

# Graphical User Interface Performance Description

Ben Bederson

## **Abstract:**

Graphical User Interfaces (GUIs) on computers are used by a wide variety of people for a wide variety of tasks on a wide variety of platforms. Our research goal is to understand how people use GUIs, how well they use them, and what the best designs to support users are. For each specific problem, we design a few similar GUIs where we modify one design element, and then we evaluate how people perform using the comparable GUIs. We measure performance speed and accuracy as well as subjective preference through interviews and questionnaires. We also track precisely how people use the interface by automatically capturing their hand motion in real-time using, for example, the trace of the mouse path as the hand moves the mouse. By this careful investigative approach, we can develop a better understanding of what design elements of GUIs are most effective, and what their trade-offs are.

## **Subject 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 120 subjects. Subjects will be enlisted either by announcements in class or flyers (example attached). Subjects will receive either \$0 or \$10 dollars or snack for their participation.

b) Children between the ages of 6 and 12 will be recruited from a local school to participate. No computer experience, sex or other selection criteria will be used to recruit the children. We are still negotiating with schools and do not yet know which school(s) we will work with. In addition to following UMD IRB rules, we will also follow whatever rules are required by the schools we work with. Children will be selected by their teachers and will not be financially compensated. In order to participate in the study, each child must check a box and write their name in the attached assent form. In addition, each child's parent must sign an attached parental permission form before the child can participate in the study.

## **Procedures:**

The subjects will first sign a consent form (or assent form if they are a child), 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.

This interface might consist of one of the following:

- An office domain application (such as a drawing application, a word processor, or a spreadsheet application) used by the subject 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 subject to identify a particular feature of the dataset under study. For example, the subject might be asked to find and highlight differences between two graphs presented on the screen.
- Information retrieval application (such as digital library or search interface) used by the subject to look for information.

Subjects will be interacting with a standard desktop, laptop, tablet or PDA computer by using a mouse, a pen, their fingers (on a touch screen) or a combination. For measurement accuracy, they might be asked to repeat a similar task several times. The software will be instrumented to record hand motion, mouse clicks, and all other interaction with the software.

Subjects may be asked to use a single GUI design or multiple designs within a single session. Subjects may also be asked to return within a short period (1-2 weeks) so we can test more designs or to see how a design works upon repeated use. In this case, we will record a unique number with their recorded data to correlate the multiple sessions. This unique number will be written with their names on paper during the study for the sole purpose of being able to re-enter the subject ID on their return. After their final participation, the paper that holds the correlation between the subject's name and ID will be destroyed.

During the study, subjects may be asked to describe what they think about the interface as they use it.

At the end of the study, subjects will fill out a questionnaire or will be interviewed. The queries 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 60 minutes (less than 30 minutes for children), including the training and questionnaires or interviews. General comments about the interfaces will also be collected.

The subjects can choose to stop performing the tasks at anytime they want, and in the case of a study with multiple sessions, they can choose to not return for a follow-up session.

### **Risks and Benefits:**

There are minimal risks involved in this project. All equipment to be used is standard commercial off-the-shelf equipment. All interfaces are typical of current freely available systems. The experiment requires less than one hour of voluntary computer usage similar

to the subjects' normal computer activities. There is no risk of stress for the subjects. Subjects can rest during the experiment or terminate it if they wish to do so.

**Confidentiality:**

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

**Information, Consent, Assent, and Parental Permission Forms:**

Subjects will be informed about the purpose of the research. For adults, a consent form will be presented and signed before the experiment starts. For children, a parental permission form will be signed before the children are contacted, and then the children will be given an assent form before the experiment starts. The procedures will be explained before the experiment and subjects will be able to ask all the questions they want either before or after the experiment.



# Graphical User Interface Performance Questionnaire (Draft)

Age..... Sex..... Date:.....

## Background information

1 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 use a computer each week?

- one hour or less (0 - 60 minutes)
- about a day's work per week (1 - 8 hours)
- more than a days work (8 - 30 hours)
- all day, every week(more than 30 hours)

Comment?.....

## Design A

3 How did you like using design A?

Not at all    ↓    ↓    ↓    ↓    ↓    ↓    ↓    Very much

Comment?.....

4 How fast was design A?

Very slow    ↓    ↓    ↓    ↓    ↓    ↓    ↓    Very fast

Comment?.....

5 How error prone was design A?

Not at all    ↓    ↓    ↓    ↓    ↓    ↓    ↓    Very much

Comment?.....

6 How comfortable was design 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 subjects to study the performance of computer Graphical User Interfaces. The study involves doing everyday office activities on a computer, and answering some questions about your background and experience using the interfaces. All of your answers will be kept completely confidential.

Eligible subjects receive **\$10** as payment for less than 60 minutes of their time.

If you would like to help us by participating in this research, please call (301) 405-2764 or send an email to [bederson@cs.umd.edu](mailto:bederson@cs.umd.edu)

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

# Graphical User Interface Performance

## Informed Consent Form

**DESCRIPTION:** You are invited to participate in a research study on the performance of different designs within graphical user interfaces.

**PROCEDURE:** You will be asked to perform common computer tasks (such as performing simple commands, navigating within a document, or looking for information). 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 no known risks associated with participation in this study. 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. This research is not designed to benefit you personally.

**TIME INVOLVEMENT:** Your participation in this experiment should take no longer than one hour.

**PAYMENTS:** You will receive no payment for your participation.

**SUBJECT'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, and you may ask any question you wish. 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 subject, 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 - the Institutional Review Board Office, 2100 Lee Building, University of Maryland, College Park, MD 20742 USA (e-mail: [irb@deans.umd.edu](mailto:irb@deans.umd.edu), telephone: 301-405-0678).

I state that I am over 18 years of age and wish to participate in a program of research being conducted by Benjamin Bederson at the University of Maryland, College Park (Tel: (301) 405-2764, email: [bederson@cs.umd.edu](mailto:bederson@cs.umd.edu)).

I give consent to be videotaped during this study:  
(please initial): \_\_ Yes \_\_ No

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

Consent for use of the videotapes by the investigators, or consent for videotapes to be shown at scientific meetings can be withdrawn at any time in the future by contacting the investigator.

SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

Name (PRINT) \_\_\_\_\_

Approval Date:

Expiration Date:

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**TIME INVOLVEMENT:** Your participation in this experiment should take no longer than one hour.

**PAYMENTS:** You will receive \$10 payment for your participation.

**SUBJECT'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, and you may ask any question you wish. 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 subject, 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 - the Institutional Review Board Office, 2100 Lee Building, University of Maryland, College Park, MD 20742 USA (e-mail: [irb@deans.umd.edu](mailto:irb@deans.umd.edu), telephone: 301-405-0678).

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Name (PRINT) \_\_\_\_\_

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**RISKS AND BENEFITS:** There are no known risks associated with participation in this study. 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. This research is not designed to benefit you personally.

**TIME INVOLVEMENT:** Your participation in this experiment should take no longer than one hour.

**PAYMENTS:** You will receive a small snack and drink for your participation.

**SUBJECT'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, and you may ask any question you wish. 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 subject, 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 - the Institutional Review Board Office, 2100 Lee Building, University of Maryland, College Park, MD 20742 USA (e-mail: [irb@deans.umd.edu](mailto:irb@deans.umd.edu), telephone: 301-405-0678).

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I give consent to be videotaped during this study:  
(please initial): \_\_ Yes \_\_ No

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

Consent for use of the videotapes by the investigators, or consent for videotapes to be shown at scientific meetings can be withdrawn at any time in the future by contacting the investigator.

SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

Name (PRINT) \_\_\_\_\_

Approval Date:

Expiration Date:

# Graphical User Interface Performance

## Parental Permission Form

**DESCRIPTION:** Your child is invited to participate in a research study on the performance of different designs within graphical user interfaces.

**PROCEDURE:** Your child will be asked to perform common computer tasks (such as performing simple commands, navigating within a document, or looking for information). Your child's 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 no known risks associated with participation in this study. The benefits that may reasonably be expected to result from this study are better designs of computer programs that your child can use for educational or entertainment purposes. This research is not designed to benefit your child personally.

**TIME INVOLVEMENT:** Your child's participation in this experiment should take no longer than 30 minutes.

**PAYMENTS:** Your child will receive no financial compensation for participation in this study.

**SUBJECT'S RIGHTS:** If you have read this form and have decided that your child can participate in this project, please understand that their participation is voluntary and your child has the right to withdraw consent or discontinue participation at any time without penalty. Your child has the right to refuse to answer particular questions, and may ask any question they wish. Their individual privacy will be maintained in all published and written data resulting from the study. If you have questions about your child's rights as a study subject, 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 - the Institutional Review Board Office, 2100 Lee Building, University of Maryland, College Park, MD 20742 USA (e-mail: [irb@deans.umd.edu](mailto:irb@deans.umd.edu), telephone: 301-405-0678).

I state that I am over 18 years of age, and wish my child to participate in a program of research being conducted by Benjamin Bederson at the University of Maryland, College Park (Tel: (301) 405-2764, email: [bederson@cs.umd.edu](mailto:bederson@cs.umd.edu)).

CHILD's Name \_\_\_\_\_

PARENT SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

PARENT NAME (PRINT) \_\_\_\_\_

Approval Date:

Expiration Date:

# Computer Program Performance

## Assent Form

**DESCRIPTION:** You can help us understand how well these programs work.

**PROCEDURE:** You will be asked to use a computer program to do common things (such as doing simple commands, moving within a document, or looking for things). We will keep track of your interactions with the computer.

**RISKS AND BENEFITS:** This study will be very similar to using other common computer software. As such, there are no known risks associated with this study. By joining us, you can help us design better computer programs.

**TIME INVOLVEMENT:** This will take less than half an hour.

**PAYMENTS:** You will not receive anything for helping us.

**SUBJECT'S RIGHTS:** You may change your mind at any time and stop working with us, or you can ask any questions you like. You also can choose to not do any task if you wish. If you have problems of any kind, please let your parent or teacher know.

Check this box if you agree to participate

Name (PRINT) \_\_\_\_\_

DATE \_\_\_\_\_

If the subject can not read, then this assent form was read to the child and the child understands its contents:

INVESTIGATOR \_\_\_\_\_

DATE \_\_\_\_\_

Approval Date:

Expiration Date: