Assignment 2
CSC 3461 3.0 User Interfaces, Winter 2008

Faculty of Science and Engineering

York University

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Due: Friday, 14 February 2008, electronic submission by 11:59pm.
Format: Individual (not groups)

A Target-Hitting Experiment

Suppose we consider the task of hitting a target on the screen with the mouse. Intuitively, it would seem that the farther away the target is from the mouse's initial position, the longer the amount of time required to reach it with the mouse and hit it.

The goal of this assignment is to test this hypothesis.

This assignment will require you to develop a software application to gather data, to run a small experiment with 3 different users, and to analyze the data.

The Experimental Setup

The experimental setup consists of the user facing an specially-developed GUI application. The application appears initially as follows: a start button and a 500x500 empty "target field" (a empty field within which the target will appear).

When the subject presses the "start" button with the mouse, a circle appears in the target space. The subject's goal is to hit the circle with the mouse as fast as possible. The circle disappears only if the user successfully clicks on it. If the user fails to hit the target, he or she must keep trying until the circle is hit. When the circle is hit, the current trial is completed. The target space is empty until the subject presses the start button again. The user must complete 20 trials.

The subject is instructed in advance about the task and should be given three practice runs.

It is your choice about where to position the start button relative to the target space. It is your choice about the size and shape of the start button. It is your choice about other attributes of the application.

It is your choice about the position(s) of the target circle. When designing this aspect of the application, consider the goal of the analysis that is described below.

Name your application `DataGatheringApp`.

You may use the services of the class `TargetField` for the creation the target space and for making the target circle appear and disappear. See the API for details.

Data Collection

We define the initial point at which the subject presses the start button to be $\sigma = (x_1, y_1)$ and the point inside the circle that the user hits to be the point $\tau = (x_2, y_2)$. Similarly, we define the point in time at which σ is hit to be t_σ and at which τ is hit to be t_τ.

Develop an application that implements the behaviour described above. In addition, the application should produce an output file. The file should contain one line per trial. Each line should be tab-delimited and should contain: the subject id, the trial number, the values t_σ and t_τ; the points σ and τ; the number of times the user missed the target; time-to-hit-target; and distance-to-target

The name of the output file should contain a subject identifier. For example: `dataSet-subject1`, `dataSet-subject2`, `dataSet-subject3`.

Ask three people to perform the task as specified above.

Thoroughly test your application before moving on to data collection.

Do not fabricate the data. This is a breach of the Senate Policy on Academic Honesty.

Analysis

Suppose we hypothesize that the time to hit a target is not correlated to the distance of the target. This is the converse of what we hope to prove (aka the null hypothesis). How would you go about proving or disproving the null hypothesis?

Prepare a graph to illustrate the relationship between the time-to-hit-target and distance-to-target data.

What is the mean time-to-hit target and distance-to-hit target overall and per subject?

Determine whether the value $t_\tau - t_\sigma$ is correlated to the distance $d(\sigma, \tau) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. Find a statistical procedure to provide an answer to this question, to the degree that is possible given the number of data points.

Find at least one other interesting thing about your data.

The Assignment

1. Design and implement the application `DataGatheringApp` as described above. Do not change the class `TargetField` in any way whatsoever; when your application is graded, it will be recompiled with the standard version of this classes.

   Submit (electronically): The application `DataGatheringApp` and any other needed classes (hint: use the MVC design pattern).

2. Collect the data as described above.

   Submit the three files `dataSet-subject1`, `dataSet-subject2`, `dataSet-subject3`

3. Prepare a written analysis that answers the questions above. Include the graph in the report. Describe your conclusion about the initial hypothesis. The report should be maximum 2 pages long (the minimum allowable font size is 11pt, the minimum margins are 0.5 inch). Call this report `Report.doc` or `Report.pdf` (as the case may be). Include your name and student number in the report.

   It is a violation of Academic Honesty to represent another persons ideas, writing or other intellectual property as one's own.

To Submit Electronically: Files may be submitted from your Prism lab account, using the `submit` command. For documentation, see `man submit`. Use `submit 3461 a2 <file>`.

Grading Scheme

A. Design and Implementation of Application	50%
B. Data Collection and Analysis	50%

- The two assignments components (A and B) will each be assigned a letter grade. A weighted average will be calculated using mapping in the course syllabus and then mapped back to a letter grade. See the course web page for more information about the letter grades.

- An elegant implementation, good design, and good coding style are expected. The code should be readable, properly indented, and adequately commented.

- The presentation of the report and scatterplots is important (including formatting and writing style). Use a spelling checker. Have someone proof read your writing.