The role of visual feedback in graphical user interfaces

Investigator

François Guimbretière
A. V. Williams Building,
University of Maryland,
College Park, MD, 20742,
Tel: (301) 405 7952
email: francois@cs.umd.edu.

Abstract:

The current evaluation methods for Human Computer Interactions (HCI) techniques (such as menu selection techniques, document navigation techniques, or information visualization techniques) focus mostly on timing of simple tasks. While very effective to rapidly identify the fastest technique, this approach often provides little insight about the reason of a particular difference. This limitation makes it difficult to conduct a systematic exploration of the design space and impedes the rapid development of the field.
In this project we are proposing to complement the traditional timing methods with eye-movement recording to capture users' fixations points as they interact with the computer. We believe that this information will help us understand better users' strategies while dealing with complex interactions such as selecting a command with a cascading menu, navigating through a complex tree visualization display, and dealing with visual distraction on the screen.

Participant Selection:

a) During this project, we will recruit adult volunteers from UMD with average computer knowledge (from computer science or other departments). While we are uncertain about the exact number of studies to be run during this project, we are expecting up to 6 studies a year, with each study requiring anywhere from 12 to 48 participants. Participants will be enlisted either by announcements in class or flyers (example attached). Depending on our grant rules, subject will received either $20 dollars for their participation or no financial compensation (I attached a consent form for both cases).

b) & c) No specific characteristics (e.g., gender, age, etc.) are required of the participants.

Participants whose informed consent has not been obtained will be excluded from the study.

Procedures:

The participants will first sign a consent form (sample attached), before receiving a brief demonstration of the interface being tested. Once the demonstration is completed, they will proceed with a training session during which they will familiarize themselves with the interface under study, before conducting the experiment proper.

This interface might consist in one of the following:

- An office class application (such a drawing application, a word processor, or a spreadsheet application) used by the participant to perform common tasks such as drawing, editing a document, or reading a long document. These tasks will be carried out using a variety of interaction techniques under test.
- Information visualization application (such as large tree or large graph visualization tools) used by the participant to identify a particular feature of the dataset under study. For example, the participant might be asked to find and highlight differences between two graphs presented on the screen.

In all applications, participants will be interacting with a standard desktop (or tablet computer) by using a mouse, a pen or both. Both the mouse and the pen might provide tactile feedback using a small vibrator attached to the device (similar to the commercially available Logitech iFeel mouse). For measurement accuracy, they might be asked to repeat a similar task several times. Participant might elect to stop performing the task at anytime they want.

At the end of the study, participants will fill out a questionnaire, which will cover background information (such as computer usage, previous knowledge of the technique used, etc) as well as questions about the interface they just used (sample attached). The study will take less than 90 minutes, including the training and filling-up the questionnaires. General comments about the interfaces will also be collected.

Eye movements will be recorded using a light-weight ISCAN eye-tracking visor. (ISCAN ETL-500, see attached documentation). The participants wear a small headset that holds a small instrument in front of the eyes so that participants can move their heads freely.

This eye-movement recording system records the movements of the eyes virtually continuously (60 times per second), by directing an Infra-red beam of light into a mirror, which reflects toward the participants left eye. The intensity of the beam is low enough to ensure that no damage is done to the participant's eye. The beam that illuminates the eye, through the mirror, is in infrared class A (IR-A) with a wavelength of 940 manometers. The U.S. Army's safety norm for this wavelength allows a maximum continuous retinal irradiation of 10^{-1} Watts per square centimeter. The maximum corneal irradiation that is accepted in the scientific literature is even lower (10^{-2} W/cm^2). The beam used in these experiments limits the retinal irradiation to 10^{-4} W/cm^2 and the corneal irradiation is limited to 10^{-3} W/cm^2. So, there is no risk to the participants.

Individual consent forms are attached to this application indicating the specific characteristics of the task and the eye-tracking device.

Risks and Benefits:

There are minimal risks involved in this project. The infrared light used in the eye tracking equipment has an intensity equivalent to the level occurring outdoor in a normal sunny day. The experiment requires less than one hour and a half of voluntary computer usage similar to the participants' normal computer activities. There is no risk of stress for the participants. Participants can rest during the experiment or terminate it if they wish to do so.

By capturing the direction of the participant gaze during their interaction we believe that we will be able to understand better why some interaction (or visualization) techniques

are faster than others. This knowledge will help developing better human computer interaction in the future.

Confidentiality:

While the identity of participants will be recorded, findings will be reported in a recoded form respecting the anonymity of participants. Results will be presented as aggregate statistics for a group. Individual traces of eyes and cursor movements used for illustration purpose will never be matched to participants. All records will be placed in the investigator office which is locked at all time.

Information and Consent Forms:

Participants will be informed about the purpose of the research. The consent form (sample attached) will be presented and signed before the experiment starts. The procedures will be explained before the experiment and participants will be able to ask all the questions they want either before or after the experiment.

The role of visual feedback in graphical user interfaces

Informed consent form

DESCRIPTION: You are invited to participate in a research study on the role of visual feedback in graphical user interfaces.

PROCEDURE: You will be asked to perform common computer tasks (such as performing simple commands, navigating within a document, or using a data visualization tool to find the difference between two datasets). During the experiment you will wear a light-weight eye-tracking headset. The headset holds a small infrared light source, a small camera and a half-transparent mirror in from of your eyes to track the direction of your gaze. This head set will not interfere with your sight nor touch your eye.

During the session, audio/video taping may take place. Your interactions with the computer will be logged for analysis purposes. This information will not be disclosed to others and the data will be discarded after the study is over.

RISKS AND BENEFITS: There are minimal risks associated with this study due to the infrared light: while the maximum power level recommended by the scientific literature for infrared illumination of the cornea is 10^{-2} W/cm^2, the system we are using is limited to 10^{-4} W/cm^2. This level corresponds to the level naturally occurring outdoor in sunny day.

The benefits that may reasonably be expected to result from this study are better human computer interaction techniques as well as better information visualization techniques.

TIME INVOLVEMENT: Your participation in this experiment will take approximately one and a half hours.

PAYMENTS: You will receive a $20 payment for your participation.

PARTICIPANT'S RIGHTS: If you have read this form and have decided to participate in this project, please understand that your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. You have the right to refuse to answer particular questions, but you may ask questions. Your individual privacy will be maintained in all published and written data resulting from the study. If you have questions about your rights as a study participant, are dissatisfied at any time with any aspect of this study, or wish to report a research-related injury, please contact - anonymously, if you wish - Institutional Review Board Office, 2100 Lee Building, University of Maryland, College Park, MD 20742 USA (e-mail: irb@deans.umd.edu, telephone: 301-405-4212).

I state that I am over 18 years of age, in good physical health, and wish to participate in a program of research being conducted by François Guimbretière at the University of Maryland, College Park (Tel: (301) 405 7952, email: francois@cs.umd.edu).

I give consent to be audio/videotaped during this study:
(please initial): __ Yes __ No

I give consent for tapes resulting from this study to be shown at scientific meetings:
(please initial): __ Yes __ No

The extra copy of this consent form is for you to keep.

SIGNATURE _____ DATE _____

Name (PRINT) _____YourID_____

Approval Date: Expiration Date:

The role of visual feedback in graphical user interfaces (Draft)

Your ID ..... Age.....Gender.....Date:.....

Background information

1 For how long have you been using a computer?

- ○ less than a year
- ○ about one to five years
- ○ about five to ten years
- ○ more than ten years

Comment? .....

.....

.....

2 How long do you think that you use a computer each week?

- ○ only one hour or less (10 - 60 minutes)
- ○ about a days work for each week (1 - 8 hours)
- ○ more than a days work (8 - 30 hours)
- ○ all week, every day (more than 30 hours)

Comment? .....

.....

.....

3 Have you use technique <name of the technique here> in the past?

Never ○ ○ ○ ○ ○ ○ ○ **All the time**

Comment? .....

.....

.....

4 Have you used two-handed interaction techniques in the past?

Never ○ ○ ○ ○ ○ ○ ○ **All the time**

Comment? .....

.....

.....

Navigation technique A

5 How did you like using technique A?

Not at all ○ ○ ○ ○ ○ ○ ○ **Very much**

Comment? .....

.....

.....

6 How fast was technique A?

Very slow ○ ○ ○ ○ ○ ○ ○ **Very fast**

Comment? .....

.....

.....

7 How error prone was technique A?

Not at all ○ ○ ○ ○ ○ ○ ○ **Very much**

Comment? .....

.....

.....

8 How comfortable was technique A?

Not at all ○ ○ ○ ○ ○ ○ ○ **Very much**

Comment? .....

.....

.....

Example of flyer (Draft)

The department of Computer Science at the University of Maryland, College Park is recruiting participants to study the role of visual feedback in graphic user interfaces. The study involves doing everyday office activities on a computer, and filling up some questionnaires about your personal background. All of your answers will be kept completely confidential.

Eligible participants receive **$20** as payment for about 60-90 minutes of their time.

If you would like to help us by participating in this research, please call
(301) 405 7952 or send an email to francois@cs.umd.edu

Please pass this message on to anyone you believe would be interested in participating.