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EDITORIAL

Can Deepfakes Improve Therapy?

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Imagine being in so much pain that you can no longer do the things you love, such as taking a relaxing walk on the beach. Now, imagine that someone offers you the opportunity to experience that walk again—virtually, from the comfort of your home. All you have to do is don a headset, and you are instantly transported, the same areas of your brain lighting up as if you were taking that walk in real life.[1] As you build your skills on your virtual beach, you are in turn building strength that could enable you to return to walking on your real-world beach in increments that are therapeutically appropriate, comfortable, and safe.

Study after study has shown that when a person learns a skill in virtual reality (VR), that skill often transfers to the physical world. Could that effect be enhanced through increased personalization? What if we could easily transport a patient not just to *a* beach but to *their* beach, with its particular attributes and landmarks. What if when they looked down, they saw a highly realistic reproduction of their own toes wiggling in the sand? As technology improves, and creators and clinicians become more able to personalize virtual experiences, how much more effective could this type of experience become? Will personalization be a new metric for immersion/presence?

Enter the deepfake—synthetic media produced by technology with the capacity to create convincing likenesses of real-world environments or people. While manipulation of media has existed since its inception, deepfakes involve powerful machine learning and artificial intelligence techniques that are used to generate convincing video, audio, or images that replicate natural objects/people. Up until a handful of years ago, production of quality synthetic media such as this, while possible, required significant time, money, and expertise. However, over the past several years, technology has evolved. Creators now use general adversarial networks—two neural networks working together to generate and discriminate between what is ''fake'' and what is ''real''—to automate the process for creating deepfakes, reducing the necessary resources and producing increasingly realistic results.[2]

These leaps in technology are not occurring solely in machine learning and artificial intelligence but are appearing at the same time as rapid developments in immersive technologies such as VR and augmented reality (AR). Combining deepfakes with other extended reality (XR) technologies such as these could exponentially increase the impact of each[2] for several reasons, including their accessibility, their user-centered nature, and their immersive qualities. For example, the hardware required to engage with AR and VR is becoming both less expensive and more compact and convenient. A smartphone alone, or the addition of a small VR headset, is all that is needed to enter a synthetic world, making it reasonable to use these technologies anytime and anywhere. In addition, VR/AR are easily personalized. For treatment purposes, VR provides a clinician with the ability to tailor the therapy session, enabling them to provide stimuli appropriate to each patient in a safe and private environment.[3] AR and VR also encourage immersion and a sense of presence (the feeling of ''being there'' in a virtual world), creating an immediacy to the experience. Finally, VR shares with the human brain the mechanism of embodied simulations. In other words, both the brain and VR rely on simulations of the physical body in the world in order to represent and predict actions, concepts, and emotions.[3] Because of this, there is the ability to design targeted virtual environments that can simulate both the external and internal world/body. A combination of deepfake technology with these immersive XR technologies could fortify each technology's perceived level of realism.[2]

The rapidly improving quality of these technologies has given rise to concerns about the morality of creating deepfakes and potential pitfalls to their development. After all, deepfakes are designed to deceive. While current deepfakes are typically still identifiable as such, the algorithms that create them are easier to build than to detect. Soon, technology will catch up with human perception, and it will be much more difficult to identify a deepfake outright. What then? Will deepfakes interfere with our sense of reality, with our ability to trust what we see and hear? And perhaps more importantly, there are those who worry about the malicious use of these technologies, so much so that politicians have even called for legislation to regulate their use.[4]

Yet, despite concerns about the manipulative and malicious use of deepfakes, there are several barriers that must be addressed before they become ubiquitous. For one thing, though creating a deepfake may require very few input images, current technology still relies on training a system from zero, which is an expensive and time-consuming proposition that also requires a great deal of expertise.[5] And even when deepfakes do begin to inundate the media, humans have defenses against deception. They do not need to be passive consumers of media. Society has adapted to new forms of media (and manipulation of that media) before and can continue to do so. By taking an active role in media consumption and fact checking sources, just as with text, people can indeed learn to detect deception in all types of media, including deepfakes.

Moreover, there are quite a few benefits to being able to manipulate media realistically. Aside from the therapeutic

benefits discussed earlier, the deep personalization possible with these technologies could permeate not just medicine but also entertainment, education, and even retail and services. Deepfakes offer the chance to be transported anywhere or any time, providing access to people and places that are either inconvenient or impossible for one to visit. Classroom teachers and museums could offer students and patrons the ability to speak with someone long deceased or to wander a city on the opposite side of the world. Deepfakes also create the opportunity for businesses to cater to each of their clients individually, employing neural networks to deliver personalized product placement and customized shopping opportunities to all.[6] These applications just scratch the surface of what experiences deepfakes could make possible.

Though the study of deepfakes is in its infancy, there is already evidence that, especially in combination with XR technologies such as VR and AR, they will revolutionize how we consume media. Though there are potential issues that accompany a technology built to deceive, we can learn to fact check deepfakes in the same way we currently evaluate the veracity of claims within texts. From entertainment, to education, to the medical field, deepfakes hold promise for making the world more accessible, more vibrant, and more enjoyable for all.

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