DIS1 WS 19/20 Assignment 1

Predicting Human Performance using Fitts' Law

Due: Monday, October 21, **09:00 am**

Description

In this assignment, you will learn how to apply Fitts' law to improve a given user interface (UI). The goals of this assignment are to help you

1) gain experience in applying Fitts' law to UIs and
2) develop an in-depth understanding of Fitts' law by evaluating and redesigning UIs

Background

Fitts' law is a model of human motor behavior derived from Shannon's Theorem, a fundamental theorem in communications theory. Fitts' law was a breakthrough since it modeled the human nervous system as a communication channel in which information (in *bits*) is transmitted while carrying out a movement task. Fitts' law is one of the most robust, highly cited, and widely adopted models to result from experimental psychology.

Tasks

In this assignment, you will solve **three** tasks based on **Adobe Photoshop**'s user interface. Adobe Photoshop is a raster graphic design application that is used to create graphs, illustrations, and the like. The tool palette is placed on the left edge of the screen as shown in Fig. 1. Assume that there are no operating system related menu or task bars on the screen. For the following tasks, please provide your solutions in the submission format explained at the end of this document. Include measurement units when necessary.

1. Apply Fitts' law to compute **movement time** for the following tasks.
   a. Consider the following scenario in which the user wants to fill a circle using Adobe Photoshop. The mouse cursor is at starting position **S**. The user first selects the fill tool **F** and then clicks inside the circle **C** to fill the circle. Calculate the movement time (**MT**) for this task by applying **Shannon's formulation** of Fitts' law. Each button in the tool palette is **4 cm** wide and **3 cm** high; the black rectangle around each button represents the clickable area. Assume that the axis of movement from S to F passes through the diagonal of the fill button. The user uses a standard computer mouse as an input device that has the following device parameters: **a** = 0 *ms* and **b** = 100 *ms/bit*.
   b. If the user uses her fingers instead of a mouse, the device parameters change to **a** = 100 *ms* and **b** = 50 *ms/bit*. Does the movement time increase or decrease as a result of this? **Hint**: You need not compute the exact movement time.
2. Redesign the tool palette such that the average time for *selecting* any tool would be minimized. Include a sketch of your redesign, and shortly describe how the redesign would minimize the selection time by using argument(s) based on Fitts' law. **Note**: You cannot change the number of tools in the palette or the shape or size of each button.

Left edge of
the screen

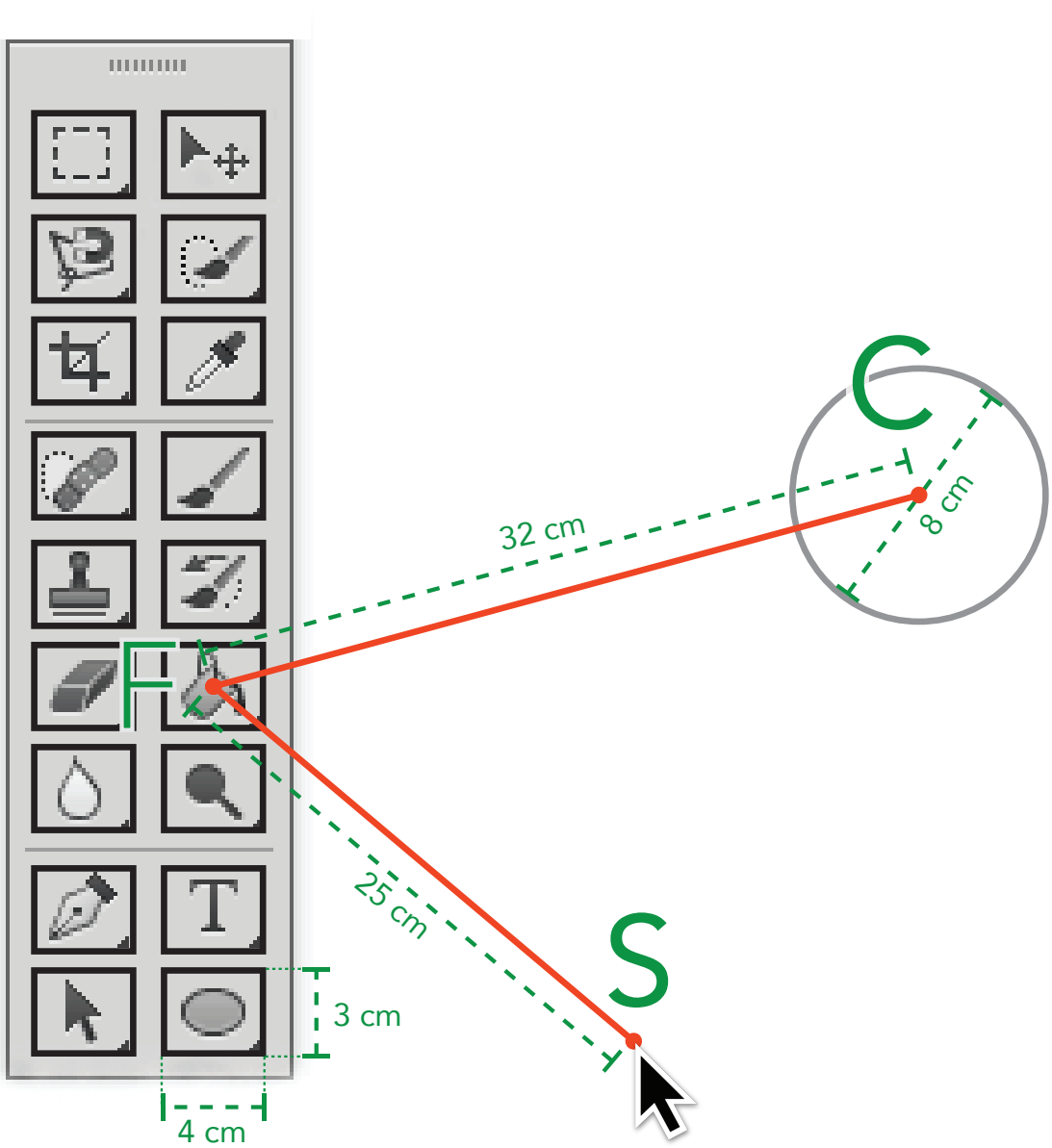

Figure 1: UI of Adobe Photoshop. The user's task is to select the fill tool **F** and click anywhere in the circle **C** to fill it.

3. Krishna redesigns the tool palette by placing the buttons farther away from each other (Fig. 2, right). Oliver comes up with another design by placing the buttons closer to each other (Fig. 2, left). Assume that the user, on average, starts from the center of the canvas (Fig. 3) and does not select more than one tool consecutively (i.e., after selecting a tool, the user gets back to the center of the canvas). Also assume that the tool palette is located on the left edge of the screen as shown in Fig. 3 and that all buttons are of the same size.

   How does Krishna's tool palette compare with Oliver's in terms of the **average selection time**? Provide **two arguments** in total for this comparison. **Hint**: The arguments do not necessarily have to use Fitts' law.

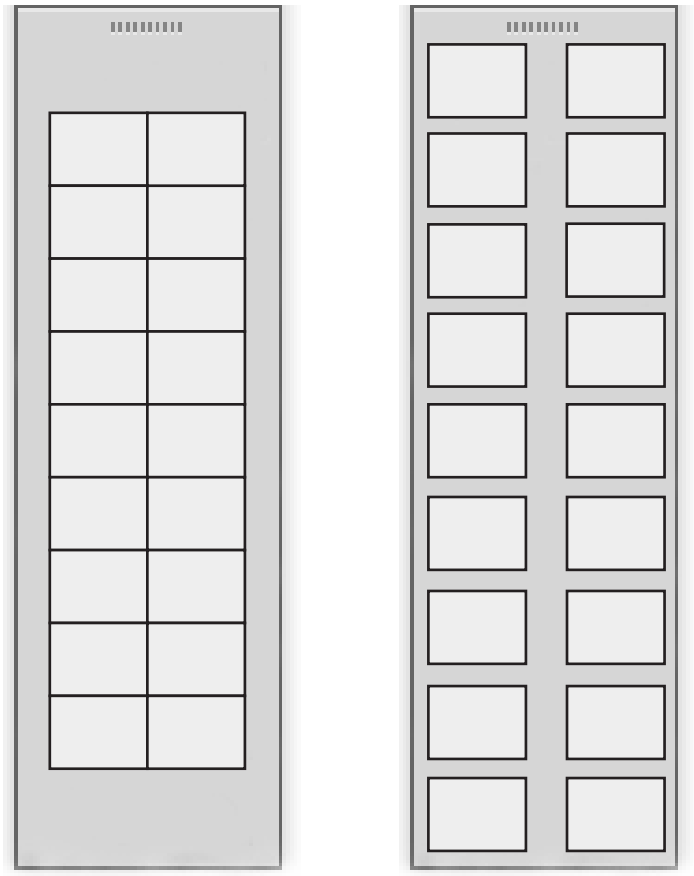

Figure 2: Buttons are closer in Oliver's design (left) and farther away in Krishna's design (right).

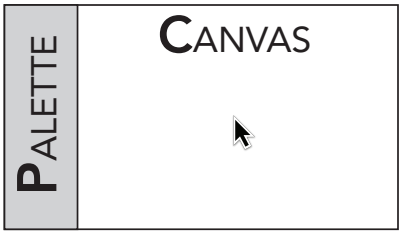

Figure 3: The palette is placed on the left edge of the screen. The starting position of the mouse cursor is in the middle of the canvas on average.

Deliverables

Prepare the solution as a two page PDF document in the submission format (**Submission Format.pdf**). Name your file **A01-GXX.pdf**, where XX indicates your group number. E.g., if you are in group 5, name your PDF document as A01-G05.pdf.

Submit your PDF to RWTHmoodle.

- You have two ways to hand in your solution in the Submission Format (see **Submission Format.pdf**):
  - Print **Submission Format.pdf**, write your answers by hand, and then scan the document.
  - Use PDF editors such as Adobe Acrobat Reader and Preview to add text to the document. You may need to export the document to a PDF (as an additional step) if you are using Preview. It is your responsibility to ensure that the annotations are properly added to the PDF.
- Submissions handed in after the deadline will be graded with 5.0.
- Submissions that exceed the provided page limit will lose points (see Submission Format).