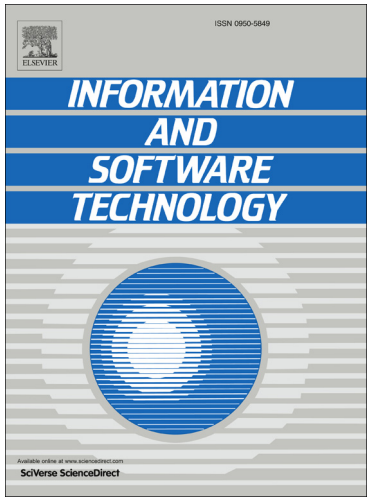

A Systematic Literature Review on the Usage of Eye-tracking in Software Engineering

Zohreh Sharafi, Zéphyrin Soh, Yann-Gaël Guéhéneuc

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A Systematic Literature Review on the Usage of Eye-tracking in Software Engineering

Zohreh Sharafi[a,**], Zéphyrin Soh[a,*], Yann-Gaël Guéhéneuc[a,*]

[a] *Ptidej Team, Département de Génie Informatique et Génie Logiciel, Polytechnique Montréal, Québec, Canada*

Abstract

Context. Eye-tracking is a mean to collect evidence regarding some participants' cognitive processes. Eye-trackers monitor participants' visual attention by collecting eye-movement data. These data are useful to get insights into participants' cognitive processes during reasoning tasks.
Objective. The Evidence-based Software Engineering (EBSE) paradigm has been proposed in 2004 and, since then, has been used to provide detailed insights regarding different topics in software engineering research and practice. Systematic Literature Reviews (SLR) are also useful in the context of EBSE by bringing together all existing evidence of research and results about a particular topic. This SLR evaluates the current state of the art of using eye-trackers in software engineering and provides evidence on the uses and contributions of eye-trackers to empirical studies in software engineering.
Method. We perform a SLR covering eye-tracking studies in software engineering published from 1990 up to the end of 2014. To search all recognised resources, instead of applying manual search, we perform an extensive automated search using Engineering Village. We identify 36 relevant publications, including nine journal papers, two workshop papers, and 25 conference papers.
Results. The software engineering community started using eye-trackers in the 1990's and they have become increasingly recognised as useful tools to conduct empirical studies from 2006. We observe that researchers use eye-trackers to study model comprehension, code comprehension, debugging, collaborative interaction, and traceability. Moreover, we find that studies use different metrics based on eye-movement data to obtain quantitative measures. We also report the limitations of current eye-tracking technology, which threaten the validity of previous studies, along with suggestions to mitigate these limitations.
Conclusion. However, not withstanding these limitations and threats, we conclude that the advent of new eye-trackers makes the use of these tools easier and less obtrusive and that the software engineering community could benefit more from this technology.

Keywords: Eye-tracking, Software engineering, Experiment
2015 MSC: 00-01, 99-00

1. Introduction

The evidence-based paradigm was first employed in 1992 in clinical medicine to integrate "the best research evidence with clinical expertise and patient values" [16]. Kitchenham *et al.* [13] were the first researchers to adapt the evidence-based paradigm in software engineering in 2004 and called it "Evidence-based Software Engineering" (EBSE). Since then, EBSE has been used to provide insights on different topics in software engineering research and practice. Performing Systematic Literature Reviews (SLR) is recognized as the main approach to realize EBSE with the goal of bringing together all existing evidence on a topic and providing evidence-based guidelines to push froward that topic [14].

In cognitive psychology, researchers have traditionally used eye-trackers to study information processing tasks [40]. Eye-trackers are also increas-

*Corresponding author
**Principal corresponding author
Email addresses: zohreh.sharafi@polymtl.ca (Zohreh Sharafi), zephyrin.soh@polymtl.ca (Zéphyrin Soh), yann-gael.gueheneuc@polymtl.ca (Yann-Gaël Guéhéneuc)