AD-A170 779 HIGH-RESOLUTION ANALYSIS OF EYE MOVEMENTS(U) MICHIGAN UNIV ANN ARBOR J JONIDES 15 APR 86 AFOSR-RR-86-0512 AFOSR-83-0269 1/1

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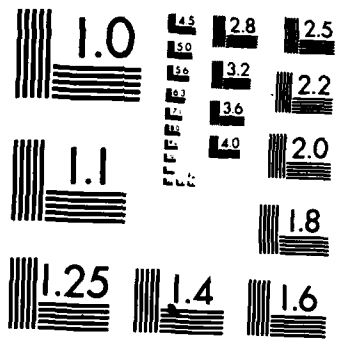

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A computerized laboratory was constructed to monitor eye movements, to present visual stimuli, and to collect and record the performance of human subjects in information processing tasks.

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AFOSR-TR- 86-0512

Final Scientific Report

Grant: AFOSR-83-0269

Title: High-Resolution Analysis of Eye Movements

Principal Investigator: John Jonides
Associate Professor
Director, Human Performance Center

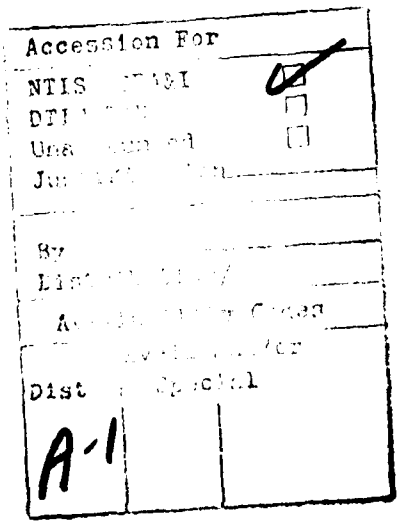
Grant Period: 6/15/83-11/15/84

Report Date: 4/15/1986

Organization: The University of Michigan
222 Research Administration
Ann Arbor, Michigan 48109

Abstract

A computerized Laboratory was constructed to monitor eye movements, to present visual stimuli, and to collect and record the performances of human subjects in information processing tasks.



Summary of Activities

During the subject grant period, a new laboratory was constructed to monitor eye movements, to present visual stimuli, and to collect and record the performances of human subjects in information processing tasks.

The laboratory space is divided into three rooms: an office, a room that houses a computer, and an Industrial Acoustics Company sound attenuating booth. The computer room houses the computer in a rack with its disk subsystems, a printer, and the computer console terminal. The computer is a Digital Equipment Corporation LSI-11/23 plus. It is equipped with the following peripherals and interfaces: a floating point processor, 640K bytes of memory, a removable cartridge hard disk sysbsystem with two disk drives totaling 15.6M bytes of storage, a floppy disk subsystem with two 8 inch floppy disk drives totaling 988K bytes of storage, 8 serial ports, one modem control port, 64 lines of digital input/output, 4 digital to analog channels, 16 analog to digital channels, and two programmable clocks.

The booth contains display and data collection equipment in addition to a seating arrangement for subjects. The data collection equipment includes an SRI International Dual Eye Purkinje Image Tracker, a mouse, a graphics tablet, and various keys and buttons to record reaction time and choice data. The Eye Tracker is interfaced to the computer through the analog to

digital converter. The mouse, a Summagraphics Summamouse, has a resolution of 100 counts per inch and is interfaced to the computer through a serial port. The tablet, a Summagraphics Bit Pad One, has an active area of 12 by 12 inches with a resolution of 200 counts per inch. It is interfaced to the computer through a serial port as well. The response keys are interfaced through the digital input/output.

There are three devices in the booth for the display of information to subjects. One is a color raster CRT, a Seiko Instruments GR-1104 color graphics terminal. Its display capacity is 1024 by 780 pixels with a density of 105 pixels per inch. It can display 8 colors from a pallet of 512 or can be configured to display any combination of three monochrome screens. It is interfaced to the computer through a serial port. The second display device is a fast phosphor, X-Y, Hewlett-Packard 1332A CRT, with a P-15 phosphor. It is interfaced via a digital to analog converter. The final device is a Photonics Technologies Plasma panel. Its display capacity is 512 by 512 with a density of 60 pixels per inch, and it is interfaced through the digital input/output. This set of interchangeable display devices permits us to tailor the device or choice to the experiment.

During experiments, subjects are seated in a modified dental chair whose height and angle of back are adjusted under motor control. The chair is positioned so that subjects can engage

themselves on a bite-bar apparatus comfortably. The Eye Tracker is positioned to subjects' right on a modified drill press stand in a way that permits the tracker to be moved out of the way for entrance and egress. The tracker's positioning also permits experimenters to adjust its parameters easily when subjects begin an experiment.

A list of the components of the laboratory that were purchased during the grant period follows:

		Cost
20	FW27 Memory Quantum 1200' magnetic computer tape [Consolidated Business]	$328.00
1	BC05W-04/JN 50 connector parallel I/0 cable [Digital Equipment Corporation]	80.00
8	H8560/JN 10 pin connector kit [Digital Equipment Corporation]	6.00
2	RL02K-DC disk cartridges [Digital Equipment Corporation]	420.00
3	LA10R-06 LA100 ribbons [Digital Equipment Corporation]	147.00
1	KDF11-BA PDP-11/23 Plus single board processor with memory management unit, two serial lines, diagnostics, boot, and program controlled line clock [Digital Equipment Corporation]	1,082.00
1	FPF11 single and double precision floating point option [Digital Equipment Corporation]	1,280.00
1	MSV11-PL 512 KB dynamic random access memory with parity [Digital Equipment Corporation]	1,280.00
1	LA100-ZA Letterprinter 100 RD terminal [Digital Equipment]	1,595.00
1	LA100 RDM Cartridge-symbols 10 [Digital Equipment]	125.00

1 00874-A Power control 120VAC 12 AMP.....447.00
[Digital Equipment]

1 Vega W/AMT H.R. #34 used Blue Ritter motor chair.....590.00
[Meek Dental Supply]

1 LA10X-AE Symbol-10 rom cart 240.....126.85
[Digital Equipment]

1 LA100-ZA YA W multiple fort opt.....1,603.00
[Digital Equipment]

1 VS-550 Graphics terminal.....1,768.00
[Loonam Computer Terminals]

1 MXV11-BF Mulitfunction option module.....832.00
[Digital Equipment]

1 MXV11-B2 Boot rom set.....80.00
[Digital Equipment]

1 AAV11-C Analog output board.....573.00
[Digital Equipment]

1 ADV11-C Analog input board.....701.00
[Digital Equipment]

1 DRV11-J 64 line parallel interface.....288.00
[Digital Equipment]

1 DLVE1-M Field install DLVE1-DP.....282.00
[Digital Equipment]

2 KWV11-C Real time clock board.....1,146.00
[Digital Equipment]

1 DLVJ1-M Field install DLVJ1-LP.....371.00
[Digital Equipment]

1 RLV22-AK RL02 w/RLV12 CRT base opt.....3,604.00
[Digital Equipment]

1 RXV21-BA Cont + dual drive 120V 60HZ.....2,241.00
[Digital Equipment]

1 BA11-SA 5 1/4 master box, Q22 120.....1,280.00
[Digital Equipment]

1 QJB56-DZ PDP-11 Op. sys. gen. lic. 11/23.....512.00
[Digital Equipment]

1 QJ013 RT-11 N/S RX02.....870.00

[Digital Equipment]

1 Shipping insurance on QJ013 RT-11 N/S RX02.....75.22

1 Transportation of QJ013 RT-11 N/S RX02.....66.29

6 BC22D-25 25' cable, ASYNC, Null 28/CB.....288.00
[Digital Equipment]

1 H9275-A Backplane/cardguide 9 x 4 Q/Q 284 B.....272.00
[Digital Equipment]

1 RL02-AK Add-on cartridge disk.....1,951.85
[Digital Equipment]

1 RL01K-DC RL01 Data cartridge.....175.00
[Digital Equipment]

1 EDCOR HA400 Headphone amplifier.....225.00
[H.Y. James Enterprises]

1 AKGK 141 Headphones.....75.00
[H.Y. James Enterprises]

1 Andor Signalman MK XII 1200 baud modem.....249.00
[Technology Partners]

1 Practical peripherals 64K serial microbuffer.....300.00
[Technology Partners]

1 64K RAM expansion for microbuffer, installed.....100.00
[Technology Partners]

29 1S25P-ND 25 pin male D plug.....71.14
[Digi-Key Corporation]

6 1S25S-ND 25 pin female D plug.....26.52
[Digi-Key Corporation]

25 HD25-ND 25 pin hood D plug.....33.75
[Digi-Key Corporation]

32 1S9P-ND 9 pin male D plug.....43.20
[Digi-Key Corporation]

48 1S9S-ND 9 pin female D plug.....85.34
[Digi-Key Corporation]

56 HD9-ND 9 pin hood D plug.....75.60
[Digi-Key Corporation]

1 1340A display module with control panel.....1,700.00

[Hewlett-Packard Company]

1 option 315 cabinet.....175.00
[Hewlett-Packard Company]

option H02 P15 phosphor.....200.00
[Hewlett-Packard Company]

1 GR1104 color raster terminal.....4,350.00
[Seiko Instruments]

1 Installation for color raster terminal.....360.00
[Seiko Instruments]

1 Extended warranty for color raster terminal.....218.00
[Seiko Instruments]

1 Pascal-2 compiler for RT-11 on RX01/RX02 floppies.....1,380.00
[Seiko Instruments]

2 3/4" x 4' x 8' nonoply.....14.16
[Fingerle Lumber Company]

1 1/2" x 4' x 8' AC plywood.....15.20
[Fingerle Lumber Company]

1 1/4" x 4' x 8' AC plywood.....9.81
[Fingerle Lumber Company]

3 2" x 4" x 7' studs.....1.06
[Fingerle Lumber Company]

12 1/2" x 1 5/8" screen molding.....3.39
[Fingerle Lumber Company]

1 125' W508-X-ND 8 cond. 22AWG shielded cable.....34.55
[Digi-Key Corporation]

1 150' W504-X-ND 4 cond. 22AWG shielded cable.....25.83
[Digi-Key Corporation]

12 P7064 130VAC zinc oxide varistors.....13.80
[Digi-Key Corporation]

1 5' R005-ND 26 cond. ribbon cable.....3.80
[Digi-Key Corporation]

1 R303-ND 20 cond. socket.....1.55
[Digi-Key Corporation]

3 LA10R-06 LA100 ribbons.....128.74
[Digital Equipment]

2 12" turntables.....11.80
[Schlenker Hardware]

6 1/4" x 3/4" x 8' strips UHMW.....44.00
[Almac Plastics]

1 Installation of 11-23 plus computer.....2,555.00
[Digital Equipment]

1 CL8187ZB drive belt.....60.00
[South Bend Lathe, Inc.]

8 8H8560-00 10 pin connector with 281 CB.....49.85
[Digital Equipment]

1 BC05W-04 50 conductor signal.....76.85
[Digital Equipment]

1 Dual Purkinje-Image Eyetracker.....54,000.00
[SRI International]

1 11 x 11 RS232 bit pad one, s/n: 52867.....745.00
[W.C. Koepf, Assoc.]

1 PS1 Std. power supply.....135.00
[W.C. Koepf, Assoc.]

1 CSR4 4-button cursor.....165.00
[W.C. Koepf, Assoc.]

1 SM-RS-PS-BP summamouse with power supply.....199.00
[W.C. Koepf, Assoc.]

1 401-04-005-5002 Rockwell-Delta drill press base.....469.00
[Monical Woodworking Machinery]

1 20-627 Rockwell-Delta drill press column.....326.65
[Monical Woodworking Machinery]

1 20-660 Rockwell-Delta drill press table.....510.15
[Monical Woodworking Machinery]

1 70-430 Rockwell-Delta drill press safety collar.....30.75
[Monical Woodworking Machinery]

1 Compiler for TR-11 host and target with floating point.....350.00
[Telecon Systems]

TOTAL.....$96,185.70

The laboratory is currently being used for the development of experimentation concerned with the integration of visual information presented across time. At present, four lines of research are in development for initiation shortly.

The first is concerned with testing the hypothesis that foveal viewing of a stimulus array provides a set of expectations for observers who then see this same array in their periphery after a saccadic eye movement is executed. The test of this hypothesis requires subjects to foveate a display, to execute a saccadic eye movement, and view a second display that may be identical with the first or different by one object, then to judge whether the second display is identical to the first. The major independent variable is the locus of the change in the display when the two displays are different as a function of the locus of the first fixation.

The second line of research further tests the hypothesis that a specialized buffer integrates information that is drawn from two fixations. The experiments in this series require subjects to view a pair of displays during different fixations and to judge whether the displays are identical or not. The major manipulation of interest in these experiments is whether the difference between displays is one of object location or identity. A second variable of concern is the time between presentation of the two displays.

The third line of work is concerned with the major influences on spatial localization. In this experiment, subjects are required to view a target during one fixation, to refixate to another portion of the display, then to judge whether the target has moved during their saccadic eye movement or not. By varying the location of the target and the location of visual landmarks in the display, we can determine the relative contributions of two mechanisms for coding spatial location: Relative locations of objects with respect to other objects, and locations of objects with respect to the locus of fixation. Thus, this line of experimentation provides us an opportunity to separate the contributions of visual and extra-visual information on localization judgments.

The final line of experimentation under development investigates whether integration of information across fixations can be assessed by determining the extent of location specific priming from information in one fixation to information in another.

While no other projects are currently making use of the new facilities, future plans call for the laboratory to be involved in experimentation concerned with planning saccadic eye movements, and with the development of automaticity in perceptual processing.

END

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