Holographic Volumetric 3D Displays

True three dimensional visualisation technologies have been fantasied and theorised about over the past half century. The scientific community and sci-fi fans know that the best way to make true 3D images is by using holographic technology. Unfortunately, holography has not lived up to expectations, which were largely driven by the realms of science-fiction fantasy following the iconic Star Wars film in 1977. While static holograms were popular for a while during the 1980s and 1990s, it soon became clear that dynamic holographic displays were "in a land far, far away." Holography went underground in the 1990s with the research performed by military contractors including Qinetiq and Zebra Imaging or high-end facilities like MIT Media Lab.

The recent proliferation of 3D content has created a demand for such displays due to the explosion of 3D data from many sources including geographical data, medical scans, computer design, simulation, low-cost depth scanners and cinema/TV. Whereas it is easy to generate 3D content, it has proven very difficult to view this content in real 3D. Conventional stereo 3D is based on glasses or 'glasses-free' lenticular arrays or parallax barriers, leading to a poor 3D experience because it is really just an illusion created by twin-2D images aimed at either eye. This is fundamentally unacceptable to the human brain and leads to all sorts of problems including dizziness and nausea. A true 3D display should have the scene or object in real space (floating in mid-air), allowing the viewer to look around objects and see them from a slightly different perspective, as they would in real life. This leads to a more comfortable and naturalistic viewing experience without all the problems of stereo 3D.

In 2007, Javid Khan, then working as a research scientist at the European Commission, realised that 3D was going to make another comeback in cinema and TV. Unsatisfied with the poor quality of stereo 3D, he decided to do something about it and started the research in his basement. The activity grew so big that he left his job, got accepted for an EngD in Photonics and sold his house to found Holoxica. The company was forged by the innovations emerging from the founder's EngD research.

Although the research community has made significant advances in recent years, the prospect of a true holographic display remains elusive. The Engineering challenge is to build a true 3D display based on holographic technology that is practical and commercially feasible. Instead of trying to create a mythical "Star Wars" display, Holoxica took a more pragmatic approach by asking "what is the simplest holographic display we can make?". The answer: a single pixel, or voxel, in 3D space, that can be switched on or off. One voxel is not particularly interesting, so we move on to two voxels and worked up from there to 4 to 9 to 16 voxels and so on.

Holoxica's first-generation holographic display demonstrator in 2010 had up to nine voxels and could show simple numeric information. The second-generation display, made earlier this year, has millions of voxels, with freeform images floating in mid-air that can change in real time. Interactivity is added with a Kinect motion sensor that allows people to 'touch' icons in space and 'draw' in mid-air. The images are bright and visible under indoor lighting conditions, and the approach is scalable, leveraging existing manufacturing techniques and high-end components.

Holographic display featured on Channel 5's "The Gadget Show", March 2013, where presenter Jason Bradbury was blown away with "... images floating in thin air in front of my face.".

Javid's is probably the most entrepreneurial EngD at the extreme end of the programme that provided Holoxica the means to survive and enabled their world-beating technology to thrive. Few doctoral thesis results have featured on national television seen by over a million people. The bottom-up technical approach to realising practical holographic displays is grounded in solid engineering reality rather than science fiction fantasy, as validated by a granted patent, publications as well as numerous awards and grants.

After decades of R&D, holographic technology is ready to re-emerge in many areas including biomedical imaging, scientific visualization, engineering design and entertainment. Holoxica's third generation holographic displays are being designed for medical imaging. Benefits include 40% faster interpretation of CT/MRI scans, 15% faster surgery and up to 20% better quality operations. These benefits are substantial and compelling. Holoxica is seeking investment and

partners to bring their holographic displays to market. The next generation is aimed at professional displays and eventually, video games. These are all substantial billion-dollar markets with huge growth potential and a large unmet need to visualise information or content in real 3D. The time is now ripe for holography to make its debut once again and claim its rightful place at the forefront of 3D technology.

Links

www.holoxica.com/demo

www.holoxica.com/gadgetshow

www.holoxica.com/holodisplay