Lab 5- 8

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Hypotheses:

H1: Users prefer responsive sites over unresponsive ones when using both a computer and a mobile device

H2: Users prefer accessible sites over inaccessible ones when browsing both kinds

H3: Able-bodied users are more likely to notice and prefer responsive sites, while disabled users will prefer accessibility over responsiveness.

H4: Sites having a combination of responsiveness and accessibility will be preferred by users.

1. Research Method:

In order to gain more information about the way web responsiveness and accessibility influence the experience users have, we decided to test the hypotheses in 3 ways. We could consider these as 3 separate experiments or as one experiment with 3 phases. The number is justified because we are looking at responsiveness on its own, accessibility on its own, and at both of them combined.

2.1 Experiment

Experiment 1 will focus on validating or invalidating ***H1***. In this experiment, 2 groups of people will be asked to interact with a set of 6 sites, both on a laptop and on a mobile phone. Out of the 6 sites, 3 will be responsive and 3 will not. After interacting with these sites, the participants will answer a survey (detailed below).

There will also be a control group, who will interact with all 6 sites. However, for the responsive ones, we will use unresponsive copies of the sites, making all 6 of them unresponsive. This way, we can accurately measure if the preference for the 3 responsive sites grew because they are responsive, removing other possible subjective reasons such as design, content, name, etc from the problem.

Experiment 2 will focus on validating or invalidating ***H2***. In this experiment, the 2 experiment groups will interact with 3 accessible sites and 3 inaccessible ones, only on a computer. After the experiment, the groups will answer a survey (detailed below).

The control group will interact with inaccessible copies of all 6 sites.

Finally, in ***experiment 3*** we will test the importance of combining accessibility and responsiveness. The participants will interact with 12 sites both on computers and on mobile devices.
There will be 3 accessible sites, 3 responsive ones, 3 inaccessible and unresponsive ones, and 3 both accessible and responsive ones.
The control group will interact with copies of all 12 sites.

2.2. Participants

The groups in these experiments will be chosen using a convenient sampling method (esantionare de convenienta). The participants will not be rewarded or paid in any way, making participation in the experiments completely voluntary. Participants will be able to withdraw at any moment. If a participant does not fully complete the survey, then she/he is considered withdrawn from the experiment and the already given answers are not taken into account.
Given the fact that we use convenience sampling, we can expect that there will be little to no demographic difference in our groups, meaning that the results we will obtain can not be generalized to a larger population.

In order to promote a more inclusive worldwide web, in this experiment, we will include a group of disabled people.

Group1: Able-bodied people (convenience sampling)
Group2: Disabled people suffering from one of the following issues: eyesight issues (including color blindness), blindness, learning disabilities (such as dyslexia), mobility issues that prevent the usage of a mouse/touchpad, seizures, ADHD.
Group3: Random people chosen by convenience sampling.

2.3 Sites

To ensure objective responses, we have tried to pick sites from a wide range of domains, as to not have them compete again each other from a content point of view. If we were to have two sites about gardening, we might subconsciously make the participant

choose which of these had better information, structure, etc, therefore making the participant pay attention to something else altogether. In any case, our research cannot avoid a dose of subjectivity, as it is impossible to take design, colors, and personal preferences out of the equation.

When choosing the sites, we consulted various online sources, such as lists of best accessible sites or examples of best responsive web design practices. Even then, we had in mind a few characteristics:

a) Responsive sites were tested on 2 types of smartphones, with different size screens and from different manufacturers, and on a tablet. We wanted to ensure readability and ease of use.
b) Accessible sites had to be readable using a text-to-speech app, the contrast between colors had to be powerful and the titles, subtitles, and text had to be easy to see and read.

The list of sites can be consulted in Annex1.

2.4 Surveys

As mentioned before, the participants would complete surveys as soon as they are done interacting with the sites. In creating these surveys, we tried to keep them short and as much to the point as possible, and we looked for several pieces of information: which site did they like the most and why, which site was the easiest to use, ratings of all sites, knowledge of responsiveness/accessibility and demographic information. The complete surveys can be found in Annex2.

3. Case Study

In order to gather, aggregate, and analyze the responses to our three surveys, we have implemented an application. This application is supposed to aid in the collection of the information as well as in the process of drawing conclusions from the data. In the future, it will also be able to export the information in an excel sheet.

3.1. Method

Upon agreeing to participate in the experiment, the participant is given a number (from 1 to 3) which represents the survey he/she will take part in and a second number (from

4 to 6) representing the group (4 - control, 5 - experiment group, 6- experiment group disabled).

After interacting with the sites given by the researcher, the participant will log into the app using these two numbers and will be presented with the questions from the respective survey and will afterward log out.

At any point, the researcher will be able to log in and ask for an analysis of the data so far gathered and will be prompted first with a list of statistics (how many of group x responded y) and then with some conclusions gathered from the data.

The code is written to be able to draw simple conclusions that support or contradict our hypotheses. (e.g. if the site most liked by the experiment groups is responsive, but the site most liked by the control group is not => responsive sites are preferred. The opposite result would show that responsive sites are disliked. If the most liked site of the experiment group is responsive and so is the one from the control group or both of them are not responsive, then no conclusion can be drawn and the hypothesis is neither confirmed nor contradicted)

Using such an application ensures that the likelihood of human error is extremely slim, as no person comes in between the answers and the conclusions.

3.2. Initial Results

After gathering responses from the 450 participants (50 for each group, for each phase of the experiment) using the aforementioned application, we have reached the following:

Experiment 1

- 64% of the control group preferred to use a mobile device over a computer, while 87% of the participants in the experimental groups preferred mobile devices. This shows that having responsive sites can improve the overall experience with a certain device. However, since this was not the purpose of our experiment, such a conclusion cannot be clearly drawn or generalized.
- In the control group, the most liked site (~43%) was site 12[1] (not responsive), while in both of the experimental groups (~32% and ~40%) it was site 5[2] (responsive).
- When asked what they liked about the site they rated most, over 60% of the participants named reasons such as colors and overall design, in control and experimental groups.

[1] https://www.aam.com/
[2] https://aneventapart.com/

- In more than 90% of the cases, the most liked site coincided with the site named as "most easy to use", both in the control and experimental groups.
- In the control group, 23 participants (~11%) said they know what responsive web design means. In the experimental groups, the results were 31 (15.5%) and 20 (10%) respectively.
- In the control group, only ~15% of respondents named one or more sites as being responsive. In the experimental groups, this percentage grew up to 62% and 57% respectively. Over 80% of the sites named in this question were, in fact, responsive (in the experimental groups).

Experiment2

- In the control group, the most liked site was site 12, while in the first experimental group it was site 11[3] and in the second experimental group it was site 2[4].
- In the control and first experimental group, the most liked site and the easiest to use site were the same in less than half of time. In the second experimental group, this percentage was over 80.
- In the control group, 43% of respondents said they know what an accessible site is. In the first experimental group, 57% of the respondents knew. In the second experimental group, 96% of the group knew.
- The control and first experimental group had trouble identifying the accessible sites. The second experimental group identified correctly in more than 78% of times.

Experiment3

- The most liked site by the control group was site 11. The most liked site by the first experimental group was site 4[5]. The most liked site by the second experimental group was site 7[6]. Site 4 is designed as responsive and site 7 is both responsive and accessible.
- In the control group, the most liked site was rarely (~23) the saame as the easiest one to use. In the experimental groups, this corelation was frequent (~68% and 83%).
- In the control group, only 38% of participants could tell what responsive web design means, and ~42% could say what accessible web design means.

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[3] https://www.budgetsaresexy.com/
[4] https://www.lonelyplanet.com/
[5] https://aneventapart.com/
[6] https://www.fivesimplesteps.com/

- In the first experimental group, 49% knew about responsiveness and 62% about accessibility.
- In the second experimental group, 41% knew about responsive web design and 94% knew about accessibility.

Demographics

- Out of the 450 respondents, 328 are employed, with 196 of them in the IT sector.
- When it comes to gender, the participants were mostly men (59%). This is most certainly due to the fact that participants were chosen by convenience, in general from universities where there are significantly more men than women.
- 412 (~91%) participants were from Romania, while the rest of them were from inside the EU.
- All of the participants have completed high school and most of them are currently attending undergraduate studies.

3.3. Conclusions:

Following the above-mentioned data, we were able to draw a few conclusions related to the nature of our hypotheses.

H1: *Users prefer responsive sites over unresponsive ones when using both a computer and a mobile device*

Judging by the results of the first experiment, responsiveness does seem to affect the way a user perceives the interaction with a site when using both a computer and a mobile device. Preference for mobile devices was significantly larger in the groups that also interacted with responsive websites. Moreover, the most liked site was a responsive one in the experimental groups and did not coincide with the one chosen by the control group. Moreover, since over 90% of the participants named the best site as the site most easy to use, it is clear that ease of use influences drastically the way a user perceives a site.

Therefore, ***H1*** is confirmed.

H2: *Users prefer accessible sites over inaccessible ones when browsing both kinds*

In the case of this hypothesis, things are more difficult. The results show that the disabled group significantly preferred to browse an accessible site over an accessible one. However, the abled-bodied group showed no preference in this regard. This is probably due to the fact that most people give little to no importance to the accessibility part of a site because it does not affect their interaction with said site.

Even so, taking into account that the majority of the disabled group preferred these types of sites, we can affirm that it is important for web developers to go the extra mile and include accessibility on their agenda.

H2 is only partly confirmed - Disabled users prefer accessible sites over inaccessible ones

H3: Able-bodied users are more likely to notice and prefer responsive sites, while disabled users will prefer accessibility over responsiveness.

Although it appears that disabled users did notice accessibility more than they did responsiveness, and showed a great interest in the former, this hypothesis can neither be confirmed nor denied as it turned out to be outside of the scope of our research. More data is needed to be able to draw an accurate image, including having the same group of participants interact with accessible and responsive sites. Although we did do that in experiment3, the information gathered is not conclusive in any way.

H4: Sites having a combination of responsiveness and accessibility will be preferred by users.

This hypothesis is confirmed, as the sites ranked top by the majority of the experimental groups were sites that included both accessibility and responsiveness. This can be due to the fact the accessible sites tend to have more contrast between the colors and are easier to use, even for abled-bodies people.

4. Related Works:

One study that is closely related to the first experiment we did is *"The effect of responsive web design on the user experience with laptop and smartphone devices"*. In this paper, the researchers asked participants to navigate on responsive and non-responsive sites on both a computer and a phone and measured their satisfaction with that interaction. According to the author "*The results revealed that users had a better user experience with Smartphones than with laptops while using the system, however, for most of the metrics collected, users' experiences with the two device types were not significantly different at 95% level of confidence, implying that for those metrics, the responsive web design had a similar effect on the users' experiences and attitudes*." [7]

The approach taken by this paper is more centered on the statistics of it all as they used a wider range of metrics than we do in ours. On the other hand, because we decided to use pairs of 6 sites in our research, we have increased the stimuli that participants interact with. Therefore, the results in our paper show a bigger perspective and are not limited to the subjective likes/dislikes of a certain site that participants may have. It then appears that users prefer to interact with responsive web design on the phone, which seems to also be the case in our experiment.

When it comes to accessibility, we have looked over *"Impact of accessibility and usability barriers on the emotions of blind users in responsive web design"*, a paper which aimed to combine both accessibility and responsiveness in an experiment with blind people. The results of this study show that blind users had negative emotions when interacting with responsive web sites in a much bigger proportion than when interacting with non-responsive ones[8]. Although not directly related to our research, this piece of information is crucial because it shows that when designing for responsiveness, web developers tend to forget to include also elements of accessibility. The paper particularly mentioned the fact that most responsive websites are not prepared to be read by the text-to-speech software that blind people use. From this experiment and from our own results, we can conclude that a combination of responsiveness and accessibility is the actual key to success. When

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[7] Hussain, Azham & Mkpojiogu, Emmanuel. (2015). The effect of responsive web design on the user experience with laptop and smartphone devices. Jurnal Teknologi. 77. 41-47. 10.11113/jt.v77.6041

[8] Nogueira, T. C., Ferreira, D. J., & Ullmann, M. R. D. (2019). Impact of accessibility and usability barriers on the emotions of blind users in responsive web design. pg. 1–8. https://doi.org/10.1145/3357155.3358433

developing only for able-bodied people, programmers risk alienating a bit part of the general population.

Another study of interest is *"Time for a Response: Responsive Design, Accessibility, and University Websites"* which tried to find a connection between the responsiveness and accessibility of university sites and the tuition fee and overall satisfaction of the students attending said university. The author analyzed 100 university websites and looked for certain metrics, then compared the results with the information he gathered about the university's community.

According to the paper, *"The study found no connection between responsive web design and tuition costs, total enrollment, acceptance rate, or geographic area"*[9]. However, it did found a correlation between the accessibility and total enrolment in the facility. Furthermore, the author mentions that bigger universities have already upgraded their sites to responsiveness/accessibility standards and it appears that smaller ones will follow suit. Although the approach and topic of this paper is not strongly similar to ours, we believe it is of importance to note because it shows that higher standards are being raised for websites worldwide. Since universities are places where change often starts, it is safe to say that inclusivity in the online world is one of the future's trends.

Our results do show that accessibility appears to be less import to able-bodied people. Different from the paper mentioned before, we have decided to use people in our experiments, therefore eliminating our personal bias. We believe although relevant, it is not clear in what way the author can draw conclusion only based on the statistics he finds about the university, as total enrolment can be influenced by many other factors.

[9] Estes, M. (2016, May). Time for a Response: Responsive Design, Accessibility, and University Websites. https://etd.auburn.edu/handle/10415/5214

Annex 1. Sites chosen for the experiment

Accessible

1. https://www.hiltoncolumbus.com/
2. https://www.lonelyplanet.com/
3. https://www.delsey.com/int/en/home

Responsive

4. https://www.ableton.com/en/
5. https://aneventapart.com/
6. https://www.currys.co.uk/gbuk/index.html

Reponsive and accessible

7. https://www.fivesimplesteps.com/
8. https://thedolectures.com/
9. https://www.floridabar.org/

Neither

10. https://www.kitchenflow.io/
11. https://www.budgetsaresexy.com/
12. https://www.aam.com/

Annex2.

Survey1

1. Did you prefer to navigate on a laptop or on a mobile device?
    a. Laptop
    b. Mobile Device
2. Out of the 6 sites you were asked to interact with, which one did you like the most?
3. Briefly explain what you liked about this site.
4. Out of the 6 sites you were asked to interact with, which one did you find the easiest to use?
5. Please rate the 6 sites in order of user experience (1 - worst user experience, 6 - best user experience)
6. Do you know what responsive web design means?
    a. Yes
    b. No
7. Out of the 6 sites you were asked to interact with, which ones do you consider to be responsive?
8. Age
9. Country
10. Last education level
    a. Middle school
    b. Highschool
    c. Undergraduate
    d. Postgraduate
    e. PhD
    f. Other forms of education
11. Occupation
    a. Student
    b. Unemployed
    c. Employed in the IT sector
    d. Employed but not in IT
    e. Freelancer

Survery2

1. Out of the 6 sites you were asked to interact with, which one did you like the most?
2. Briefly explain what you liked about this site.
3. Out of the 6 sites you were asked to interact with, which one did you find the easiest to use?
4. Please rate the 6 sites in order in order of user experience (1 - worst user experience, 6 - best user experience)
5. Do you know what accessible web design means?
    a. Yes
    b. No
6. Out of the 6 sites you were asked to interact with, which ones do you consider to be accessible?
7. Age
8. Country
9. Last education level
    a. Middle school
    b. Highschool
    c. Undergraduate
    d. Postgraduate
    e. PhD
    f. Other forms of education
10. Occupation
    a. Student
    b. Unemployed
    c. Employed in the IT sector
    d. Employed but not in IT
    e. Freelancer

Survery3

1. Out of the 12 sites you were asked to interact with, which one did you like the most?
2. Briefly explain what you liked about this site.
3. Out of the 12 sites you were asked to interact with, which one did you find the easiest to use?
4. Did you prefer to navigate on the computer or on a mobile device?
    a. Computer
    b. Mobile Device
5. Please rate the 12 sites in order of user experience (1 - worst user experience, 6 - best user experience
6. Do you know what web accessibility means?
    a. Yes
    b. No
7. Out of the 12 sites you were asked to interact with, which ones do you consider to be accessible?
8. Do you know what responsive web design means?
    a. Yes
    b. No
9. Out of the 12 sites you were asked to interact with, which ones do you consider to be responsive?
10. Age
11. Country
12. Last education level
    a. Middle school
    b. Highschool
    c. Undergraduate
    d. Postgraduate
    e. PhD
    f. Other forms of education
13. Occupation
    a. Student
    b. Unemployed
    c. Employed in the IT sector

d. Employed but not in IT
e. Freelancer

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