

## **User Interface Design & Software Accessibility**

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By

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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## Introduction

A user interface in the context of the field of software development and web applications is the medium in which a human interacts with the piece of technology they are using. How a user interface is designed is significant - as a badly designed user interface can prevent the intended audience from using it. With more and more devices using some form of computers, we are seeing a growing variety of interfaces to interact with them (Blair-Early & Zender, 2008). Additionally, there is often a conflict of interest between the profitability of the company designing the application and the functionality of the application, for example when a designer chooses to create a flashy feature at the expense of usability to the end user. This isn't a trivial problem to solve and can sometimes be viewed as *tacit knowledge* due to its strong relationship to the arts. For example as a designer creating an application for an apartment building, what if I model it after *kotaku.com*, a site with a significant millennial user presence (Kilcullen, 2018)? This could have a huge impact on the whole business. Residents, specifically those of an older demographic, could have issues navigating the site or simply understanding how to use it. This leads to issues with making payments or accomplishing tasks such as requesting maintenance assistance. In turn the business owner's reputability and profit can be negatively impacted.

To dive a bit into the *usability* aspect of user interfaces , the Institute of Electrical and Electronics Engineers (IEEE) created a high level metric. It's called the Usability basics for software developer. It specifies the attributes as how easy the UI is to learn, efficiency (number of tasks one can perform per unit time) , how easy it is to retain skills learned, reducing error rate, and increasing user satisfaction (Ferre, Juristo, Windl, & Constantine , 2001). The guidelines described offer ways of maximizing all attributes and measuring how well one has accomplished them. Finally it also lays out various methods of analyzing users to gauge what type of UI a UI designer should create and how to conceptually design it. In order to address issues related to *user interfaces*, designers have realized the necessity of creating a design principle. Principles that can help create mindful UI that looks good, while also giving us some metric for measuring what 'good UI' or 'bad UI' is. There are a couple of philosophies as to how one should systematically approach this and although they might differ slightly in details and names, most accepted and successful one's share the very same core ideas.

A well researched and applicable one is laid out in *Designing the User Interface: Strategies for Effective Human-Computer Interaction* in which Professor Ben Schneiderman lays out 8 usability heuristics for designing (Shneiderman, 1997). The first three rules describe metrics for how the UI should look towards the intended audience , exemplifying consistency, universal usability, and offering feedback. Rules four through eight describe what dialogue is with respect to user interfaces , prevention

of errors, giving users control, and reducing how many things your user has to keep track of in their head.

For example let us look at a well respected and loved user interface - the Spotify desktop UI. It's consistently the same style - a very dark grey with bright green. Just seeing those colors screams Spotify to younger age groups , who are also the most frequent users of Spotify. It has simple error handling , reversal of actions, and is simple enough to figure out within minutes. On top of this actions are organized very strictly and follow the mental model of what a music application should do. For example to create a playlist and add songs to it , there is a large button that says create playlists then while browsing for songs, you can click and drag songs into that playlist as you wish. With how the UI is set up , it is almost impossible to make significant errors and if you do, like accidentally deleting the playlist, you can undo it. Looking at these aspects, it fits Shneiderman's criteria perfectly. TechWriterPro did a very in-depth test of the Spotify UI and found that users were able to complete actions optimally aside from a few issues with the Spotify radio (Davis & Brown, 2015). This is a feature that Spotify hasn't updated in years and is arguably Spotify's weakest feature due to it not being their focus as a social music streaming platform (something like Pandora.com is more suited for this).

On the other hand we have a disliked application like SIS. It is extremely disliked by faculty and students here at UVa. The only Shneiderman criteria it meets is the consistency of look. Aside from that from reducing errors to permitting an easy reversal of actions, SIS is very complicated does not meet these criteria at all. It's hard to learn

and even harder to memorize the excessive steps required to perform a simple action. On grounds, a common sentiment that is heard about SIS is that it is stressful. This is not something a user interface should be causing for its users.

While a framework such as this gives us a way to measure how well a user interface is designed and how to create our own, there are still some grey areas or rules defined that are very open ended. Exploring how user interface creators engage with their intended audience when designing and implementing their interface can reveal very interesting discoveries on the role of iterative design in user interfaces. Likewise, we can observe how this directly impacts people, specifically how accessible a site is.

## **Engagement with Users**

The software development cycle is a timeline that is commonly used to implement large scale projects. It focuses on the customers of the project as well as the high level technical timeline. There are six steps to the cycle, the initial being the planning stage and the final being maintaining the product after it is released (Hussung, 2019). To reach the final step from the initial one developers must go through the *analysis stage* which defines the project goals (Hussung, 2019). This stage also includes addressing the technical details as well as conducting in-depth user surveying. How people think and how technology functions does not always match up (Norman, 2003). Seeing how users in this phase react to various things and how they perform in relation to what is expected allows designers to make educated assumptions on what the mental model of their target audience is. Using that collected information the team

must *design* the product, keeping in mind usability and user interface standards.

Afterwards the team prepares for the final stage by implementing the designed product and testing it out. Testing at this stage consists of conducting technical testing alongside testing the product out with potential users to ensure UI and usability standards were met. If they failed, the team creating the product has to go back to the design stages to address the issue.

From the software development cycle described above we can see that the initial surveying of potential users, designing the product based on that, and testing if it was implemented well is key to a successful usable user interface. When designing the user interface and considering various cases of usability, it's critical to conduct audience analysis and engage with the intended users. In *Usability Basics for Software Developers*, IEEE gives a breakdown on how to conduct audience analysis. A developer should identify who the users are, what they want to accomplish, how they want the system to help them, and how the system will do that (Ferre, Juristo, Windl, & Constantine , 2001).

IEEE gives several methods to approach user analysis. One method is site visits. This is considered to be a go-to method as it is applicable to a majority of industries within software development (healthcare, music, etc.). What developers and designers do during this stage is they observe potential users conduct some task without using the product their team is about to create. This lets the team know common issues users have, what their mental model is, and how they generally behave. Using site visits gives a very organized method to collect information on users.

Focus groups and surveys are other methods in which designers get to interact with potential users directly. In focus groups a team organizes a discussion and they get to provide that group topics of discussion. These topics pertain to the product the team is attempting to create and refer to common problems or issues the participants of the focus group might have. Surveys essentially ask these questions, but in a more constricted manner as they are usually online or paper forms with set questions. A focus group has a bit of an advantage because it's not restricted in the sense that one can ask follow up questions, but it is also more expensive since it requires finding a location to conduct it and getting the participants there.

### **Design with Intent**

After collecting information from users, designers must apply it to their design. This starts with simply designing conceptually. This is regarded to be the key step in design (Ferre, Juristo, Windl, & Constantine, 2001). Typically designers can do this using paper/pencil or mock up tools available online. Here designers try to write out what the user will see and how they will interact with it. This step is supposed to be very high level and focuses on user-system interactions rather than what they see.

After conceptual design designers will visually design the product. Using the previous conceptual design step, designers define the interface very specifically. This includes, but is not limited to: color specifications, size of the fonts, how fast boxes will pop up. At first this might seem easy, simply choose colors that don't *look ugly*, choose

a font that you can easily see, etc. but there is a lot to consider with a designer's audience here.

For example let us explore two applications that have two completely different audiences - the College Board site vs. American Association of Retired Persons. The College Board is commonly used by high schoolers when applying to colleges ("The Collegeboard Homepage", n.d.). It has a database of an individual's college entrance exam scores as well as a financial aid evaluation tool called the CSS. When entering the website a user is greeted with very stylish elements. There is heavy usage of semi-playful small fonts, very light colors, and a prevalence of social media links. In comparison the AARP site has more reserved colors, darker and larger font usage, and a more rigid structure to it with almost everything being accessible from the landing page ("AARP Official Site", n.d.). It's evident that the designers of both sites carefully looked at their audiences and applied usability and user interface standards to meet their needs. Following well defined standards to produce a good looking product is wonderful and all, but what really matters in the end is the accessibility. If the interface is what is preventing customers from interacting with one's product, then there was a big problem in either the initial user surveying or during the design stages.

## **Accessibility**

According to Mads Soeggard "A design is only useful if it's accessible to the user: *any user, anywhere, anytime*"(Soeggard, n.d.). Soeggard describes aspects of accessibility and I'd like to focus on visual and auditory accessibility (Soeggard, n.d.). He defines visual accessibility addresses those who have vision problems like



blindness, vision issues and it can be extended to those who can be visually affected by lights - like those with photosensitive epilepsy. Soeggard then describes auditory accessibility by saying it addresses those who have hearing problems due to some level of deafness. If a website is not accessible by some of these standards there are legal repercussions people can take, for example, there is the EU Web Accessibility Directive. The directive states “In the context of this Directive, accessibility should be understood as principles and techniques to be observed when designing, constructing, maintaining, and updating websites and mobile applications in order to make them more accessible to users, in particular persons with disabilities”. This can cost a company a large amount of money. In the US the ADA (American with Disabilities Act) allows for similar actions which was shown earlier this year when the Supreme court allowed a blind man to sue Domino’s over the site accessibility (Tuckerhiggins, 2019).

## **Conclusion**

A lot of the decisions made during UI design have to do with Iterative Design Decisions. How to make something simple yet functional? On top of this - how does one make it accessible? What are the costs related with sacrificing things like accessibility and what are the costs with trying to hit every point making a product accessible. It’s fairly challenging designing the ‘*perfect*’ user interface, but using various metrics like the IEEE guidelines and Schneiderman’s rules designers can push towards a product that has a usable and accessible user interface, that is free from discrimination, and gets it’s intended job done. We live in a society that is experiencing rapid technological

advances and with new ways to use them . By focusing on user interface design intensely in computing related education as well as software bootcamps, I believe major problems can be mitigated.

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