

Master Interaction & HCID - Université Paris-Sud

Fundamentals of Human-Computer Interaction

Exam - 16 November 2016 - 3h

Authorized document: a single A4 handwritten sheet.
Please read the questions carefully. Answer clearly, precisely and concisely.

A. Modeling interaction: Color selection (6 points)

The time MT to reach a target of size W at distance D is given by Fitts' Law. The table below gives approximations of MT (in milliseconds) for various values of D/W , according to the formula $MT = 100 + 150 \log_2(1 + D/W)$:

D/W	4	5	6	8	10	15	20	30	40	50
MT	450	500	525	575	625	700	750	850	900	950

The Keystroke model is used to compare the times to execute interactive tasks by decomposing them into actions called "operators". In this exercise, we consider the following two operators:

Name	Description	Time
$P_{D,W}$	Pointing to a target	Fitts' Law (see table)
K	Type a key or push a button	100ms

In the rest of the exercise, when you describe an interaction, make sure to explain what each operator corresponds to and to specify the distance and width used for each $P_{D,W}$ operator, for example $P_{10,2}$.

We consider an interface for editing drawings made of geometric shapes (circles, rectangles, etc.). A shape is selected by clicking within it. Multiple shapes can be selected by clicking the first one and shift-clicking the others.

1. The following interactions are available to change the color of an object:
 - a) Select one or more shapes, then select a color in the color palette;
 - b) Right-click on a shape to display the color palette at the position of the cursor and select a color in the palette;

The layout of the display is as follows:

- The shapes are 2cm wide on average, and are 10cm apart on average;
- The size of each color swatch in the color palette is 1cm x 1cm;
- The color palette is made of 5 x 5 color swatches; For method b) above, you can use an average distance of 4cm between the cursor and the color swatch;
- The center of the color palette is 30cm away from the shapes;

At the beginning of each task, the cursor is 10cm away from the closest shape and 30cm away from the color palette.

- 1a.** Draw the content of the display and show the trajectory of the cursor for each of the above two techniques.
 - 1b.** Calculate the time to change the color of one shape with each of the two techniques. Which technique is fastest?
 - 1c.** Calculate the time to assign the same color to 3 shapes with each of the two techniques. Which technique is fastest? Compare with the results of 1b.
 - 1d.** Calculate the time to assign a different color to 3 shapes with each of the two techniques. Which technique is fastest? Compare with the results of 1c.
- 2.** We now use a toolglass, i.e. a semi-transparent floating palette manipulated with the non-dominant hand. The toolglass contains the color swatches. To apply a color to a shape, the user moves the toolglass over the shape with the non-dominant hand so that the desired color swatch is over the shape, and then moves the cursor with the dominant hand over the color swatch to “click-through” it.
 - 2a.** Draw the interaction and specify any new hypothesis about the layout that you may need. Explain why the time to assign the same color to multiple shapes with this technique is the same as the time to assign a different color to each shape.
 - 2b.** Calculate the time to assign a color to 3 shapes with this technique. Compare with the results of question 1.

Next exercise on pages 3-4

B. Conceptual modeling: Split the bill (8 points)

When going out to a restaurant or a bar, splitting the bill is often an awkward moment. The easiest solution is to divide the bill equally, but some people may feel frustrated because they did not eat or drink as much as the others. Or one person offers to pay for the wine or the first round of drinks. Even when people agree on how to split the bill, not everybody has the exact change. And finally, after everybody has put in their money, someone realizes that the tip was not included...

Your job is to design a smartphone app that helps to solve these problems. The app should have a simple mode for when the bill is split evenly, and an advanced mode for when each person wants to pay their fair share.

1. Splitting the bill equally

When splitting the bill equally, you need an easy way to enter the key information (number of persons, total amount, tip), and an easy way to adjust the tip to round out the individual amount. You want to see (and edit) the tip as an amount *and* as a percentage of the bill. You also want to make it easy for someone to pay for two or more people.

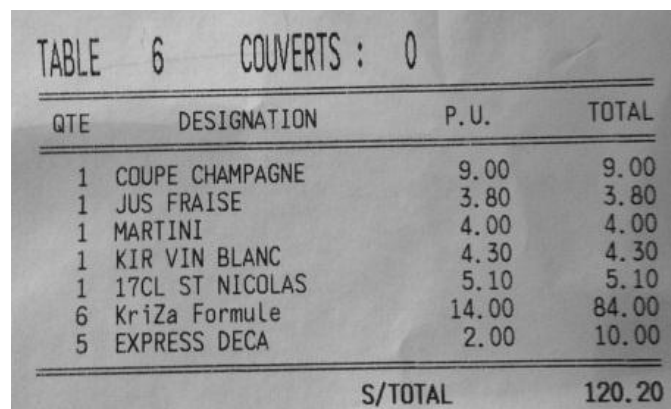
1a. Design an interface for a touch-enabled smartphone that fulfills these requirements. Draw the interface and describe the various interactions.

1b. Show how your design works for an amount of 150€ for 9 people, with an initial tip of 10%, adjusted to 8% (12€) to get to a round amount for each person (18€ per person).

1c. Count the number of elementary actions (touch, drag, etc.) for the scenario above, and compare it with the number of actions you would need to get to the same result on a regular calculator.

2. Each person for themselves

To split the bill according to what each person has consumed, the system needs to know the list of items and their prices. We assume that the smartphone has a powerful image recognition program that can turn a snapshot of the paper bill into a list of items with their price. For example, for this bill:



QTE	DESIGNATION	P. U.	TOTAL
1	COUPE CHAMPAGNE	9.00	9.00
1	JUS FRAISE	3.80	3.80
1	MARTINI	4.00	4.00
1	KIR VIN BLANC	4.30	4.30
1	17CL ST NICOLAS	5.10	5.10
6	KriZa Formule	14.00	84.00
5	EXPRESS DECA	2.00	10.00
S/TOTAL			120.20

the system will create a table with a list of items and, for each item:

- The quantity;
- The text description;
- The unit price;
- The total price.

You need to create an interface that lets users:

- Take a snapshot of the bill and turn it into a list of items;
- Enter the number of people and, optionally, their names;
- Assign each entry in the list of items to the person paying for it;
- Enter the tip and adjust it; and
- Show the amounts owed by each person.

Create a conceptual model of the interface. Make sure to follow the principles of direct manipulation and to **justify your choices**.

2a. Identify the objects and operations of the conceptual model.

2b. Design the visual aspect of the interface. Use drawings to illustrate your descriptions. Keep in mind typical use cases, and try to make the interface playful (a spreadsheet is probably not a good idea!) and efficient. You can use gestures, voice recognition, etc.

2c. Fill out the objects and operations tables to describe the complete conceptual model of the interface. The tables below include one object and one operation, with a rather boring interaction: it is up to you to improve it!

Objects table:

Objects	Representations	Properties	Operations
Item	Line in table	Quantity, Name, Price	Assign to user

Operations table:

Operations	Commands	Feedback	Responses
Assign item	Tap the item	A menu of people's names appears	The person's name appears next to the item
	Tap the person's name		

Next exercise on pages 5-6

Answer part C questions on both sides of this page.

C. Course questions (6 points)

1. Link the features on the left with the historical systems on the right:

- | | |
|------------------------|---------------|
| Windows and icons • | |
| Geometric constraints• | • SketchPad |
| Videoconferencing • | • NLS/Augment |
| Bimanual interaction • | • Xerox Star |
| Direct manipulation • | |

2. List 4 **interaction styles** and give a short description for each:

1. _____

2. _____

3. _____

4. _____

5. List the 3 components of the sense of touch and briefly describe them:

1. _____

2. _____

3. _____

3. Describe two menu techniques other than the traditional linear menu and list one advantage and one drawback for each of them:

Technique 1: _____

Advantage: _____

Drawback: _____

Technique 2: _____

Advantage: _____

Drawback: _____

Technique 3: _____

Advantage: _____

Drawback: _____

4. Indicate the type of task (from the list of six basic interaction tasks seen in class) corresponding to each of these interactions:

Click the OK button in a Print dialog: _____

Use the scrollwheel when reading a document: _____

Drag a file icon to the trash: _____

Select the Cut command in the Edit menu: _____

Click and drag to specify the position and size of a rectangle: _____

Click and drag to move a corner of a rectangle: _____

6. List and explain two limitations of touch interfaces:

1. _____

2. _____
