REPORT 312-5

## CONSTITUTION OF A SYSTEM OF STEREOSCOPIC TELEVISION

(Study Programme 1C/11)

(1963-1966-1970-1978-1982-1990)

1. Methods of providing stereoscopic television have long been the subject of study. Projects carried out in various countries have led to production of industrial systems. However, many of the methods thus developed utilize professional equipment in closed-circuit and are not practical for public three-dimensional television. Most methods propose that the reproduced stereoscopic images be overlapped and channelled separately so each reaches the proper eye of the viewer.

The first method, based on the optical stereoscope, reproduces two small spacially separated images, one for each eye. Larger image separations require prismatic viewing devices or prismatic spectacles to produce visual registration of the two images. The prism spectacles cause annoying eye fatigue when the viewer looks away from the television images. A second method consists of two overlapping images, each produced in a different colour; and the use of similarly coloured filters to separate the two images, sometimes mounted in spectacles. Colour filtered glasses may cause psychological and physiological viewing problems and do not produce a full colour picture. A third method provides two overlapping images, polarized in different orthogonal planes, together with the use of spectacles with similarly polarized filters to separate the two images.

Several methods of separating the stereo images without the use of spectacles or viewing devices have been designed. These make use of gratings, or Fresnel or lenticular screens in association with cathode-ray receiver displays. When two stereo images are used these methods have more serious limitations as to permissible viewing positions than do methods employing spectacles. Recently, methods have been developed using multiple stereo images with lenticular-type screens which provide expanded viewing positions. Holographic three-dimensional television requires excessive bandwidth and its perfection is not expected in the immediate future.

2. The transmission of a stereoscopic television picture requires the simultaneous or successive transmission of several separate signals. Methods have been suggested for reducing the bandwidth required. This question has many aspects in common with the development and techniques used in colour television. Various solutions for reproducing the stereoscopic television picture have been envisioned. Presently, electronic image tubes are used to pick up the picture, and direct view or projection cathode-ray tubes are used to display the picture. In the near future charge-coupled matrix devices will be employed for pick-up and display. The flat matrix devices provide very accurate positioning of each picture element.

3. A practical stereoscopic television system requires:

- Orthoscopic three-dimensional display (the depth of the scene should appear natural and without viewer discomfort);
- group viewing (almost any location in the room should provide good stereoscopic viewing);
- compatibility (three-dimensional colour receivers should display a stereoscopic transmission in full depth and a two-dimensional transmission monoscopically; present two-dimensional receivers should display a stereoscopic transmission monoscopically);
- non-degraded picture (the colorimetry and resolution of a three-dimensional colour television picture should be comparable to a present two-dimensional colour picture);

- minimal modification of video standards (the industry and government specifications should not require extensive revision); and
- moderate price (the cost and complexity of converting studio and station television equipment and the cost of the stereoscopic television receiver should not be significantly greater than the conversion from monochrome to colour).

4. Three examples of proposed stereoscopic television systems, which meet some or all of the above requirements, are given below:

- stereo-pair system without spectacles using a charge-coupled matrix pick-up and a flat screen matrix display with a lenticular screen accurately positioned in accord with picture elements [CCIR, 1978-82a];
- stereo-pair system with polarized spectacles using a stereoscopic colour television camera to pick-up two images, transmission of images on two channels or with bandwidth reduction means on one channel, and display with special polarized direct view cathode-ray tube or by projection [CCIR, 1978-82b];
- multiple stereo-image system without glasses using special stereoscopic colour television camera to pick-up a panoramic sequence or continuum of stereo images, transmission of multiple images on several channels or with bandwidth reduction means on one channel, and panoramic display in a special direct view lenticular-type cathode-ray tube or by projection on a lenticular-type screen [CCIR, 1978-82b].

5. The limitation to merely two images commonly applying to stereoscopic systems (as compared to the infinite number of images perceived in normal viewing and - adapted from it - in holographic pictures) means a severe restriction in sensation which may cause irritation and/or eye fatigue if certain rules are violated in shooting stereoscopic pictures. [CCIR, 1986-90] reports results of the quality assessment of a half-hour stereoscopic television production. The system used two PAL signals recorded on magnetic tape with a system of two colour projectors. The display screen was viewed through polarizing glasses. The evaluation of the subjective assessments identifies items of concern which, if not taken into account or avoided in the composition of stereoscopic pictures, cause impaired performance. Although a variety of negative effects were encountered in the stereoscopic image composition, the overall effect is a significant enhancement to the impression of natural vision.

6. [CCIR, 1958; 1962a and b; 1963-66a and b; 1966-69; 1974-78; and 1978-82a and b] and their bibliographies, contain information on the question of stereoscopic television.

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