Poster Session I

BINOCULAR DISSOCIATION WITH INTERACTIVE GRAPHICS
ON PERSONAL COMPUTER AND STEREOVIEWER

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Abstract

Clinical evaluation of stereoacuity by binocular dissociation is a screening method to detect anomalies of binocular vision. An IBM-PC/AT system with EGA was interfaced with a stereoviewer of Nintendo family game. This system synchronized stereoviewer with two digitally generated stereo-patterns which were displayed on a color monitor alternatively. The amount of disparity in the stereo-patterns can be interactively changed and recorded through IBM-PC/AT. Besides, this system can show color pictures to each eye and also can be applied to test the binocular time separation for motor fusion.

Introduction

The methods of binocular dissociation used in clinical practice include stereoscope (such as troposcopo), vectograph (such as Titmus and Randot stereotest) and anaglyph (such as TNO stereotest). [1,2] The stereoviewer of Nintendo family game interfaced with personal computer provides another method.

Materials and Methods

IBM-PC/AT running at 12 MHz is the main controller. The interactive graphics is implemented through the EGA interface card with 256 KBytes RAM which can store up to eight 32 KBytes color pages of screen 7 supported by BASIC language. The displayed pages can be changed quickly by changing addresses &H3D4 and &H3D5.

The videoscreen and the stereoviewer were synchronized so that left eye was occluded when the pattern for right eye appeared on the screen, and vice versa. (Fig.1) The reversal rate was 30 cycles per second. It was quick enough that you felt as if you saw different pictures with your two eyes, i.e. binocular dissociation.

The input signals to the Nintendo stereoviewer include 5V, ground and another line jumping between 0V and 5V in 30 Hz. We simulated these signals from IBM-PC/AT through TTL output of commercially interface card and 7406 NOT gate. (Fig.2) The 7406 open collector gate is important since the input signals to the stereoviewer are current sensitive.

Figure 1. Flowchart of our system

Figure 2. 7406 open collector gate and where we used as input signal to Nintendo family game

The assembly program was used to detect the vertical fly-back of the monitor through address &H3DA to change the status of the viewer through bit 2 of address &H301 and to change the displayed pages through addresses &H3D4 and &H3D5.

The BASIC program under QuickBasic environment loaded different preformed patterns into the RAM of EGA card, changed the sequence of displayed pages and changed the palette of displaying colors.

Since the stereoviewer was reversed in a constant rate of 30 Hz, we changed the duration and delay for each eye to view the picture by displaying these two pictures and one blank screen (screen 7,,0) along a given sequence in an array.

Discussions

Contra to vectograph and anaglyph, both eyes never viewed the stereo-pairs simultaneously in our system. Since the page reversal was so quick, the temporal effect of vision could memorize the pictures and could even do motor fusion under this circumstances.

Vectograph and anaglyph showed only monochromatic pictures. Colored random-dot stereograms could be easily implemented in our system. The form vision through color differences and texture differences can be further investigated.

Changing the duration and delay of the pictures, both eyes dissociated temporally, we get another parameter to evaluate the ability of motor fusion.

References

- [1] Westheimer G, Mckee SP: Stereogram design for testing local stereopsis. Invest. Ophthalmol. 19:802-809, 1980
- [2] Marsh WR, Rawlings SC, Mumma JV: Evaluation of clinical stereoacuity tests. Ophthalmology 87:1265-1272, 1980

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