appeared in March 2005

Tele-immersion found mirrored in nature!

Rendezvous in virtual space!

The facility of videoconferencing, where people not only hear each other's voices but also see video pictures, has not taken off as a replacement of people traveling to meet, says S.ananthanarayanan.

The trouble seems to be that in teleconferencing you see a flat picture of persons talking to the camera, but there is no eye contact, no co-coordinated movements, that make up much of real, face-to-face communication. But we are not far from realising 'tele-immersion', the creation of a 'shared virtual space' where you see not faces in a computer screen but lifelike, 'moving sculptures', sharing a life-size, 3D space.

Virtual World

The idea dates from 1968 when Ivan Sutherland, regarded as the father of computer graphics, created a 'virtual world' where participants wore a helmet with a pair of display screens, one before each eye. The separate display before each eye ensured the '3D' effect and with computers recalculating each picture at every movement of the wearer's head, the wearer was given the impression that she was in a real, stereoscopic space.

The next step was 'virtual reality, which combines 'virtual worlds' with computer networking, over distances. Here, head-mounted displays put each participant in a shared virtual space, while computers over a network reflect each participant's movements in the pictures sent to the displays.

An early product, in 1989, was RB2, or 'Reality Built for Two', which enabled the participants to see representations, known as 'avatars' of each other. The avatars of the time were simple, cartoon-like figures generated by computer graphics, but the movement transmitted did convey a sense of presence, emotion and locus of interest!

Real tele-immersion

The challenge in real tele-immersion is that each participant must have a personal representation of all views of the virtual space, two, in fact, one for each eye, and this has to be transmitted fast enough that movements of participants are in step with each other! And, moreover, the 'whole picture' needs to be sent several times a second, in contrast to RB2, where only changes of the computer graphics had to be sent.

One way of measuring the contours of real, moving human figures was with the 'sea of cameras' (1993), where the pictures seen by different cameras in a room are compared. Adding up the pictures can result in a nearly correct view from points between the cameras. This method, using 51 cameras, worked effectively in 1995, recording the movements in a room in 'virtualised reality' for replay later, but not in 'real time'.

For sending the information over distances, much of the processing needs to be done before transmission and again upon reception, so that only a 'code' need actually cross over. A number of algorithms have been developed, including the use of cameras in overlapping 'triads', and limiting the information sent to 'changes', with the computer at the receiving end reconstructing the current pictures. As the processing can readily be split into independent parts, use of parallel processors speeds up the processing.

Limited tele-immersion of nearly lifelike quality was demonstrated in May and Oct 2000 by Jaron Lanier at North Carolina.

A challenge in real-time applications is still to attain the stupendous bandwidths called for. While optical fibre cable offers the best solution, the fibres are actually not straight paths but a zigzag, as light reflects off the sides of the glass fibres. This causes a 'latency' or delay in transmitting information, which may be unacceptable.

Nature shows the way

Recent researches into the working of animal eyes suggest that the same issues are addressed and devices for economy of data gathering and transmission are used in nature.

Scientists at Univ of California at Berkley have found that animal ganglion cells, the ones that send sight signals to the brain, are divided into about 12 groups. Each group handles only one feature of the picture being scanned, maybe movement at the periphery, presence of uniform stretches, etc. Finally, just these 12 ‘sketches’ are pieced together, using some information in memory, into the remarkable detail that sight can attain.

The finding shows that with evolved ‘data compressing’ techniques the limitations of bandwidth may still be overcome to make actual physical separation imperceptible in tele-immersion meetings of the future.