Editorial: Immersive Technologies in Healthcare

Salam Daher[1]*, Adrian Clark[2]* and Roghayeh Barmaki[3]*

[1]New Jersey Institute of Technology, Newark, NJ, United States, [2]School of Product Design, University of Canterbury, Christchurch, New Zealand, [3]Department of Computer & Information Sciences, University of Delaware, Newark, DE, United States

Editorial on the Research Topic

Immersive Technologies in Healthcare

Immersive technologies such as Virtual Reality, Augmented Reality, Mixed Reality, and immersive games can have a transformative impact on healthcare, both in the mental and physical (medical) domains. Examples of areas within these domains where Immersive Technologies have been shown to provide a positive impact include, but are not limited to: training healthcare providers, rehabilitation, surgery, communication, and telemedicine. This Research Topic describes advancements and discusses leading edge research in: 1) opportunities and challenges of Virtual Reality in healthcare, the effects of 2) rendering styles and 3) interaction fidelity of virtual patients, and 4) exergaming for children with autism spectrum disorder (ASD).

Interdisciplinary collaboration between computer scientists and healthcare professionals (e.g., doctors, nurses) is not uncommon during the development of healthcare simulations to improve training and applications to help patients. Involving healthcare professionals in the development of these applications is crucial for the creation of applications that are effective, usable, and accepted. Many times, healthcare professionals are either the end-users (e.g., doctors, nurses), or they know about the needs of end users (e.g., patients). In this Research Topic, Halbig et al. identify opportunities for and challenges in introducing virtual reality in healthcare, where healthcare professionals are involved in the creation of immersive technology applications.

Patient simulation involves the replication of patient characteristics and interactions to provide a safe practice environment for healthcare providers. It has been suggested that the fidelity of the simulation might impact the cognitive and clinical skills of healthcare providers interacting with the simulation (Lasater, 2007; Lee and Oh, 2015). A high level of fidelity and realism is associated with effective learning (Barry Issenberg et al., 2005) and is required by the National Council State Boards of Nursing (National Council of State Boards of Nursing and National Council of State Boards of Nursing, 2009). The closer the realism is to clinical reality, the easier it is for participants to engage in the simulation scenario (Dieckmann et al., 2007). Different aspects within these simulations have their own fidelities, including the facilities, clinical methodology, and patients. The patient aspect encompasses the representation of interactions with all or part of a patient, such as communicating with or performing a procedure on a patient, and considers the fidelity of appearance, anatomy, and physiology (Tun et al., 2015). In this Research Topic, Carnell et al. evaluate virtual patient interaction fidelity with advanced communication skills learners, and found that the level of learners affects the choice of interface.

Continuing on the topic of simulation fidelity, this Research Topic also includes the work of Stuart et al., who examined the effects of virtual human rendering style on user perceptions of visual cues. Rendering style can affect how users perceive visual cues in virtual human simulation, which can be important in healthcare settings. While rendering styles with higher fidelity are preferred for

observing subtle visual cues, especially when it comes to determining the severity of symptoms, the realism of virtual humans does not have an effect on interpersonal communication. Rendering style and complexity of information is also important for special populations such as people with ASD, as it can be a factor for learning and processing stimuli (Atherton and Cross, 2018). It has been found that people with ASD feel much more comfortable interacting in virtual environments, as opposed to the real world (Strickland, 1997).

Children with autism spectrum disorder (ASD) tend to engage in less physical activity than their typically developing peers (Srinivasan et al., 2014; Jones et al., 2017), in part due to deficits in motor function (Fournier et al., 2010) and social interaction. Further to this, children with ASD also spend more time playing video games than typically developing peers (Mazurek and Wenstrup, 2013). In their work published in this Research Topic, Graham et al. suggests that, because of this

higher-than-average engagement in video games, exergames (video games where players use their body to play) are a promising way to encourage children with ASD to remain active and participate in exercise. They present the *Liberi* exergaming system (Hernandez et al., 2013), which was specifically designed for children with neurodevelopmental disorders, and evaluate the design and efficacy of the system in a 6-weeks pilot study of children with ASD. The results indicated increasing the level of physical activity among children participants with ASD.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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