

## Chapter 7

# Flashlight as a Process Tracing Method

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### ABSTRACT

*Flashlight is an open source process-tracing tool that records mouse movements in real time during an information search task (Schulte-Mecklenbeck, Murphy & Hutzler, 2011). Using this tool, acquisition behavior and visual attention can be recorded in an unobtrusive way with a wide variety of different stimuli. Because of the structure of the stimuli in Flashlight, information acquisition behavior can be measured similarly to how eye tracking works, but unlike eye tracking systems, Flashlight can be implemented without any special equipment. The motivation for developing a new process-tracing tool comes from experience with existing process tracing methods and their limitations. Other existing process tracing tools restrict the structure of information (often in a rigid matrix similar to an information board); require a fixed and confided laboratory setup; and need specialized hardware and software that is both expensive to purchase and operate. Flashlight solves these issues by providing a free open source adaptable software package that can work via a Web browser on any Internet connected personal computer. Moreover, the researcher has great flexibility in how stimuli are constructed and presented, and Flashlight also enables easy access to a large number of participants through Internet based experiments.*

### INTRODUCTION

Process tracing, i.e., collecting multiple data points instead of just looking at one response from a participant, is a data collection approach that includes a diverse set of different methods like thinking aloud protocols, eye-tracking or mouse-tracking (Schulte-Mecklenbeck, Kühberger, &

Ranyard, 2011). A bundle of methods is available today, ranging from collecting verbal utterances of participants in thinking aloud protocols to the recording of eye or mouse movements in information board studies. When developing Flashlight, an online attention tracking software, we had in mind that 1) eye-tracking is cost intensive, 2) information boards (matrix setup of information as

DOI: 10.4018/978-1-4666-0315-8.ch007

can be found on comparison websites) offer only limited means of presenting information and 3) researchers should be able to adapt the code to their specific needs at any time. With our software it is possible to overcome the above mentioned issues.

## BACKGROUND

The collection of process data has seen a growing interest in recent years. In a review of scientific journal articles on process tracing tools in decision making research, Schulte-Mecklenbeck, et al., (2011) found a steady increase in this literature in a large variety of methods during the last 30 years. Methods like information boards (Payne, 1976; Todd, & Benbasat, 1987; Willemsen & Johnson, 2011), eye-tracking (Reeder, Pirolli, & Card, 2001; Cutrell, & Guan, 2007; Buscher, Dumais, & Cutrell, 2010; Russo, 2011), active information search (Huber, Huber, & Schulte-Mecklenbeck, 2011) or log file analysis (Tauscher & Greenberg, 1997) have been used to investigate a) psychological processes in information acquisition, b) questions in human computer interaction with computer programs or websites or c) usability issues in interface design (Schulte-Mecklenbeck, Kühberger, & Ranyard, 2011).

The development of Flashlight has been motivated by these methods and has the following aims: (1) we want broad flexibility in the type of stimuli presented to participants (e.g., overcome the common rigid matrix setup of stimuli), (2) we aim for a cost-effective method, at best free of charge, (3) we want to record multiple participants in parallel to minimize experimental trial time and cost, (4) we want data collection within the laboratory as well as online, and (5) we want to enable other researchers to use and modify our code (open-source availability) according to their needs and innovations.

## METHODS THAT RECORD PROCESS DATA

A considerable number of process tracing tools have been discussed in the literature. In what follows we will introduce different tools that collect data in the laboratory or over the Internet and which had conceptual influence on how Flashlight was developed.

**Eye tracking.** The observation of eye movements in psychological research has a long history. Rayner (1998) provides an excellent overview over the historical and technical development as well as the basic characteristics of eye movements. In contrast to the rather laborious recording of eye movements in earlier days (e.g., Javal, 1878), the technical advances in recent years have resulted in ready-to-use, computer-based eye trackers with relatively low technical demand to the end user. While there are a variety of different methods to measure eye-movements, recording corneal reflection (video based eye-trackers) is the most common method used today (Duchowski, 2002). High performance eye-trackers record observations often over 1000 times a second and thus deliver data at resolutions of over 1000Hz. This resolution allows for the measure of both rapid micromovements (i.e., saccades), as well as fixations (i.e., resting of the gaze on a single location) with high precision.

**MouseTracker** (Freeman & Ambady, 2010) records mouse movements produced by participants while they are confronted with visual or auditory stimuli. The purpose of the program is to track trajectories of mouse movements while categorizing stimuli into different classes. Discrepancies between an initial categorization and the final response are shown in deviations from a linear movement of the mouse to one of the response alternatives. MouseTracker comes with a straightforward setup tool, a data recording program, and a package for analyzing and exporting collected data. The validity of the approach has been shown in several publications mainly

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