Real Reality Interfaces with Interactive Light Field Displays

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We are currently experiencing a hype cycle surrounding Virtual/Augmented Reality systems. Companies are purporting that such systems would eventually replace our desktops and smartphones, and that users would be performing everyday computing tasks with such devices. In this abstract, I argue that the very presence of a headset is the chief limiting factor in Virtual/Augmented Reality systems. Firstly, headsets currently present only a stereoscopic image of the world, when light from objects in the real world, in fact, travels in all directions, rendering an infinite number of images. As a result, users claim an uncomfortable viewing experience due to the limited ability for vergence. Secondly, particularly in Augmented Reality applications, the use of a headset requires very tight registration of head movements with the location of real world objects. Failure to do so can result in user fatigue and dizziness. Finally, the presence of a headset prevents co-present users from viewing a user's facial expressions and eye movements, making it difficult to have a normal conversation, and take turns in mixed reality settings [1]. While more light-weight headset form factors may be developed in the future, we propose that Augmented Reality take the form of light field displays that are embedded in the environment instead. Light field displays render every angle of a scene through angular pixel technologies, and have the clear advantage of being able to provide multiple co-present and remote users with different views of the same scene, or with different views altogether, without head tracking. This means a display can be situated in the environment, and its pixels re-used for different purposes, for different users. Figure 1 shows an example application of light field displays for telecommunication purposes. The TeleHuman2 system employs a large array of pico projectors angled around a cylindrical retroreflector to constitute a light field that emanates 360 degrees, displaying volumetric video of a remote user. The volumetric video is captured using a camera array that feeds images to the projector array.

Figure 1. TeleHuman2 Cylindrical Light Field Display with Hologram.

Experiments show that, without requiring any form of head tracking, such display can represent virtual objects with the same angular fidelity as physical objects that are present in the room [2]. We propose to call interactive user experiences produced with this type of hyper-realistic hologrammatic display Real Reality Interfaces.

References

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2. D. Gotsch, X. Zhang, T. Merritt, and R. Vertegaal. TeleHuman2: A Cylindrical Light Field Teleconferencing System for Life-size 3D Human Telepresence. In Proc. of ACM CHI 2018. (2018).