CS4249 Phenomena and Theories of HCI
Assignment 2: Fitts Law, GOMS, KLM, and CogTool

This assignment is due on
Monday, 27 October 2014, 11:59 pm (Week 11)

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<td>Analyse and design user interface</td>
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<td>Compare user interfaces and propose improvements</td>
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Work on Section 1 yourself first.

Then, find a partner by Wednesday, 15 October 2014 to work on Sections 2 and 3.

Purpose
Understand and apply the various models (Fitts Law, GOMS, KLM) you learned into analysing user interfaces.

Overview
In this assignment, you will refer to two simple web applications that determine the award level based on a user’s total score in the recently revised Individual Physical Proficiency Test (IPPT)\(^1\).

What you will do is to analyse a similar task in both user interfaces using KLM. Then, model and compare the results with the UI prototyping tool CogTool.

You will then design a new feature on either user interface. When you are done, perform an analysis on the interface you have designed with the GOMS model and CogTool (which is based on KLM), and compare your interface with the one designed by your partner.

Using the result of your analysis, both of you will produce an improved user interface for the web application and present it to the class by the end of this assignment.

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\(^1\) The Individual Physical Proficiency Test (IPPT) is a standard physical fitness test in Singapore. It is applicable to people who have National Service liability.
Section 1: Analysing and Designing User Interface (15%)

Individual deliverables
1. CogTool file of the task you have modelled for both interfaces
   MatriculationID_FullName_CogTool_A_and_B.cg
2. PowerPoint slides (or other interactive format) and CogTool file of your UI mock-up for a new feature (quality will be considered in grading)
   MatriculationID_FullName_Mockup.pptx
   MatriculationID_FullName_CogTool_New_Feature.cg
3. Your report
   MatriculationID_FullName_Individual_Report.docx

Imagine that you are a professional UI designer. Your job is to critic two IPPT score calculators. Both of these web applications allow users to enter their raw score for each test station and see the resulting award level based on the total score.

![Interface A](http://ippt.yctay.com)
IPPT Calculator and Scorer

![Interface B](http://dezhang.sg/ippt/)
New IPPT Score Calculator
You are also provided with the scoring system and tables to understand how the calculations are done.

<table>
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<tr>
<th>Fitness Award</th>
<th>Total Points Required</th>
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<tbody>
<tr>
<td>Pass</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>60 (for incentive)</td>
</tr>
<tr>
<td>Silver</td>
<td>70</td>
</tr>
<tr>
<td>Gold</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>85 (for commandos/divers/guards)</td>
</tr>
</tbody>
</table>

Analyse the task of entering the scores to determine the award. You will need to refer to the steps and operators listed in KLM to complete your analysis. Assume that this is done on a non-mobile web browser.

Next, use CogTool to set up the task of entering the scores for both interfaces. You will need to import your screenshots from the first frame to the last frame, for both interfaces. Record the completion time predicted by CogTool for both interfaces. Compare the design.

In addition, add a new feature, which will be explained in a moment, in either Interface A or Interface B. You may do this with PowerPoint or other interactive tools that you are familiar with. Then, use CogTool to analyse the interface with the new feature.

This feature would automatically suggest the minimum score for each test station (or permutation of minimum scores, depending on your design) to achieve the user’s desired award. The user may also change the scores to fit his/her goal realistically but will not be allowed to change the scores such that the total falls below the goal. For example, if the user’s goal is Silver, the user will know that he/she needs to achieve 40 sit-ups, 30 push-ups and complete 2.4 kilometres in 11:10 minutes (and maybe change to 41 sit-ups, 32 push-ups and 11:30 minutes to still achieve Silver).

Finally, give a detailed report of not more than 8 pages in the following format.

1. **Cover Page.** Include your name, matriculation number and a meaningful title of the assignment.

2. **KLM Analysis (6%) [up to 3 pages].** Based on the operation defined by Kieras in 1993, calculate the time needed to accomplish entering the station scores for each interface above **without** using CogTool and delineate the steps in a numbered list. Include the actual numbers of all the parameters (A and W) of all the steps you used to calculate the cursor movement time using Fitts Law, and the formula you use to come up with the predictions. Justify your choices properly.

3. **Task Modelling with CogTool (3%) [up to 1 page].** Set up and compute the task of entering the station scores in CogTool for each interface.

4. **Design Rational (3%) [up to 2 pages].** Describe briefly the design process of your UI mock-up of the new feature. You should report what you actually did during the design process, and the justifications behind the design.

5. **Analysis (3%) [up to 2 pages].** Reflect on the lessons learned in the design and analysis process. Describe how CogTool has helped you to compare the two interfaces and how the answers from CogTool are different from the answers you manually calculated. Try to explain the difference.
Predicting movement time using Fitts Law
To estimate the total cursor movement time, you need to interact with the interface from the starting screen until the finishing screen (this may include multiple steps).

To calculate movement time, you can use one of the 3 formulas (Fitts, Welford, Shannon) as part of your analysis.

- Note that since you do not know the “a” and “b” values in the Fitts Law formula, you can simply use them as constants in your answer. For example, given the value of Index of Difficulty (ID) as 2.5, your answer may be Total Time = a + 2.5b. (Or, you can use the value a= -0.1, and b = 0.2 for mouse. These values are based on an experiment conducted by Scott Mackenzie.)
- Assume the cursor is at centre of the screen when it starts. You can pick a screen resolution you are comfortable with (as long as it is higher than 800 * 600).
- Assume scrolling a scrollbar also follows the Fitts Law
- Please list the detailed steps of how you arrive at your conclusion

Index of Difficulty (ID) in Fitts Law represents the difficulty of a point-and-click interaction task, usually done with a mouse. ID of such tasks can be calculated with the equation (based on Fitts formulation),

\[ ID = \log_2\left(\frac{2A}{W}\right) \]

where A is the distance from the cursor to centre of the target, and W is the width of the target that is parallel to the movement of the cursor.

Two variations of this equation are also used. The first variation is “Welford” formulation.

\[ ID = \log_2\left(\frac{A}{W} + \frac{1}{2}\right) \]

The second variation is known as “Shannon” formulation, and can be written as

\[ ID = \log_2\left(\frac{A}{W} + 1\right) \]
Section 2: Compare User Interfaces and Propose Improvements (5%)

Group deliverables
1. Executable version of the refined UI mock-up
   GroupID_FullName1_FullName2_Improved_Mockup.pptx
2. Group CogTool file of the refined UI design
   GroupID_FullName1_FullName2_CogTool_Improved_Mockup.cgt
3. Group report
   GroupID_FullName1_FullName2_Group_Report.docx

Compare the task completion time of the new feature in your UI mock-up with your partner’s UI mock-up using CogTool. Propose potential improvements to the UI with better completion time. Implement the improvements in an interactive mock-up and import screenshots of that design into CogTool to perform another round of completion time in comparison with the two individual UIs done by you and your partner. You may use any technology you are familiar with to create the mock-ups.

Grades for your individual work in section 1 will not be affected by the outcome of the comparison.

Answer the following questions in the group report within 4 pages.

1. **Cover Page.** Include your group number, matriculation number, names and a meaningful title of the assignment.

2. **Design Improvements (4%) [up to 4 pages].** List the improvements you have made to the UI and explain why they could improve the task performance based on your analysis. This score of this part also includes the CogTool modelling and comparison you have done to compare the two UI mock-ups of the new feature.

3. **Answer the following question in one or two paragraphs (1%).** CogTool’s prediction of the task completion time is predicated on the assumption that the users are familiar with the software (a.k.a expert users). Would the same completion time be achievable with new or novice users? Explain your answers.
Section 3: Group presentation (5%)

Group deliverables
1. Zipped folder with the following files from Sections 1 and 2
   
   GroupID_FullName1_FullName2_Assignment2.zip
   - MatriculationID_FullName1_Mockup.pptx
   - MatriculationID_FullName2_Mockup.pptx
   - MatriculationID_FullName1_Individual_Report.docx
   - MatriculationID_FullName2_Individual_Report.docx
   - MatriculationID_FullName1_CogTool_A_and_B.cgt
   - MatriculationID_FullName2_CogTool_A_and_B.cgt
   - MatriculationID_FullName1_CogTool_New_Feature.cgt
   - MatriculationID_FullName2_CogTool_New_Feature.cgt
   - GroupID_FullName1_FullName2_Improved_Mockup.pptx
   - GroupID_FullName1_FullName2_CogTool_Improved_Mockup.cgt
   - GroupID_FullName1_FullName2_Group_Report.docx
2. 6-minute presentation delivery (with 1-minute Q&A)
   
   GroupID_FullName1_FullName2_Final_Presentation.pptx

Both of you should include the following sections in the presentation:

1. Introduce the individual UI mock-ups of the new feature and the design justifications.
2. Provide a demo for both individual mock-ups.
3. Present the CogTool comparison results.
4. Introduce the improved UI and the rationale behind the changes.
5. Present the CogTool results of the improved UI.
6. Share what you have learned during the course of this assignment.