HCI W4-5

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Group Number: 50

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1 Complete Prototype

To be able to preview the application, simply open up the `index.html` file in your default browser. To view the app in it's intended aspect ratio, either

1. Chromium: Right click → Inspect → Toggle Device Toolbar (Shift+Ctrl/Cmd+M)
2. Firefox: Go to Tools → Browser Tools → Responsive Design Mode

Any handhold-able device will suffice. Since storing data locally via JSON files does not work due to "`Cross-Origin Request Blocked`" errors, a working prototype featuring a self-hosted http server will be implemented for the user experiment.

2 Descriptions

2.a Prototype description

Weekly Tasks/Homepage

Day Selection

- We have made the buttons for navigating to the tasks belonging to a different day bigger, and included their date as well, making it more informative for the user. Previously, there was no highlight to indicate which day the user was currently viewing; therefore, we have also added this detail.

Task Card Design

- The cards are now minimized, showing less content, but keeping the key information. This change was made due to the desire for a constant design throughout the whole application, without much difference when it comes to complete/uncompleted tasks. Instead, to see more information about a certain task, we have thought of making the tasks show more information such as changing the date and time upon pressing them and thus, opening an overlay.
- Color addition: to distinguish completed tasks from uncompleted ones, we added a lighter pink background for the uncompleted/in-progress ones along with a dark blue border, while the completed ones have a darker pink background with a pink border. The theme used is Rose Pine Dawn, whereas the color for each UI element has been picked to look the most pleasing too look at, whilst also using enough contrast to distinguish different elements.
- The changes mentioned above also apply to the *Task Menu*.

Task Addition

- We removed the "*create*" and "*menu*" buttons, replaced them with specific symbols which illustrate their functionality, made them bigger and kept the same size throughout the whole application, due to the results from our previous experiment in Week 3. As a result, the entire UI is more cohesive and consistent (which was one of the negative aspects reported by the user questionnaire).

Friends View/Groups

- We changed the display of friends in a group from "*Rank/Level*" to "*Name/Rank*", since we are already displaying the next level of the respective user in the progress level bar, in order for the main user to know the names of the friends in a group.

Profile View/Achievements

- We included new icons for the achievements displayed on the user profile which are more representative (winner cups).
- A lighter pink background was added for the uncompleted/in-progress tasks along with a dark blue border, while the completed tasks have a darker pink background with a pink border in order to maintain the same design for all card-like objects throughout the whole application.

2.b Experimental description

2.b.1 Objective

The future experiment will have as a main objective pinpointing interface design aspects that require improvement or refinement, to enhance the user's experience. Several elements will be looked at, as follows:

- **Navigation efficiency**: How fast and precisely can users navigate the app, and, therefore, how intuitive the layout is?
- **Aesthetic design interface**: Are the colors for clickable features distinctive enough from non-interactive ones?
- **Task effectiveness**: Is the main feature of our app well-implemented and self-explanatory to the users? Does it need a tutorial?

2.b.2 Methods and Setup

All users will have to complete a set of exercises meant to evaluate the various features of the app:

- **Navigation efficiency**: To assess the app's intuitiveness, different users compared to the first experiment will be asked to perform certain tasks. These will be similar to the previous experiment's tasks, to help us identify the usefulness of our design changes regarding navigation. Unlike the previous experiment, the next study being conducted will gather real world empirical data which we will be able to analyse after in great detail. Our designed test will feature JavaScript code (using event-listeners) to track the position of the cursor along side the time when clicking the mouse. The data is stored in a JSON file (or a similar data format file type). With this data, we can ideally evaluate accuracy (by measuring the distance from the cursor position to the UI element) and efficiency (by tabulating the time intervals between mouse clicks) more accurately.
- **Aesthetic design interface**: Following their use of the app, users will answer a questionnaire with responses ranging from 1 (disagree) to 5 (agree) about their opinions on its visual layout. We will once again use the standardized System Usability Scale questionnaire, and we will compare the results to those of the previous test.

2.c Variables

One user study takes into account a crucial independent variable: the experience of the user. Therefore, we plan to measure the following dependent variables:

- **Task completion time**: The amount of time it takes an user to finish a predefined task, which will reveal how well-thought the app's design is.
- **Accuracy**: Measures the app's effective usability. This variable will indicate how many errors (miss-clicks) a user makes while performing tasks (and possibly how severe these mistakes were).
- **Satisfaction**: Based on the results of the questionnaire, participants' evaluations of their experiences will be collected.

3 ANOVA Calculation

An ANOVA is the to determined if an independent variable is having an impact on a dependant variable. Here in this experience we are trying to compare two interface techniques to see which is better. Better in our case means the superior performance on the dependent variables is going too be completing time or the speed while texting in two different situations. The assumption that there is no difference in the means of the two categories is the starting point of ANOVA test and is called null hypothesis. ANOVA tests the data to determine the likelihood of the null hypothesis being true or rejected.

Null Hypothesis (H_0): $\mu_1 = \mu_2$
Alternative Hypothesis (H_1): $\mu_1 \neq \mu_2$

Participant	Texting speed (wpm)	
	Sitting	Walking
P1	13	10
P2	14	11
P3	12	9
P4	9	13
P5	15	14
P6	11	8
P7	18	9
P8	9	11

Table 1: Caption

$\overline{X_1}$ is the mean of the words typed per minute by the first group of participants texting while sitting, and $\overline{X_2}$ is the mean of the the second group.

$$\overline{X_1} = \frac{13+14+12+9+15+11+18+9}{8} \tag{1}$$
$$= \frac{101}{8} \tag{2}$$
$$= 12.625 \tag{3}$$

$$\overline{X_2} = \frac{10+11+9+13+14+8+9+11}{8} \tag{4}$$
$$= \frac{85}{8} \tag{5}$$
$$= 10.625 \tag{6}$$

$$\overline{X} = \frac{\overline{X_1} + \overline{X_2}}{2} = 11.625$$

i	$(X_i - \overline{X_1})^2$	j	$(X_j - \overline{X_2})^2$
13	0.14	10	0.39
14	1.89	11	0.14
12	0.39	9	2.64
9	13.14	13	5.64
15	5.64	14	11.39
11	2.64	8	6.89
18	28.89	9	2.64
9	13.14	11	0.14
$\sum$	65.87	$\sum$	29.87

Table 2: Caption

$$\overline{X}$$

is the overall mean,

Sum of the squares between, SSB, a value and the grand mean:

$$\texttt{SSB} = 8 \times (12.625 - 11.625)^2 + 8 \times (10.625 - 11.625)^2 \tag{7}$$
$$= 8 + 8 = 16 \tag{8}$$

,

$$n_1 = n_2 = 8$$

as n_i is the sample size of the categories

$$k = 2$$

and k is the number of groups.

degree of freedom between groups df_1:

$$df_1 = k - 1 = 2 - 1 = 1$$

Sum of squares of Errors, SSE:

$$\texttt{SSE} = \sum_{i=1}^{8} \left(X_i - \overline{X_1}\right)^2 + \sum_{j=1}^{8} \left(X_j - \overline{X_2}\right)^2 \tag{9}$$
$$= 65.87 + 29.87 \tag{10}$$
$$= 95.74 \tag{11}$$

N is the total number of the observations across k groups,

$$N = 8 \times 2 = 16$$

df_2 is the degree of freedom of errors,

$$df_2 = N - k = 16 - 2 = 14$$

eventually with all the data and calculations gathered, mean squares between groups:

$$\texttt{MSB} = \frac{\texttt{SSB}}{df_1} = \frac{16}{1} = 16$$

and mean squares of errors:

$$\texttt{MSE} = \frac{\texttt{SSE}}{df_2} = \frac{95.74}{14} \approx 6.83$$

ANOVA test statistic is going to be;

$$f = \frac{\texttt{MSB}}{\texttt{MSE}} = \frac{16}{6.83} = 2.34$$

	NONE	STATIC	DYNAMIC	Row Total
MAC	13	8	25	46
PC	25	21	18	64
Column Total	38	29	43	Grand Total: 110

Table 3: Caption

and then we will conclude the test at:

$$F(1, 14) = 4.6$$

Assuming a critical value of $\alpha = 0.05$, since $2.5 < 4.6$. As the value we concluded to is bigger than the critical value given on the table, we do not have enough evidence to reject the null hypothesis. We do not know if sitting or walking makes a difference on the texting speed.

4 Chi-square calculation

For this experiment we used a chi-squared test which is also known as Pearson chi-square as recommended, to tests the relationship of a categorical or nominal values and in this specific case the variables representing attributes of people and their behaviour(habits). The data is gathered in a contingency table. We are already provided with observed data and we need to find the expected values based on the table and compare them to the observed data. For this matter we are using equation 12.

$$\text{Expected Value} = \frac{\text{Row Total} \times \text{Column Total}}{\text{Grand Total}} \tag{12}$$

Observed	Expected	$O_i - E_i$	$(O_i - E_i)^2$	$\frac{(O_i - E_i)^2}{E_i}$
13	15.89	-2.89	8.354	0.525
8	12.127	-4.127	17.03	1.404
25	17.98	7.02	49.2	2.73
25	22.109	2.891	8.357	0.37
21	16.87	4.13	17.057	1.01
18	25.01	-7.01	49.14	1.96

Table 4: Caption

The final chi-square value is the sum of the individual chi-squares in the table (13). to complete the test, two additional details are needed: the degree of freedom for the chi-square (r - 1)(c - 1) where r is the number of rows and c is the number of columns, and alpha, which is supposed to be chosen before the test is being done. In this case we assume alpha is 0.05 14.

$$X^2 = \sum_{i=1}^{6} \frac{(O_i - E_i)^2}{E_i} = 7.999 \tag{13}$$

$$\alpha = 0.05 \tag{14}$$

$$df = (r - 1) \times (r - 2) = 2$$

Based on the chi-square table, the critical value is 5.991 for p ¡ 0.05 . Since the critical value $X^2 > \chi^2_{(r-1)(c-1),\alpha} \rightarrow (7.999 > 5.991)$, we reject the null hypothesis.

Since the computed value is bigger than the critical value, the difference in the observed values are statistically significant. Therefore we can get to the conclusion that MAC users and PC user do have different habits when it comes to their wallpapers.