



Essay

A Virtual Reality Prescription: A Future(s) of Healthcare

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Abstract

This paper is a thought piece intended to push the boundaries of what might be possible using the latest technology and futures scenarios to solve an increasingly worrisome or wicked problem. Virtual reality is beginning to find uses beyond training in the field of healthcare. It's not just the opportunity to perform a task afforded by this technology but the ability to cross a threshold and experience something novel. This novelty extends beyond the treatment provided to encompass new ways of inclusion and pursue the idea of one size fits one. Immersion changes perspective and allows a user to believably transform. This article marries virtual reality and experiential futures to provide a platform for radical healthcare transformation.

Keywords

Experiential futures, virtual reality, embodiment, virtual healthcare, wicked problems

Introduction

Experiential futures offer opportunities to engage with multiple possible futures as a user rather than watch as a spectator. (Candy & Kornet, 2017; Kelliher & Byrne, 2015) Scenarios, the result of both art and science, stretch the user's imagination allowing them to see, feel and learn about the future by going there. Experiential futures take you there, and you learn by doing. These scenarios are powerful but, in many cases, have limitations that make them inaccessible to most. Physical interpretations are limited to the construction materials and resources available. They are not easily transportable, are defined by the size of the space provided, have difficulty effectively conveying realistic futuristic technology, occur as a single event, and connect with just a limited number of people before being removed. Immersive virtual reality (VR) can provide a solution to those concerns. Perhaps the most important consideration on that list is getting these futures in the hands of many vs. few. In addition, VR provides opportunities for embodiment, (Biocca, 1997), presence (Bailey & Bailenson, 2016), and empathy (Schutte & Stilinović, 2017). These features could deliver an additional layer of engagement increasing scenario effectiveness.

Combining experiential futures and virtual reality creates a new multidisciplinary approach to discovery. What if this approach was applied to healthcare? Change is hard, and patients have difficulty following prescribed orders from their doctors, especially over long periods (Tasler, 2018). Future scenarios depicting possible outcomes related to a health issue can be delivered as VR immersions. These immersions could be prescribed by doctors just as a drug or a test is administered.

If patients could experience themselves in the future in multiple states of health, might they make the required changes more easily? Might this prescription be an antidote for a heavily burdened healthcare system? How might this technology reach those historically and systemically overlooked? Could this experiential medicine go deeper so those who have faced generations of fundamental mistreatment could reconnect to a healthier future self? Would it be possible to reduce the incidence of disease and reduce healthcare costs because of reduced medication and number of procedures?

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An Intervention

Imagine a universal health card renewal that includes updating your VR avatar. Let's set the stage. Your doctor informs you that your sugar levels are high and that you are pre-diabetic.

At 32 years of age, you are a slightly overweight female. Active and sporty ten years prior but now chained to a desk and often eating on the run. Before moving to medication, your doctor suggests that you need to see a dietician and make some significant modifications to your lifestyle. You have 20 lbs. to lose, but you're not obese. You've been on countless diets, and you know what the dietician will say. It's a matter of sticking with it and being motivated.

Along with your dietician appointment, you are handed a VR Rx card. The following week you have an Immersion Therapy appointment. Before your meeting, you go to the med lab to have your blood drawn, and your body scanned. The 3D scan of your body is sent to the immersion centre, creating your avatar for virtual reality: capturing your weight, age, gender, body proportions, and physical attributes like hair and eye, and skin color. This scan also incorporates genealogy, so the complete picture includes the patient today and the patient's ancestry to help connect the future by using both the past and present.

Arriving at the immersion lab, you scan your health card, which carries your newly created avatar, and you follow instructions to immersion room Q. As you enter your assigned room, dozens of others enter rooms along the corridor for a myriad of other health problems. The floor of this room is an omnidirectional treadmill you put on your head-mounted display, and a haptics suit snaps into place. Like an exoskeleton, the suit, is easily altered to fit all body types and abilities. You will be experiencing three possible futures because of your prediabetes diagnosis. First, you will encounter the potential negative consequences of your diagnosis at 20 and 40 years. The third experience will be a positive immersion in five years.

It begins.

Scenario 1

You walk by a store window and catch your reflection, a first-person account. You've put in another 35 pounds. Now at 52, you are carrying about 55 extra pounds, exercise is not a regular activity, you find it not impossible but a bit tiring to walk. The haptics in the immersion room has slowly added 35 lbs to your suit. You didn't notice it. You are also walking slightly on an incline due to the treadmill, but the images you see tell you that you are walking on a flat surface. Your brain connects with the environment you see (Kilteni et al., 2012, p. 16). You feel the strain. Your 52-year-old image shocks you.

Immediately you panic, your heart rate increases, and you begin to sweat. This immersion aims not to have you look at your physical image but to engage in day-to-day activities as a full-blown diabetic who did not take precautions to halt the disease 20 years earlier.

In this scenario, you are meeting a friend for lunch. At the restaurant, you look at the menu. You see what you want to have and what you should have. Your friend (an avatar) asks about your diabetes and if there is anything you can eat on the menu. A salad with protein is not what you want, but you feel impending judgment if you don't make that choice. You're annoyed, but this is a treat, so you order a sizeable carb-laden lunch and decide to up your insulin a bit to compensate.

You log into Google Air, a hologram workspace, and instruct your medically implanted insulin delivery system to provide five extra units than usual. You wonder if there was a discrete way to make this change or if you should have excused yourself to find an empty corner to create the instruction. You feel the slight sting from the delivery—the result of immersion haptics. Throughout lunch, you wish you had just ordered the salad. After, you feel tired because of the high carb load. Going back to work and staying awake will be challenging this afternoon. You have a lot to do, and you're a little angry at yourself for not doing the right thing, and you vow that you'll do better next time. (You've said a million times before).

You see a door in the distance indicating you can exit this scenario, so you walk to it, happy to escape.

Scenario 2

It's now 40 years later; you're 72. Many heavy carb lunches, exercise in fits and spurts, one child, decades of binge-

watching tv during years of pandemic lockdown has provided you with a much slower metabolism and an additional 15 pounds. You are, by all definitions, obese. You are returning from the grocery store in a cab because you can no longer drive. You have retinopathy. The tiny blood vessels in your eyes have weakened because of high glucose levels over the years, and the vessels are now leaking. Your vision is impaired.

The head-mounted display only allows you partial vision. You have also lost most of the sensation in your feet. They continuously tingle, or you feel pain if you feel anything. Advanced haptics in the immersion chamber can mimic the tingling sensation using vibration. You are trying to make dinner. It is not easy to see, but you prepare a simple recipe. Standing on your feet causes pain. You shuffle and decide to sit while you work. It takes so much longer.

To your left, you spot another door. Quickly you get up, and you take it. You need to leave this future self behind without delay.

Scenario 3

Today, you are five years older than when you entered the immersion. You have lost that 20 lbs. and you are out walking. The sun is shining, and you enjoy the sites in your favourite part of town. Everything smells fresh. It almost feels like your theme song is playing. (Maybe it is.) You go into a coffee shop and order green tea. You glance at the sweets, but you don't want any. You feel energized. The scent of grapefruit surrounds you. Everyone seems happy. As you leave the coffee shop, you catch your reflection in the glass, and 20 lbs. thinner, you look great. You want to be that person.

The scenarios have shown that you have options.

A quick counseling session follows your immersions, and copies of the scenarios have been made available on your cloud drive. You can access them anytime you like. Will you change your lifestyle?

Breaking it Down

Experiential Futures

The scenarios above are neither right nor wrong. They are quick sketches used to consider the possibilities and feel the results of different consequences. Not only is your physical self challenged, but also your mental and spiritual self. Experiential futures push boundaries. "Any useful idea about the future must at first appear ridiculous." (Dator, 2007, p. sec II). To extend beyond our existing scope of vision, people must entertain the possibility of something that appears unrealistic, impossible, or even obscene. Our views today exist because of outdated or stagnated thinking, but our ideas must change as new information becomes available (Dator, 2009). We are inundating with information, and telling a person something they don't want to hear only engages personal biases (Darmstadter, 2013; Nyhan & Reifler, 2010). It is the role of the futurist to make a ridiculous notion plausible. It's important to remember that everything was once a new idea; farming, computers, uploading your mind to the cloud...

The mainstream medical system is built on the concept of medicine as a drug. A prescription and the fate of one's health are expected to be delivered on a piece of paper that will end more often than not with a bottle of pills. If we take those pills, we have the best chance of recovery. As everyone knows, "doctors know best." Experiential Futures can help extend the boundaries of this thinking. In this case, the prescription gives people experiences that can help them see the invisible. People are unable to visualize their future selves. When one thinks about their future self, the neural patterns in one's brain are the same as if one was thinking about a stranger (Hershfield et al., 2011). The push with virtual prescriptions is not about interventions via drugs and lifestyle changes but instead about connections and being able to see the complete picture. It is about a holistic view and the understanding gained from embodiment and immersion (Kilteni et al., 2012) and the identity cures achieved through engagement leading to behavior change (Yee & Bailenson, 2009).

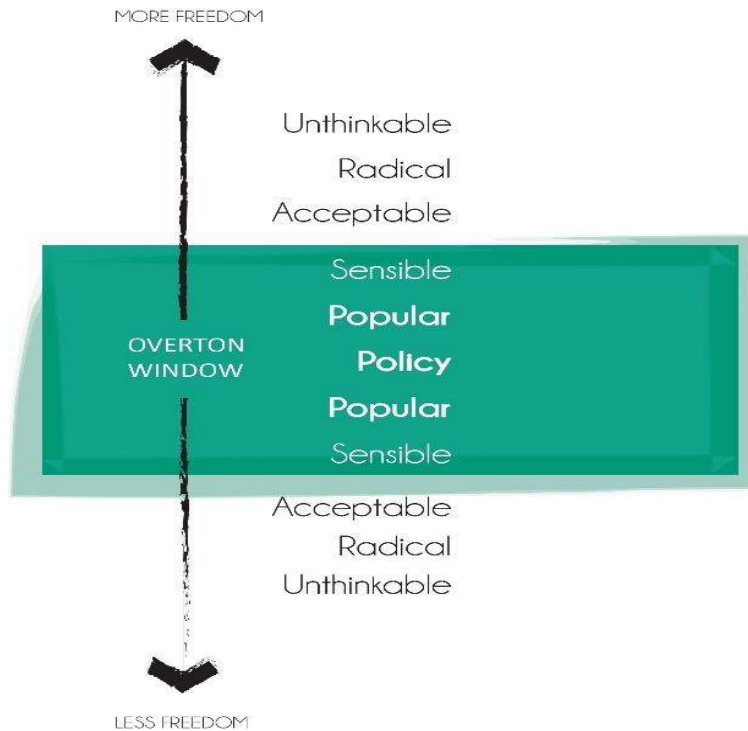


Fig. 1: The Overton Window. (Illustrated by the author)

The Overton Window provides a framework to consider how radical ideas are socialized and find their way into mainstream society. Joseph Overton used this framework to describe the socially acceptable positions of any idea found inside the window. Those that fall outside the window demonstrate the journey before and after acceptance. Sometimes these ideas are considered radical, ridiculous, and even dangerous (Lehman, 2018). As a futurist, the idea starts in the unthinkable or the radical. Using the seatbelt as an example, you can see how something started as a radical idea but quickly moved from acceptable and sensible to policy as data emerged regarding its life-saving effects. Seatbelts were invented in 1885, but until physicians began testing their efficacy in 1933, the idea wasn't accepted by either users or politicians. In 1966 all American cars were required to have seatbelts, but it wasn't until 1996 that all States had laws enforcing people to use them (Defensive Driving, 2016). Seatbelts are always required on buses and now on planes. They went from unthinkable to sensible by doctors, to popular by automakers, and then to policy by lawmakers, but it took more than 100 years.

Today a virtual reality prescription would find its home in the radical.

The role of experiential futures is to incite a response, open minds, and provide a place for contemplation and consideration (Dunagan et al., 2019). It brings something on the peripheral directly into your view. It is a catalyst for change on the "continuum of human experience" (Candy & Dunagan, 2017, p. 137). The Centers for Disease Control and Prevention in the US states that 88 million Americans have prediabetes (Centers for Disease Control and Prevention, 2021). The estimated cost of prediabetes and diabetes in the US is 327 billion. This problem is wicked (Rittel & Webber, 1973), and tackling it requires radical thinking.

Virtual Reality Scenarios

The diabetic health portholes are scenarios offering multiple possibilities for the future. Growing chronic issues are

just one of many emerging on the global health landscape. Others include customized experiences - one size does not fit all, digitized health care and having more control over your data and information, a distributed healthcare system that provides for online or virtual experiences, and new technologies that step outside merely diagnostic technology tools (Tepperman & Thompson, 2001). Unheard or overlooked voices from those with systemic disadvantages can see themselves in these experiences and connect with healthcare in ways that align with their history. Virtual reality presents many opportunities to make the system richer and more impactful and to right wrongs that have been ignored for decades. One size fits one flexibility is possible.

A VR scenario is relatively easy to construct and can allow the patient to experience embodiment and presence, which could help the patient make a change. Empathy, by definition, speaks to the understanding of the feelings of another. Could you have a connection and a concrete understanding of your situation in 20 years if you went to the future and experienced it directly?

VR worlds are reasonably simple to create, maintain, share, and update. The field makes improvements daily, and the software is accessible and open. Leaders like Unity and Unreal Engine offer their software for free. Schools provide computer programming at every level, from online certificates to PhDs. Thousands of new graduates enter the market every year. VR worlds are customizable, yet many components of the models could be shared and reused for multiple patients. Virtual reality is an emerging technology, but since the release of the Oculus Rift in 2016, many competitive products have launched, and prices of this technology continue to drop.

Without the use of this technology, the scenarios would not be possible. Without VR, significant physical space is required, and the scenarios are staged and removed. Scenario reuse would be difficult as a method of ongoing therapy. The technology's fluidity would allow a Health Portal to be a prescription delivery method for millions of people globally.

Virtual Connections

In VR, Sense of Embodiment (SoE) is achieved when three states exist. They are the sense of self-location, the sense of agency, and the sense of body ownership (Kiltner et al., 2012, p. 373). The sense of location occurs using the first person, like avatars in a shooter game scenario. The patient can see themselves in reflections throughout the experience and look at their bodies like we see ourselves every day. Even as the body is modified, the connection persists (Steptoe et al., 2013). The sense of agency happens when the patient encounters tasks requiring decision-making. What to order, where to administer her insulin. The decisions occur in real-time as if the patient was there. The sense of body ownership is achieved using haptics. Walking on an omni-direction treadmill; a change in plane, the use of scent, the tingling sensation on the feet, or the prick of an insulin needle. If included in the scenario, haptics would provide an enhanced sense of body ownership (Kiltner et al., 2012, p. 377). By developing the tactics required for SoE, the patient will experience connections and feelings towards their virtual body, like the relationships and emotions they have with their own body.

In these health scenarios, the real-world patient accepts changes to their virtual self as if they were one and the same. Steptoe, Steed, and Slater's work (Steptoe et al., 2013), using human avatars with long functioning tails, reported that real-world users felt the tail was part of them the same as their arms and legs and controlled it by swiveling their hips. Imagine having a patient experience what it's like to navigate a city street in a wheelchair, make a cup of tea without their sight or get out of bed and dressed when you've had your legs amputated below the knee. An extreme example but a critical one as globally, it is estimated that leg amputation due to diabetes occurs every 30 seconds (Azura Vascular Care, 2017).

Not only does the patient feel the virtual body is their own, but they also think that the virtual mind is theirs. "The senses are portals to the mind" (Biocca, 1997, p. 13). When this connection between mind and body occurs, it is called embodied cognition (Bailey & Bailenson, 2016). The body systems that SoE enables then send signals to the brain. What the avatar sees becomes a memory, not just in the avatar but also in the real world. The movements that the avatar makes become actions. The emotions felt in the virtual world (like the judgment the patient felt at the table or the frustration that happened when she was having difficulty making dinner) are embodied and become introspection— (2016, p. 222). Embodied cognition is the basis for creating empathy (Shin, 2018). Through empathy, the prediabetes patient can observe themselves and walk a mile in their own "future" shoes. Schutte &

Stilinović demonstrated that when given a choice between a 2d representation of an issue or a VR representation of the same problem, those that experienced the VR were significantly more engaged and felt substantially greater empathy (Schutte & Stilinović, 2017, p. 710).

Scenarios exist to offer multiple options for the future. While the patient experienced two negative possibilities at 20 and 40 years, she also experienced a near future of only five years. This near-future offered a positive outcome. The effects of the positive portal are equally motivating. Identity cues using a thinner body type, clothing, and interaction with others help support a positive attitude. Scent and sound heighten the positive feelings and provide the SoE required to feel connected. These positive reinforcements can also change behavior (Yee & Bailenson, 2009).

Experiencing the harmful effects of a future where the disease is present and the positive impact of changing the diagnosis provides healthcare practitioners and patients a 360-degree view of possible futures (Ogilvy, 2011, p. 8). A wide range of emotions, environments, and options are presented, and multiple opportunities for engagement are provided. Patients are encouraged to use VR scenarios to develop a Sense of Embodiment, triggering embodied cognition and providing opportunities to empathize.

Virtual Access and Inclusion

One of the benefits of a virtual portal is its ability to shift away from a one-size-fits-all solution. If you have a headache, you take aspirin; if you have cancer, there's chemotherapy, but what if you suffer from systemic generational disadvantage? Additionally, one must ask how much a virtual reality portal costs and who has access? As the virtual prescription leaps forward, does it do so only with a chosen few in its arms? As a new intervention, a virtual reality prescription must take the opportunity to offer a broader, more inclusive approach.

VR portals, as mentioned above, through their methodology using experiential futures combined with VR technology, have a unique opportunity for creative freedom and boundless opportunities. In this writing, diabetes is the issue explored, but with this technology, co-creation of solutions for any health issue that requires being rather than just seeing can be established.

Today VR is used as a therapeutic tool for helping those with PTSD (Deng et al., 2019; Rothbaum et al., 1999) and as a method for healing Aboriginal Stolen Generation survivors in Australia (Tiwari & Stephens, 2020). These solutions are alternative treatments for an established issue.

The VR prescription in this writing is preventative; stop diabetes from occurring. Could we decrease heart disease, depression, or anxiety from the pressures of a world experiencing exponential growth or for a community that has suffered systemic generational damage? Put into the hands of users who may exist outside the "traditional medicine" space, it can be modified to develop any experience. The engagement can be created as n=1, one experience tailored to one person to help solve one issue.

The VR portal portrayed in this scenario is elaborate, with haptics and precisely tailored environments, and it relies on the technology available in the market today. The opportunity for this tech is just coming into focus. VR has yet to find its footing in mainstream consumer products. As demonstrated by Stuart Brand's Pace Layering (LeJeune et al., 2018), imagination and early adoption in art and fashion will bring widespread opportunity to the masses. As demand increases, new brands will emerge, increasing competition and delivering competitive pricing.

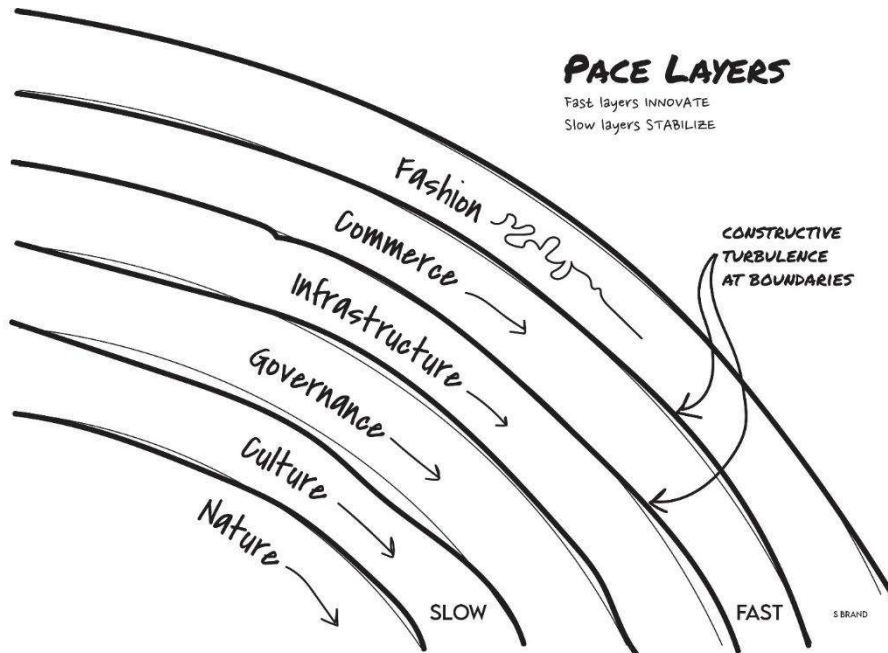


Fig 2: Stewart Brand's Pace Layering (illustrated by the author)

Recent TV programs are leaping forward with creative tech in shows like Upload and Star Trek's Strange New World, using VR to create locations for future worlds. These artistic expressions accelerate the Overton Window and move ideas from radical to acceptable and even popular. Demand for products in gaming, education and business will help lower costs and increase access to broader populations.

Conclusions

Experiential futures and virtual reality combined to produce VR portholes for patients and health care providers could solve a growing problem. With disease states like diabetes on the rise and associated healthcare costs, the opportunity to get ahead of these diseases and stop them before they start is significant. People could avoid more difficult and painful lives by prescribing VR portholes as treatment or pre-treatment education, but those people would also save thousands of dollars. The health care system could save millions, if not billions. The estimated lifetime cost for the average diabetes patient is \$124 600.00 (Zhuo et al., 2014, p. 2558). In addition to the direct medical expenses, estimated lost productivity due to diabetes results in yearly losses amounting to 69-billion-dollars. By 2034 these numbers are expected to double. There is an urgent need for intervention, new thinking, and new programs.

As we think about the future of education, VR futures could become a school health class. It could be a connection between healthy eating and exercise. Lunch could shift from a mid-day break to a class about cooking and a nutritious diet, conveying by making food and eating together. VR portholes could occur in the medical center or at the patient's home as more people own personal VR equipment. These prescriptive treatments could begin to take hold in the places they are needed most, creating a distributed healthcare system that could be more accessible and equitable for all, designed for the people by the people. Like a pill or a test, a VR prescription could become a mainstay of the health industry as we consider treatments for both mind and body.

To make the shift, we need to think differently. Like Overton's model suggests, we need to consider the radical and unthinkable. The role of future thinking could be instrumental in finding new ways to solve old problems because that old way of doing things isn't working. It's time to consider the virtual reality prescription.

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