

EYE TRACKING RESEARCH & APPLICATIONS SYMPOSIUM 2000

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Table of Contents

Preface6
Sponsors7
Welcome & Keynote Addresses	
Welcome Address	
<i>Andrew T. Duchowski</i>	
Keynote Address: Four Theoretical and Practical Questions .....	.8
<i>John W. Senders</i>	
Design, Text Input, Gaze-Assisted User Interfaces	
Design Issues of iDict: A Gaze-Assisted Translation Aid .....	.9
<i>Aulikki Hyrskykari, Päivi Majaranta, Antti Aaltonen, Kari-Jouko Räihä</i>	
Text Input Methods for Eye Trackers Using Off-Screen Targets .....	.15
<i>Poika Isokoski</i>	
Effective Eye-Gaze Input Into Windows™ .....	.23
<i>Chris Lankford</i>	
Cognition, Usability	
Comparing Interfaces Based on What Users Watch and Do .....	.29
<i>Eric C. Crowe, N. Hari Narayanan</i>	
Extended Tasks Elicit Complex Eye Movement Patterns .....	.37
<i>Jeff B. Pelz, Roxanne Canosa, Jason Babcock</i>	
The Effects of A Simulated Cellular Phone Conversation on Search For Traffic Signs in an Elderly Sample .45	
<i>Charles T. Scialfa, Lisa McPhee, Geoffrey Ho</i>	
Color Plate .....	.145
Tracking Devices, Eye Movement Analysis	
High Image Rate Eye Movement Measurement	not available for publication
<i>Andrew H. Clarke, Caspar Steineke, Harald Emanuel</i>	
GazeTracker™: Software Designed to Facilitate Eye Movement Analysis .....	.51
<i>Chris Lankford</i>	
An Interactive Model-Based Environment for Eye-Movement Protocol Analysis and Visualization .....	.57
<i>Dario D. Salvucci</i>	
Eye Movement Analysis	
Analysis of Eye Tracking Movements Using FIR Median Hybrid Filters .....	.65
<i>J. Gu, M. Meng, A. Cook, M. G. Faulkner</i>	
Identifying Fixations and Saccades in Eye-Tracking Protocols .....	.71
<i>Dario D. Salvucci, Joseph H. Goldberg</i>	
Visual Fixations and Level of Attentional Processing .....	.79
<i>Boris M. Velichkovsky, Sascha M. Dornhoefer, Sebastian Pannasch, Pieter J. A. Unema</i>	

Table of Contents

Panel Discussion

“Saccade Pickers” vs. “Fixation Pickers”: The Effect of Eye Tracker Choice on Research Findings	87
<i>Keith S. Karn (moderator), George McConkie, Waldemar Rojna, Dario Salvucci, John W. Senders, Roel Vertegaal, David Wooding</i>	

Gaze-Contingent Displays, Visual Search, Visual Inspection

Binocular Eye Tracking in Virtual Reality for Inspection Training	89
<i>Andrew T. Duchowski, Vinay Shivashankaraiah, Tim Rawls, Anand K. Gramopadhye, Brian J. Melloy, Barbara Kanki</i>	
Color Plate	146
User Performance With Gaze Contingent Displays	97
<i>Lester C. Loschky, George W. McConkie</i>	
Evaluating Variable Resolution Displays with Visual Search: Task Performance and Eye Movements	105
<i>Derrick Parkhurst, Eugenio Culurciello, Ernst Niebur</i>	

Posters and Demonstrations

“GazeToTalk”00: A Nonverbal Interface with Meta-Communication Facility	111
<i>Tetsuro Chino, Kazuhiro Fukui, Kaoru Suzuki</i>	
Using Eye Tracking to Investigate Graphical Elements for Normally Sighted and Low Vision Users	112
<i>Julie A. Jacko, Armando B. Barreto, Ingrid U. Scott, Josey Y. M. Chu, Holly S. Bausch, Gottlieb J. Marmet, Robert H. Rosa Jr.</i>	
Eye-Movement-Contingent Release of Speech and “SEE”-Multi-Modalities Eye Tracking System	113
<i>Weimin Liu</i>	
What Eye-movements tell us about Ratios and Spatial Proportions	115
<i>Catherine Sophian, Martha E. Crosby</i>	
Technical aspects in the recording of scanpath eye movements	116
<i>Daniela Zambarbieri, Stefano Ramat, Carlo Robino</i>	

Pupillary Response, Hand-Eye Coordination

Hand Eye Coordination Patterns in Target Selection	117
<i>Barton A. Smith, Janet Ho, Wendy Ark, Shumin Zhai</i>	
Color Plate	147
Pupillary Responses to Emotionally Provocative Stimuli	123
<i>Timo Partala, Maria Jokiniemi, Veikko Surakka</i>	
The Response of Eye-movement and Pupil Size to Audio Instruction While Viewing a Moving Target	131
<i>Koji Takahashi, Minoru Nakayama, Yasutaka Shimizu</i>	
Conference Committee	139
Cover Image Credits	141
Author Index	142
Color Plate Section	143

EFFECTIVE EYE-GAZE INPUT INTO WINDOWS™

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ABSTRACT

The Eye-gaze Response Interface Computer Aid (ERICA) is a computer system developed at the University of Virginia that tracks eye movement. To allow true integration into the Windows environment, an effective methodology for performing the full range of mouse actions and for typing with the eye needed to be constructed. With the methods described in this paper, individuals can reliably perform all actions of the mouse and the keyboard with their eye.

Keywords

Eye-gaze, disabled, mouse clicking, typing, windows.

1. INTRODUCTION

The Eye-gaze Response Interface Computer Aid (ERICA) is a computer that tracks eye movement. The system noninvasively tracks where a user is looking by monitoring the user's eye movements through a camera mounted underneath the computer monitor. ERICA was originally developed to assist the disabled by providing them with a means to communicate. The device has helped numerous disabled individuals since its inception in 1983. ERICA recently moved to the Windows platform. The mouse cursor now points to where the user is looking on the screen. To fully take advantage of the capabilities Windows has to offer, a method to click and to type with the eye needed to be incorporated into the graphical user interface (GUI).

2. GAZE CLICKING

To develop a successful "eye-mouse," the system needed to possess some means of performing mouse actions with the eye. The two obvious methods were either with a blink or by using eye fixations (calculating how long the eye dwells at a particular region).

Blinking seemed like a particularly noisy methodology. Detecting a blink seemed difficult, and since people blink involuntarily every several seconds, the mechanism would have to work with a

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prolonged blink. Thus, using fixations seemed more reliable.

2.1 Dwell Time Gaze Clicking

The system uses dwell time to provide the user with access to various mouse clicking actions. When the user fixates (focuses at a point on the screen and keeps the mouse cursor stationary) for a predetermined amount of time on the computer display, a red rectangle appears, centered on the point of fixation. This rectangle begins collapsing in on itself. The rectangle serves as a visual cue to the user that if they keep fixating at that point, then they will perform a mouse control action at the point. The rectangle will turn to a blue circle halfway through its collapse and then continue collapsing. If the user looks away while the blue circle is collapsing, then they will start dragging what they were fixating on. If the user prolongs their fixation and allows the circle to reach the end of its collapse, then the system clicks once on where they were looking. Lastly, a green rectangle will appear, and after a predetermined fixation time, the system will double click on where the user is fixating. Figure 1 shows the different stages of collapse.

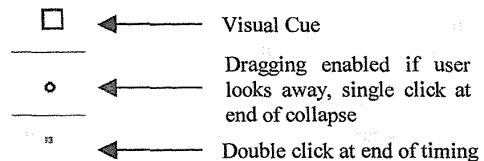


Figure 1. Gaze Clicking Collapse Stages. The rectangle migrates through various stages of collapse to signal the mouse action it will perform.

If the user knows they are going to be only using certain actions, like left button single clicking, then the other mouse actions may be disabled. For example, if dragging and double clicking are disabled, then the visual cue is simply a red collapsing rectangle that single clicks where the user is fixating when the rectangle reaches the end of its collapse. This is often used in children's games, where the only mouse action really needed is single clicking with the left mouse button. Also, children may have difficulty understanding the meaning of the collapse in the beginning, so disabling the multiple collapse modes facilitates teaching them to use the system.

The system may use an alternative method for clicking instead of the dwell time. If the operator still has some use of their hands,

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