AUGMENTED REALITY

The real, physical world is being enhanced with virtual information.
JV Chamary steps into Reality 2.0...

You're wandering around a strange city and your nannay's crumbling.
As you walk through the streets, virtual signs pop up to show directions to local restaurants and fast food outlets, complete with ratings and reviews.

This is the world of augmented reality, where virtual images are superimposed over physical surroundings to enhance your perception of the real world.

It sounds like something from a science-fiction film, but you can actually experience augmented reality (AR) today, through a smart mobile phone.

Smartphones often come equipped with a compass and GPS, which are used to detect your location and orientation. Install a mobile AR application on your phone and it will use this data to retrieve online information about places tagged with geographical coordinates matching your position. When you look at the world via the phone's camera and screen, the app overlays virtual information about nearby places of interest on top of the phone's viewpoint.

This is what allows mobile AR apps like Wildtupe and Layar to annotate the real world with virtual signs, enabling you to see everything from the nearest pub to a Beatles tour with 3D models of the band crossing Abbey Road.

"You hold up your phone and select a "layer", just like on the web when you go to a website," explains Layar co-founder Maarten Leen-FlaGerald.
The Real Thing

AR is being used to improve performance on the battlefield, in surgical operations and in the manufacturing industry.

Medicine

Surgeons are now getting "a-ray vision" through an augmented view that helps make a model of procedures more precise and less invasive. Researchers led by Prof Nadim Navab at the Technical University, Munich, have managed preparing an X-ray miniature to give them an AR view that shows both the outside and inside of a patient simultaneously. They do this by using the scalable X-ray machine commonly used in operating rooms and adding a camera and a video that is transmitted to an X-ray. Before an operation, virtual images from X-rays are registered then matched in computer vision technology which then allows the X-rays to be superimposed on a monitor in real-time during surgery.

Since this AR view, surgeons waste time by constantly comparing what they see in front of them against X-rays pinned to the wall. And because fewer X-rays need to be taken, everyone is exposed to less radiation.

Caming

The first outdoor augmented game was AR Quake, a first-person shooter (FPS) game from Bruce Thomas at the University of South Australia. By pointing your mobile phone camera at a head-mounted display, players could shoot virtual monsters jumping out from behind barrels and between crates.

Another FPS concept, Altheron, was developed by Blair MacIntyre and set a touchscreen phone. As you point the phone's screen at a lawn mower, 3D holograms you to avoid a lawn mower overgrown with zombies. You fly around town and touch the screen to avoid the undead zombies, or set off virtual bombs by placing real sweets on the 2D maps.

Industry

Overlaying graphical instructions in manufacturing and repair means that users don't need to go back and forth between physical objects and computer screens. Overall plans to give their mechanics AR glasses that show the steps and tools needed to fix a car without needing to consult a repair manual.

Aircraft manufacturer Boeing has used AR to perform complex wiring tasks that involve assembling specific cable arrangements before they're threaded through a plane. Workers wear head-mounted displays that show cables go together, based on combinations of coloured dots along each wire.

Military

Funded by the US Navy, the Battlefield Augmented Reality System (BARS) was designed to provide sailors with better situational awareness. The system uses an HMD to overlay computer-generated virtual objects on the environment, such as the position of targets. The $5-million project was led by Steven Diller (now at US Army from 1998 to 2004) but it's not known what, or even if BARS has been implemented.

AR displays have also been fitted to the windscreen of many vehicles in Iran to show the position of mobile bombs, while motion-tracking specialists Intersense offer AR helmets for helicopter pilots.

Tracking in 3D

AR was invented in 1968 by Ivan Sutherland, who superimposed virtual graphics over a head-mounted display connected to a computer. The cumbersome headset used a beam splitter (a half-silvered mirror made of glass) to allow only half the light through the display, then augmented the view with computer-generated graphics.

Similar "optical see through" systems are still used today, and we've since added "video see through", which grabs the live images from devices such as a photo's camera or a computer's webcam.

Although the technology has been used in specific applications for a decade (see "The Real Thing", right), AR has only recently entered our everyday lives, where its been quickly exploited by manufacturers and retailers who see its potential for engaging shoppers.

"AR is enabling the consumer to have an infectious, memorable experience with a brand," says Miles Perrott from Total Immersion, a company that provides AR software solutions.

The commercial sector is keen to capitalize on AR because its "wow factor" helps them make more money, admits Peyton. "We know that the larger someone holds a product, the more likely they are to purchase it. Retailers are using this technology to introduce new revenue streams."
Such discreet wearable computers will have social repercussions. For instance, mobile AR systems linked to facial recognition software could create privacy issues if you’re using it to google someone you’ve just met in real time. On the other hand, it could also make social situations less awkward for those who have trouble putting names to faces, reminding them just enough to jog a memory and kick-start a conversation.

As the technology improves, AR will also become more immersive and interactive (see ‘Mixed Reality’, p.38). At the Wearable Computer Lab at the University of South Australia, Prof Bruce Thomas has recently constructed a spatial AR environment, a room containing 40 projectors that beam virtual images onto unmarked objects.

This AR room will enable industrial designers to test different configurations for control centres in submarines, and the tech could eventually filter down to consumers, letting you see which finish would look best on your kitchen surfaces. It’s not the Star Trek holodeck just yet, but it’s not far off.

Wearable computers will also allow us to interact with virtual images without touching them directly, like the displays in the film Minority Report, where characters could control distant displays by slipping on a pair of special gloves and making gestures in the air. Pranav Mistry of the Massachusetts Institute of Technology is already doing something similar with Sixth Sense, a £250 AR interface that projects images onto a flat surface and tracks the movements of coloured dots on your fingertips to let you interact with the projected images.

With virtual sights already enriching our everyday environments – and sounds and touch on the way – it won’t be long before AR becomes so integrated that it will be indistinguishable from our physical experiences. By then we won’t be calling it ‘augmented reality’ anymore, it will just be reality.

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