not therapist driven.* We are now seeing smartphone apps used as a means of engagement, such as for patient education and to facilitate treatment. In addition, patients are using tools to sustain gains after treatment has ended, such as those being used to provide positive reinforcement. Patients everywhere have become active participants in their own health and well-being, and have driven development of these downloadable and free or inexpensive apps.<sup>7</sup>

6. *Patients are now empowered to treat themselves.* However, in order for self-care apps to realize their full potential, they must be not only well-designed and appropriately social media marketed to patients, but they must also be proven efficacious and cost-effective through evidence-based research. To date, very few randomized clinical trials have been conducted showing the efficacy of apps. The United Kingdom’s NHS has established criteria for the evaluation and recommendation of patient-focused health apps.

7. *The cost of VR has dropped significantly while becoming more widely available.* The price of wearables is now coming within reach. Google Glass made news in 2014 but didn’t catch on. Now, in 2016, we have seen Microsoft’s HoloLens, Facebook’s Oculus, the HTC Vive, and Samsung’s Gear VR all show real promise for significant market uptake and sustainability at an affordable cost.

8. *The use of objective measures is becoming ubiquitous.* Built into your smartphone are sensors such as accelerometers that measure movement and orientation; location services such as a magnetometer and GPS; a proximity sensor that can tell when you move your phone to your face; and an ambient light sensor—all of which may be used in conjunction with other standard features such as your camera to measure your behavior. Measurement of HR, SpO2, respiration, skin temperature, and other vital signs, allow for objective assessment of patient progress over a 24-hour time period.

9. *With the advent of mental health parity, significant growth is now possible.* The importance of behavioral interventions is now regularly seen in the management of chronic diseases such as congestive heart failure, diabetes, and atrial fibrillation. Several years ago, the Quantified Self movement began. An international collaboration of users and makers of self-tracking tools, forums include diet, sleep, and mood tracking. But challenges for uptake still remain. The biggest obstacles researchers face in being able to use this natural source of “big data” are protocols for device data—and of course more funding.

10. *All of us are riding the wave of technology development.* This is one reason the VR and behavioral healthcare community continues to experience success, to use tools and technologies created in other domains, and to apply those tools to empower our patients—and all individuals—to help themselves. This global movement will continue to provide significant opportunities for new ideas in clinical assessment and interventions.

I hope this editorial will leave you energized to continue your research, to engage in the process of whatever country you hail from, to ensure that people everywhere have access to the latest tools and technology to improve their health and well-being—and to ensure that the impact of new technologies remains positive. With VR, we may have begun to change the eyes that see reality ... but as Robert Frost said, “We have miles to go before we sleep.”

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