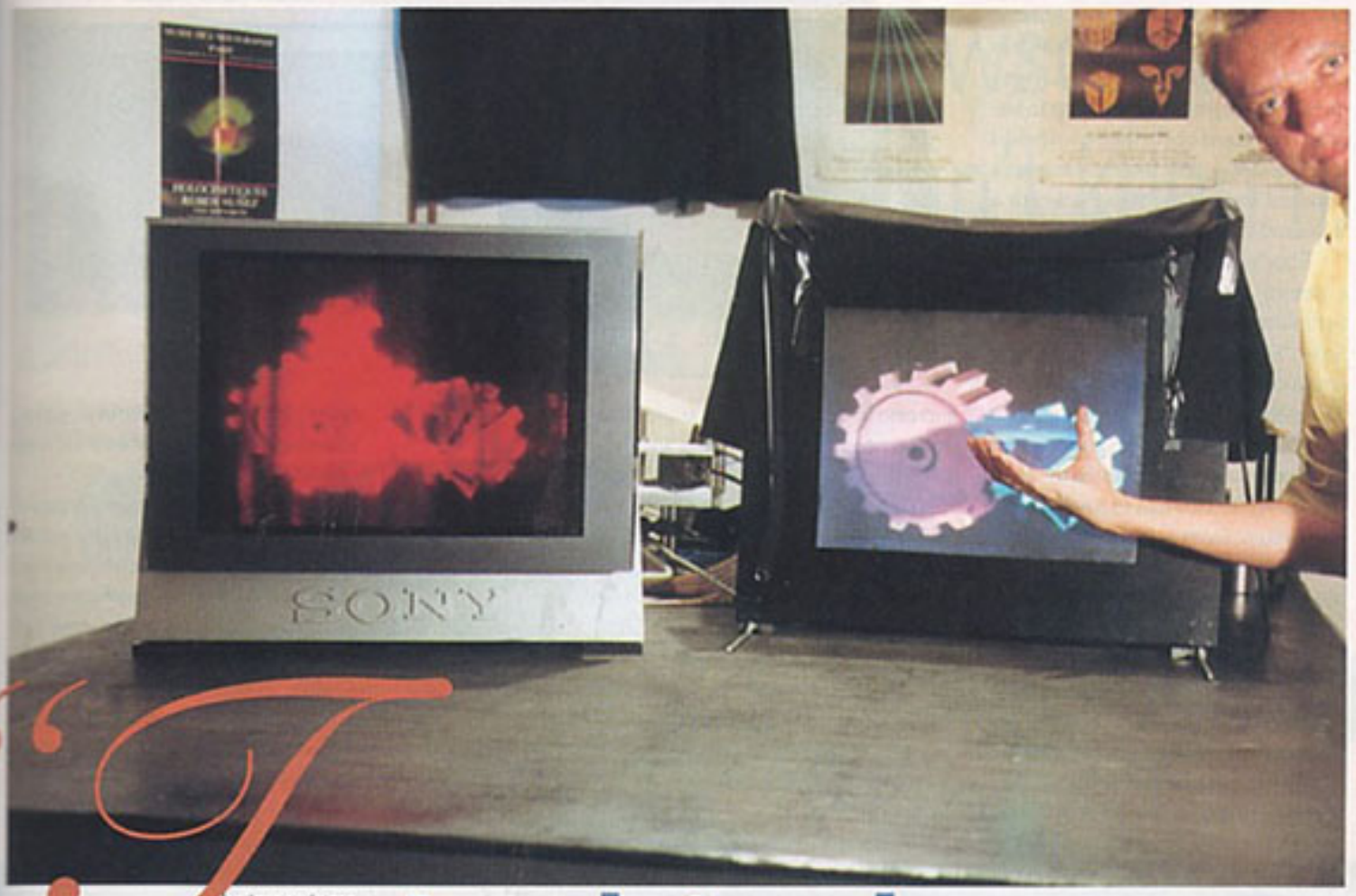


Is this the future for 3D?

Lajos Nagy *talks to the Hungarian inventor of a promising new three-dimensional TV display technology...*

A colour prototype is expected within 18 months

"The image is created on this plane," says Balogh Tibor, the driving force behind the first practical no-glasses 3DTV prototype, as he points to the front on what looks like a normal TV. "We came out with the flat screen at about the same time as Sony launched its flat Trinitron," he jokes.

The system may be a long way from a finished product, but the reference to Sony is far from fanciful, as the Japanese electronics giant is firmly backing the project in its pursuit of TV with a third dimension – the last major challenge for television technologists.

Tibor describes the screen as a universal hologram using laser light to create the image point by point according to the angle of view.

"I have been dealing with holograms since I finished university 20 years ago, and have tried all types and technologies," he says. "How to make a moving hologram has always fascinated me. The earliest attempts involved exposing a series of holograms on film one after the other, but the pictures were so tiny that you could barely see them.

"It was at the Massachusetts Institute of Technology that I saw the first holographic video. Imagine a 10x10 cm image and the university's high capacity computer counting the holograms onto the acoustic-optical crystal in real time to diffract the laser beams with mechanical synchronisation. It was immediately obvious that this was extremely complicated, and that there was no need to generate holograms in order to perceive space. Holograms contain billions of bits of information that are not needed.

"I started to think that instead of wrestling with technical concepts about what would happen to light if I were to refract it this way or that through a lenticular sheet, it would be better to take a look at how a window works. Choose a point on a window and you realise that depending on what is behind it the light patterns change."

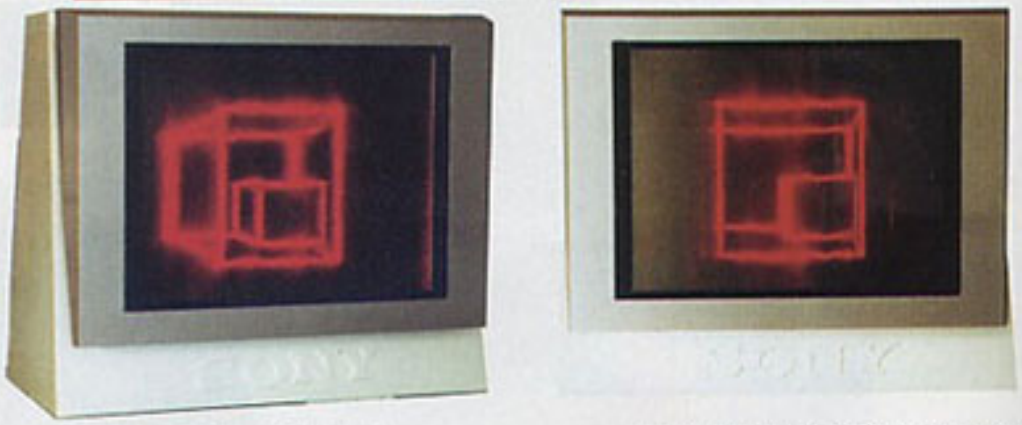
In other words, constructing a complex 3D image with light was unnecessary if a screen could deliver subtle image changes from different viewpoints. This meant creating a new type of light emitting surface, which nobody had done before. "The whole project is based on this," says Tibor.

"In the early stages I won a grant from the OMFB (National Technical Development Commission). With the help of a few pixel models, we presented the concept to Sony in 1996, and were encouraged to start up a project to prove that it could work. We told Sony that, with the technology of the day, in 15 months we could build a real 3D display where the viewer is not fixed in one place and no special glasses would be needed, but we were wrong – it took us 17 months. That was the first stage of our work.

"The first real 3D display prototype was presented in Tokyo, and I wouldn't be exaggerating to say that it had a great effect. An exclusive presentation was arranged for the decision makers.

PERSPECTIVE

The perspective of the flat panel image changes with the angle of view.



but at some point the dyke burst – everybody brought in his subordinates and the interest was amazing. Every division came, with each looking to see what they could use in their own field. I told the story – the theory – at least a hundred times. One word is worth a thousand to describe it: surprise.

Tibor's company, Holografika holds a patent covering the basic display technology, and shares others with Sony. "Even with certain compromises, approximately 50-100 times more data has to be handled for a 3D picture than for 2D," he says. "You can imagine that we need much larger and faster electronics. For this we had to develop special circuits from scratch. The entire thing is digital, based on programmable logic devices (PLD).

"These are not like normal integrated circuits, but rather the user has to install tens of thousands of gates in them. This means the IC is an empty box whose internal structure we had to determine by means of software. And there are several in the machine."

The set is the size of a normal 21in TV, but the screen is not a CRT, LCD, nor plasma – so what is it? "This is a completely solid-state piece of equipment with laser diodes, light deflecting crystals and optics inside, while the screen itself is a universal holographic optical element," says Tibor. "We call this photonic technology – not simply electronics, but a technology based on the manipulation of light."

Holografika's prototype has a 60deg optical angle, and is based on monochrome 300x200 dpi resolution – using red light – meeting the VGA standard of computer monitors. It follows the coordination of research at several organisations, including the Department of Atomic Physics at Budapest Technical University, the Hungarian Academy of Sciences Crystal Physics Research Institute and outside companies such as Linearlab.

Tibor is confident that a higher resolution widescreen prototype with twice the current screen width and in colour will be ready in a year to 18 months. The larger box will still be thinner than traditional cathode tube sets, he claims.

"It would be a mistake to think that colour is simply a matter of placing green and blue next to the present red emitters," says Tibor. "We have to be a little more creative than that. If you double the resolution that is a fourfold increase in data, and colour triples that so you need 12 times the data and processing speed. That is not an easy job."

That's why an operational system will have to use data compression. "Due to the laws of perspective, there are relationships that assist the process of 3D picture compression," says Tibor, who believes it will be possible to fit a 3D picture into the bandwidth of today's uncompressed video. There is also work going on to reconstruct a true 3D form from fewer camera pictures.

"Instead of acquiring images from several hundred possible angles we could recreate the image from only three or five cameras' pictures, for example," he says. "The system will have to be extremely fast. At the moment we're working on an algorithm that can be 'wired' into an IC – as firmware – to decode the signals in real time." Techniques for recording the 3D data are also under development, utilising existing storage devices.

Tibor is adamant that the project will continue as part of Holografika's research – even if partners change their minds or turn to other directions of research. "We have our own ideas and we want to carry them through to the end," he says.

What will be the first applications? "The project was called 3DTV from the outset, but it's first use is likely to be on computers for automotive and other design work – or for medical analysis and even air traffic control – rather than television broadcasting. It's blatantly obvious that the conservative world of television systems standards will not adapt itself to this standard in a day.

"But the transition of TV to fully digital operation is directing the water toward the wheels of our mill, because whether digital data is conveying the various elements of a three dimensional image or something else is irrelevant. But we are of course paying attention to the issue of compatibility with today's 2D systems.

Sony is firmly backing the project

BALOGH TIBOR
Inventor of the 'universal hologram'.

"It you think about the history of TV and display technology you will see that first there was low resolution black and white, then better resolution black and white, colour TV and now HD. Obviously the next step will be 3D. It's a really awe-inspiring phenomenon, which tricks the senses a bit. The image appears to have a higher resolution, and everything that links your eyes to the screen's plane disappears."

Finally I asked Tibor if he knew of other 3D systems under development. What sort of competition is the holografika project up against?

"There are many stereoscopic systems that they like to call 3D, but which require special glasses," he says. These typically use opposingly polarised filters to direct polarised left and right images to the correct eye – or LCD filters that alternately switch light to the right and the left eye in sync with a sequence of left and right images.

"There are fewer of the so-called multi-viewpoint autostereoscopic systems, which work on the similar principle as the lenticular novelties – the cartoon cards coated with a ribbed plastic lens, where simple movement is apparent when the card is rocked to and fro.

"I have only seen one or two pure 3D system like ours, but they were not as practical. One I remember involved a row of clattering mechanical mirrors; when they turned it on it sounded like a jet engine warming up.

"In all modesty I can say that ours can do more than the other solutions so far. But of course that doesn't mean others are not working on this – so we have to be on our toes." TV

Lajos Nagy is editor of Médiatechnika in Budapest.