A Correlational Study Between User Interfaces Attributes to User Experience in a Website

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***Abstract*—In this paper, we explain how website's symmetry, colorfulness and visual complexity weights to user experience as a whole. For this study, 15 random websites with varying levels of user interface attributes were chosen, and 10 people volunteered to be the research subject for this study. The user interface attributes are symmetry, colorfulness, and visual complexity. We use UMUX to measure the user experience of a website numerically and compare it to the user interface attributes score using scatterplots. We found a positive correlation between the symmetric website and the UMUX score and an inverse correlation between Visually complex websites and UMUX scores.**

***Index Terms*—UI design, UX design, Symmetry, Colorfulness, Visual Complexity,UMUX**

I. Introduction

It is a fact that we use digital technologies in our daily life. From checking your phone when waking up in the morning, until midnight before going to bed, we are constantly using technology. There can be no doubt that we are tied to it. The first thing that we see in using technologies is the user interface (UI). The interface is what the users use to add inputs and receive outputs, these may be in the form of texts, images, buttons, or videos [1]. The next thing that the users feel is user experience (UX). It is crucial because the user experience is how the users feel when they are using the interface [1], these may be how easy it is to access a certain function, how easy it is to get the information that users want, and how annoying some pop-ups or features to use. With this, the push of having both a good user interface and user experience is very pivotal, since they are the first things that users interact with. A study has shown that a good user interface alone will make users more comfortable using the software, and so does a good user experience [2]. A combination of both will be the finest [2].

Creating good User Interfaces and User Experience comes with many challenges, an easily recognizable problem is when a digital application has a bad user interface, creating navigation problems. On a website, its color arrangement may cause partially sighted people to struggle to comprehend. In addition, their content hierarchy, which follows menu placement, may be difficult to locate. Another challenge with a website is to have a good user experience. Users who are familiar with a certain style of layout will have better navigation compared to those who have never seen this style or are not so tech-savvy. Issues in designing, implementing, managing, maintaining, training, evaluating and refining user interface of interactive systems are very prominent in this stage [3].

To measure the level of user experience of a system, a technique called SUS is commonly used. System Usability Scale (SUS) is a widely used standardized questionnaire for assessing perceived usability [4]. SUS has accounted for 43% of the post-study questionnaires in industrial usability studies [4]. On March 13, 2018, Google Scholar citations for the paper that introduced the SUS showed 5,664 citations [4].

In this paper we are aiming to answer these research questions:

1) Analyzing user's Usability Metric for User Experience (UMUX) for various websites
2) Finding and analyzing various levels of user interface attributes for various websites
3) Analyzing the correlation between UMUX and user interface attribtues score

We chose to use UMUX, dubbed the metric to be measured when SUS takes too much time [5]. UMUX is a relatively new standardized usability questionnaire designed to get a measurement of perceived usability consistent with the SUS [6], [7], but using fewer items that more closely conformed to the ISO definition of usability (effective, efficient, satisfying). Similar to SUS, it does not matter whether the UMUX is unidimensional or tone-based bidimensional [8]. In either case, practitioners should treat the UMUX as a unidimensional measure of perceived usability [8].

II. Literature Review

With rapid technological evolution toward intelligence and interactive technologies, it is required for us to balance everything. The 7 most outstanding challenges of humanity include Ethics, Well-being, Privacy and Security, Human-Environment Interactions and Accessibility including Universal Access [9]. Human-Environment Interaction along with Accessibility is one of the points mentioned that we need to consider in our research. It has been proven that improving the UX design of real-life space may be positively influential to the accessibility of elderly people [10], from which, we may ask whether improving a virtual program or application may reap positive benefits.

A user interface (UI) refers to a system and a user interacting with each other through commands or techniques to operate the system, input data, and use the contents [11]. UI is the interface that is a tool that users can use to manipulate things [12] and can be found in systems such as computers, mobile devices, and games [11]. On the other hand, UX refers to the overall experience related to the perception (emotion and thought), reaction, and behavior that a user feels and thinks through his or her direct or indirect use of a system [11]. It is essentially the interaction between the user and a digital object, this is what humans experience [12].

There are a variety of challenges associated with a good user interface. One of them is aesthetics, [13] stated that for several years, Human-Computer-Interaction (HCI) research has highlighted the positive impact of website aesthetics on constructs such as the overall impression, website utility, trust and credibility, perceived information quality and possibly perceived usability. [14] elaborated that in most cases aesthetics has a positive influence on actual performance when users must perform tasks with a user interface.

The effects of good or bad UI/UX can be seen in our daily lives. For example, one of the important features of e-learning design is to have an attractive UI and a good UX [15]. In digital shopping, UI and UX have an inverse correlation with the effect of purchase intention [2]. A good UX will bring a significant positive effect on purchase intention, while the reverse is true for UI [2]. In gaming, users interact with the interface for as long as the users play. Bad UI/UX can cause confusion to players which may make them leave the game [16].

When designing UI/UX, considerations which might include the target user's age and the availability of the product (i.e, platforms, target market section, etc) must be made. Older aged users have a tougher time seeing small things and accessing different gestures like drag & drop and tap & hold [17]. Not only that, different platforms introduce different constraints. A personal computer (PC) will allow navigation using a mouse pointer and a physical keyboard, while in contrast, a mobile device will need to use a touchscreen for both mouse pointer and keyboard input. Constraints for PCs may or may not work with mobile devices and vice versa due to differences like size and resolution [18]. Developers can use tools like Data Flow Diagram to help make clear UI/UX that will increase usability and avoid confusion [19].

To measure the level of user satisfaction on UX design, there are quite some indicators that are mainly used, primarily in the form of questions. The usual way of evaluating usability is to let a subset of users use the interface and analyze their satisfaction along with the ability to perform selected tasks [20]. While usability is commonly perceived as user experience, there is a subtle difference among them. 'Usability' refers to the user's ability to use something to do a task, while 'User Experience' takes a broader approach; looking at the individual's interaction with the object, as well as the thoughts, feelings, and perceptions generated [21].

The System Usability Scale is one old indicator that is dubbed 'Quick and Dirty' [22]. Created in 1996, it is a widely used standardized questionnaire for the assessment of perceived usability [4]. Though, SUS is very reliable to this point with score conversion and comparison to other indicators available [8], [23]. A positively worded System Usability Scale yields results that are like those generated using the standard System Usability Scale [24]; either version of the scale can be used, although the positively worded scale may yield fewer errors in responding and scoring [24]. Other approaches of evaluation are mainly a derivative of SUS. Research stated that compared to other models, the SUS metric achieved the highest accuracy level with the smallest number of samples [25]. An improvement of the said metric has been suggested which includes text-field input for future system improvements suggestion [26].The higher the SUS score the better as it means that the evaluator likes it and is more likely to recommend it to other users [1], [27].

An adaptation of SUS is the UMUX and the UMUX-LITE metric. It itself has been adapted into a possible product quality metric for healthcare technologies [28] as well as spun off into an Artificial Intelligent based conversational agent diagnostic tool [29]. While these metric were developed independently and seemingly asks of a different question, these metric has been proven again and again to measure the perceived level of usability [6]–[8].

III. Methodology

A. Research Participants

In this experiment, ten young adult participants (aged between 18 and 25) were chosen. All participants are technologically literate, having used tech devices for more than 4 hours daily. The majority of the participants are university students.

B. Research Object

Fifteen websites with varying levels of user interface attributes were chosen according to the attributes described by Schmidt and Wolff [14]. These websites are the ones whose main functionality can be accessed instantaneously, without any kind of wall (i.e., authwall & paywall).

C. Research Questionnaire

Each website has seven statements divided into three UI-related statements (scored 1 to 9) and four UMUX statements (scored 1 to 7). The following are the questions that were asked:

UI statements:

- The website is symmetric
- The website is very colorful
- The website is visually complex

UMUX statements:

- The website's capabilities meet my requirement
- Using this website is a frustrating experience
- This website is easy to use
- I have spent way too much time correcting things with this website

D. Research Procedure

After participants have given their consent on participating in the research, they are introduced to a questionnaire sheet where they will score each website with the previously mentioned content. We then select a website from the list in a random order and wait for the participants to explore as much as they want for that website. In the end, when an entry to a website has been filled, we continue to run down the list and select another website until every website's entry has been filled.

IV. Result and Analysis

A questionnaire filled out by 10 participants was used to calculate the results of this experiment. The results are aimed to compare between UI attributes and UMUX score.

A. Calculating UMUX Score

To calculate the UMUX score of a website, assume that X is the raw score of each questionnaire answer and n is the amount of UMUX questions in the questionnaire. The following formula was used:

$$x_{\text{odd}} = X_i - 1$$

$$x_{\text{even}} = 7 - X_i$$

$$\text{UMUX} = \frac{\Sigma_{i=0}^{n} x_i}{n}$$

The UMUX score is then summed from every respondent's answer and divided by the number of respondents to get the average UMUX score for a specific website. Lastly, these steps are repeated for every website to get the average UMUX score for each website, the higher the UMUX score the better the user experience.

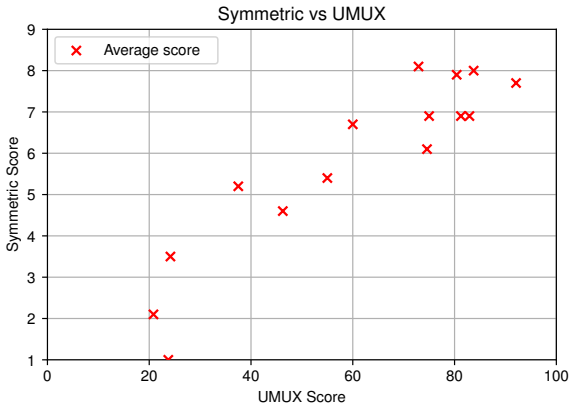

Fig. 1. Plot graph of Symmetric score vs UMUX score

B. UI Attributes vs UMUX Score

The UI attributes scores are averaged from all participants' answers according to their categories: Symmetric, Visual Complexity, and Colorful. These scores are then put into a graph where X represents the UMUX score (ranging from 0 to 100) and Y represents the UI attributes ranging (from 1 to 9).

Figure 1 is a point graph visualizing the location of the UMUX score compared to the symmetric score. The symmetry score is directly correlated with UMUX Score. The higher the UMUX score, the more likely it is to have a high symmetric score. Indicating the respondents tend to have a better experience on websites with a higher symmetric score.

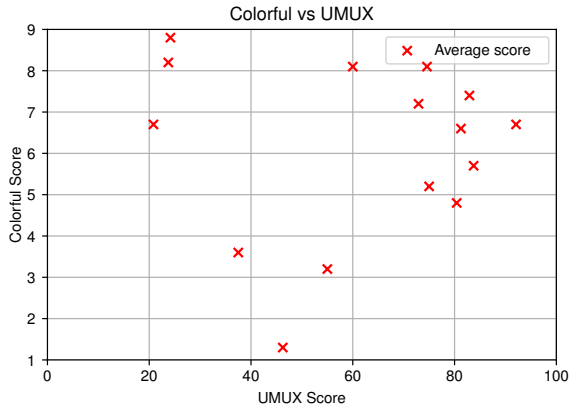

Fig. 2. Plot graph of Visual Complexity score vs UMUX score

Figure 2 is a point graph visualizing the location of the UMUX score compared to the colorful score. The point graph shapes convex upward, and the colorful score appears to be high at the lower and upper ends of the UMUX score, whereas the colorful score appears to be low in the middle range of the UMUX score.

Figure 3 is a point graph visualizing the location of the UMUX score compared to the visual complexity score. The visual complexity scores have a negative correlation with

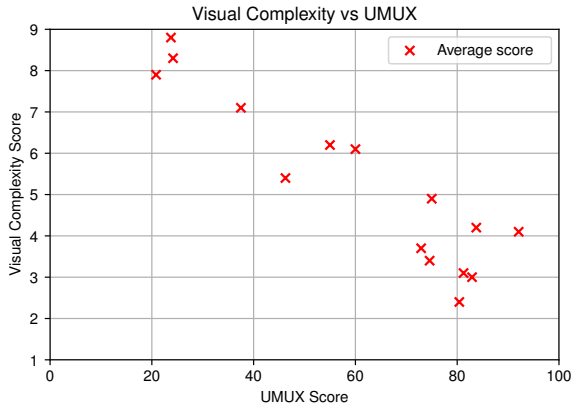

Fig. 3. Plot graph of Visual Complexity score vs UMUX score

UMUX Score. The higher the UMUX score, the less likely it is to have a high visual complexity score. Indicating the respondents tend to have a better experience on websites with a lower visual complexity score.

V. Conclusion

In summary, our research has found multiple correlations between UI attributes and UMUX scores:

- There is a positive correlation between the Symmetric website and the UMUX score. The more symmetric the website is, the more usable it will get.
- There is an inverse correlation between Visually complex websites and UMUX scores. The more complex a website is, the less usable the website will be.
- Correlations between colorful websites versus usability (UMUX score) are not certain. At the low end of UMUX scores, the website tends to be very colorful. In the middle of my UMUX score, the website is not colorful. And at the high end of the UMUX score, the website is colorful again
- Further research with various website corpus is needed to get better accuracy.

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