CLW 2014: The Fourth Workshop on Cognitive Load and In-Vehicle Human-Machine Interaction

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Abstract

Interactions with in-vehicle electronic devices can interfere with the primary task of driving and increase crash risk. Interactions with in-vehicle interfaces draw upon visual, manipulative and cognitive resources, with this workshop focusing on cognitive resources for which measurement processes are less well known or established. This workshop will focus on two methods of measuring cognitive load, the Decision Response Time Task and collecting eye fixation data. The workshop will describe and demonstrate how they are collected, and discuss how the resulting data are reduced and analyzed. The focus will be on practical aspects of collecting and analyzing data using these methods, not on reporting research results.

Categories and Subject Descriptors

H.5.2 Information interfaces and presentation: User Interfaces. H.5.1 Multimedia information systems.

General Terms

Design, Experimentation, Human Factors, Measurement.

Keywords

Cognitive load, estimation, management, driving.

INTRODUCTION

In-vehicle human-machine interaction (HMI) can interfere with the primary task of driving. The concept of cognitive load can help us understand the extent to which these interactions interfere with the driving task and how this interference can be mitigated. Research has progressed to the point at which the process for collecting measurements for the estimation of cognitive load (but not analyzing them) has been standardized (such as [1]). The purpose of this workshop, the fourth in the series [2, 3, 4], is to get at the details of two measures, most likely Decision Response Time (DRT) and eye glance measures, though others may be considered. Each measure will be considered separately.

WORKSHOP GOALS

The workshop has three goals:

1. **Describe how a few measures of cognitive load are collected and describe the likely advantages and disadvantages of the measurements, problems with their use and solutions that they provide in enhancing understanding**: For each measure, there will be one or possibly two invited papers that will provide an overview of each measure selected. The presentation will describe current standard data collection procedures for each measure including subject selection, IRB issues, training, practice, and data logging. The presenter should go beyond recounting standard protocol, describing the practical issues they have experienced with each measure. The focus is on the method.

2. **Demonstrate how they are collected**: Those attending the meeting are invited to bring hardware and software to demonstrate the measures in question. This includes DRT and eye fixation hardware and software, as well as a driving simulator or driving video game to show how the data are collected.

3. **Describe how the data from those measures are reduced and analyzed**: To some extent, this will involve summarizing existing practice codified in standards. However, we are looking for presenters to go beyond what is in those documents, describing practical problems of filtering and cleaning up the data, censoring, rules for eliminating outliers, methods of quantifying lost data, identifying potential confounding factors and situations that arise with the use of a measure can bias interpretations of results and software that can help produce results. This should not be viewed as an opportunity to present a paper describing results.

The workshop organizers will bring together a number of experts from government, industry, and/or academia to address the above topics. In addition, position papers on these topics will also be solicited. In contrast to prior workshops on the topic of cognitive load, this workshop will focus on two particular methods, DRT and eye glance measures, though that could be changed to other measures depending on submissions. However, the focus will be on measures that are or will be standardized, and discussions in detail about practical issues.

WORKSHOP ORGANIZATION
Before the Workshop
PROGRAM COMMITTEE RECRUITMENT

The program committee will be recruited from the extensive list of academic and industry contacts of the organizers, in the HCI, speech, ubiquitous computing, and human factors and ergonomics communities. We will primarily target our colleagues who were part of the PC in 2011, 2012, and 2013.

The workshop will be publicized using a dedicated website hosted by the University of New Hampshire. The Call for Papers will be distributed via the following channels:

- ACM CHI mailing list,
- Ubicomp mailing list,
- WikiCFP,
- HFES Surface Transportation Technical Group Newsletter,
- Driving Assessment conference email list,
- Contacts of program committee members in their fields.

PAPER SUBMISSION, REVIEW AND SELECTION

We will invite papers by experts on the two measures of cognitive load. We will work with the authors on any necessary edits and improvements.

Position papers will be submitted and reviewed using the EasyChair conference management system [5]. This will allow for online paper submission and simple management of reviewer assignments and feedback. The organizers will make the final paper selection based on reviewer recommendations. Note that EasyChair is a free service hosted by the University of Manchester CS Department; therefore no funding will have to be secured for its operation.

FINAL PRE-WORKSHOP ACTIVITIES

The list of accepted papers will be posted on the workshop website in early September. The organizers will create a mailing list to distribute accepted papers to workshop participants prior to the workshop.

Participants will also be encouraged to use the mailing list to initiate interactions before the workshop.

Homework

Prior to the workshop, we will post either the standards describing the methods to be described or, if there are copyright issues, summaries of them. Attendees will be expected to read those papers before attending the workshop. This is intended to make the level of prior knowledge of these more uniform and facilitate discussion.

During the Workshop

SESSIONS

The workshop will start with an introduction by Chris Monk, Human Factors Division Chief at the National Highway Traffic Safety Administration. This introduction will be followed by three sessions:

Session 1: DRT – The detection response task (DRT) is undergoing final balloting as part of an ISO WG 8 standardization activity. The task requites a driver to respond with a figure switch to the illumination of a red LED (mounted in front of the driver eyes, i.e. head mounted or remote) or the vibration of a tactile sensor (mounted on the drivers left shoulder). Response times are considered a measure of spare attentional capacity. Presentations will provide practical insight into the effective utilization of this measure in accordance with the proposed standard. Insight on compliant experimental procedures, data reduction and analysis techniques will be discussed as will the benefits and drawbacks of utilizing different forms of the task in various experimental setups. The advantages and disadvantages of utilizing the DRT as a measure of cognitive load will be summarized.

Session 2: Eye Glance Measures – Measures of gaze concentration and percent road center (PRC) have become a popular method of gauging cognitive load. However, little consensus appears in the best method for computing these measures. For instance PRC can provide an effective measure of cognitive demand when comparing epochs of varying time length, however in fixed intervals of time the standard deviation of horizontal gaze points may provide more sensitivity. Measure of either form requires the use of eye tracking equipment, which often necessitates filtering prior to analysis. This session will focus on discussing various methods of computing each measure and the relative advantages and disadvantages. A detailed review of how various assumptions in the implementation of filtering approaches can influence data will be considered.

Session 3: Poster session presenting contributed papers.

Feedback
As in 2011, 2012, and 2013, at the end of the workshop organizers will solicit feedback from participants in anonymous written form. Participants will be asked to evaluate the relevance and ultimate value of the workshop using responses on a Likert scale. Suggestions for improvements will also be solicited.

After the Workshop
ONLINE REPORT
Based on the notes taken during the workshop, the organizers will create journal article summarizing some of the practical issues that seem to be common and solutions to them. If not appropriate for a journal, then a proceedings paper will be written.

WORKSHOP AT AUTOMOTIVEUI 2015?
Assuming that participant feedback indicates that the workshop was successful, the organizers will contact participants for suggestions for a workshop to be held at AutomotiveUI 2015.

ACKNOWLEDGMENTS

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[1] ISO 17488, Road Vehicles - Transport information and control systems - Detection Response Task: (New Work Item for ISO TC 22 SC13 WG8). International Standards Organization, Geneva, Switzerland, 2013 draft

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[5] EasyChair Conference Management System, http://www.easychair.org/