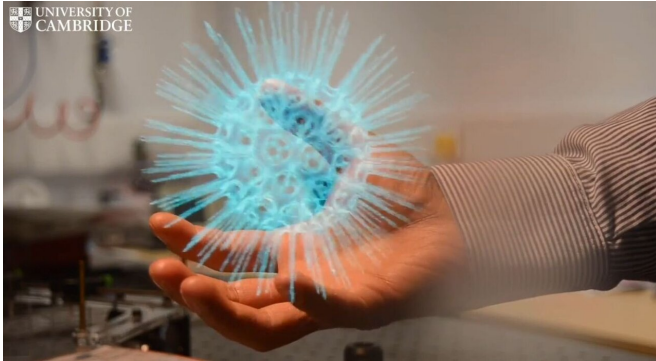


New augmented reality head mounted display offers unrivaled viewing experience

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Cambridge engineers have developed a new augmented reality (AR) head mounted display (HMD) that delivers a realistic 3-D viewing experience, without the commonly associated side effects of nausea or eyestrain.

The device has an enlarged eye-box that is scalable and an increased field of view of 36° that is designed for a comfortable viewing experience. It displays images on the retina using pixel beam scanning which ensures the image stays in focus regardless of the distance that the user is fixating on. Details are reported in the journal *Research*.

Developed by researchers at the Centre for Advanced Photonics and Electronics (CAPE) in collaboration with Huawei European Research Centre, in Munich, the HMD uses partially reflective beam splitters to form an additional "exit pupil" (a virtual opening through which light travels). This, together with narrow pixel beams that travel parallel to each other, and which do not disperse in other directions, produces a high quality image that remains unaffected by changes in eye focus.

The results of a subjective user study conducted

with more than 50 participants aged between 16 and 60 showed the 3-D effect to be "very convincing" for objects from 20 cm to 10 m; the images and videos to be of "vivid color" and [high contrast](#) with no observable pixels; and crucially, none of the participants reported any eyestrain or nausea, even after prolonged periods of usage over a few hours or even all day.

The HMD is of high brightness and suited to a wide range of indoor and outdoor uses. Further research is progressing on exploring its potential use in areas of different applications such as training, CAD (computer-aided design) development, hospitality, data manipulation, outdoor sport, defense applications and construction, as well as miniaturizing the current head mounted prototype to a glasses-based format.

Professor Daping Chu, director of the Centre for Photonic Devices and Sensors and Director of CAPE, who led the study, said: "Our research offers up a wearable AR experience that rivals the market leaders thanks to its comfortable 3-D viewing which causes no nausea or eyestrain to the user. It can deliver high quality clear images directly on the retina, even if the user is wearing glasses. This can help the user to see displayed real world and virtual objects clearly in an immersive environment, regardless of the quality of the user's vision."

More information: Pawan K. Shrestha et al. Accommodation-Free Head Mounted Display with Comfortable 3D Perception and an Enlarged Eye-box, *Research* (2019). [DOI: 10.34133/2019/9273723](#)

Provided by University of Cambridge

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