
Eye Tracking Methodology in Screen-based Usability Testing

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ABSTRACT

Eye tracking is an important tool in usability testing of a screen-based user interface. Though eye tracking has been used in usability testing for quite a while, challenges remain. For example, how to accurately calibrate gaze point? How to interpret a scan pattern? In this tutorial, we will introduce the basics of the human oculomotor system, the role of eye tracking in cognition, eye tracking recording techniques, and data analysis methods. Upon the completion of this tutorial, students will have a basic understanding of physiological and psychological mechanisms underlying eye tracking, data collection techniques, and data analysis methods.

CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)** → **HCI design and evaluation methods** → **Usability testing**

KEYWORDS

Usability; Usability Testing; Eye Tracking; Eye Movement; Saccades; Gaze

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1 INTRODUCTION

Eye tracking is an important tool in usability testing of a screen-based user interface. Though eye tracking has been used in usability testing for quite a while, challenges remain. For example, how to accurately calibrate gaze point? How to interpret a scan pattern? This situation suggests a need for education of basic eye tracking knowledge and techniques in the usability community. In this tutorial, we will introduce the students to the basics of the human oculomotor system, the role of eye tracking in cognition [1], eye tracking recording techniques, and data analysis methods. Upon the completion of this tutorial, students will have a basic understanding of physiological and psychological mechanisms underlying eye tracking, data collection techniques, and data analysis methods.

The intended audiences are user experience researchers and practitioners with beginning or intermediate level of experience in user testing or user research. No specific prerequisites are required, though some experience in eye tracking recording is preferred.

2 MODULE 1: HUMAN OCULOMOTOR SYSTEM

In this module, we will review the neural pathways of visual information processing including light sensation, image perception, and motor-action. The neuronal mechanism of saccadic eye movements will be discussed in detail.

3 MODULE 2: VISUAL ATTENTION AND EYE TRACKING

In this module, we will discuss the concept of attention, particularly visual attention. We will then explore the association between visual attention and eye tracking [2]. The concepts of gaze and gaze shift will be introduced.

4 MODULE 3: EYE TRACKING DATA COLLECTION

In this module, we will describe a generic workflow of eye tracking recording. We will also teach the student how to carry out a calibration procedure, and how to deal with head movements. Practical skills will be demonstrated.

5 MODULE 4: DATA ANALYSIS

In this module, we will teach the student data abstraction methods such as how a saccade latency is abstracted from a raw dataset, and statistical methods for analyzing the abstracted data. We will also demonstrate various data visualization approaches such as a gaze plot and heat map, and discuss pros and cons of different approaches.

6 MODULE 5: CASE STUDY

In this module, we will use a real-world example to conduct a usability evaluation incorporating eye tracking, as an instructor-led classroom exercise to help the students to review what they have learnt in the previous modules. The case study will start with developing an evaluation plan, followed by data collection, data analysis, and an evaluation report. We will demonstrate in this case study how eye tracking data are used along with other performance measures.

7 INSTRUCTOR BACKGROUND

Dr. Lin Wang is a Research Psychologist with a range of expertise including human performance analysis, eye tracking research, data analytics, healthcare research, and information technology. In his human factors research, Dr. Wang's interest has been centered on information processing in persons with normal and impaired vision. He has more than 30 years of experiences in eye tracking research using three major methods: Infra-red pupil-center/corneal-reflection technology, electro-oculography, and scleral search coil technology. Dr. Wang has conducted a variety of human performance and usability evaluation studies including air traffic controller vigilance, prosthetic vision, online survey instruments, data dissemination websites, and mobile-device-based web applications; and published about 20 peer-reviewed research articles. He is currently serving as the leader of the Human Factors Research Group at the U.S. Census Bureau.

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