

Phases of User Interface Design

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PHASES OF USER INTERFACE DESIGN

9.1 - Introduction and Background

User interface design has many steps needed to create the perfect product. Some of these steps include business functions, collection, analysis, and conceptual model development, guidelines for screen design, evaluation, usability testing, and prototype design. Critical goals in user interface design are defining how the product will be used and for whom the product is intended. Business functions will introduce the idea of activities that carry out part of a function of an organization.

Evaluation and usability testing develops a report that shows how well users can use the product. Collections and analysis takes the data from a product to improve the product. Prototyping creates either a semi-functional or fully functional product. All of these topics are discussed in the report to show how each piece of the process helps create the best possible product.

Furthermore, user interface design is incredibly important because it has the clear purpose of “mak[ing] a better experience for users when navigating through your platform” (Cristian, 2018, 1). This process has been in development since at least the 1970s. The Alto personal laptop was developed in the early 1970s and had one of the first graphical UIs. Alto was an experiment in how users would use a personal computer. The major applications envisioned for the Alto were interactive text editing for documents and program preparation (Thacker, 1984, 3).

Another example of a product with a good user interface design is Airbnb. It is a widely popular site with an easy website to use and navigate. Furthermore, it promotes trust between the renter and the user. Airbnb allows people to book a house right from the home screen. Like any good user interface design, familiarity is important to a successful product. Airbnb actually used many characteristics found on the Virgin American website.

9.2 – Determination of Business Functions

The design process has to focus on a mix of functionality and aesthetics for a better user experience. A person is more likely use a product that is easy to use and that is easy to look at. Some products that are too flashy or have too many bright colors could deter people away from the product. Many people would prefer to look at a symmetric website that incorporates easy colors: “Users have to achieve their goal as fast and as easy as possible and they cannot do that if the design is crowded or they have a lot of reading to do” (Cristian, 2018, 2). For instance, Amazon now has a one-click buy button. Users can easily look up what to purchase and press one button that immediately buys it. This is a useful tool for many users and for Amazon. Amazon’s sales most likely increased because users did not have to go through multiple steps to purchase a product.

Companies are most likely to reuse UI elements that have been proven successful for other companies. Furthermore, having “help options such as tooltips and message boxes are useful as a last resort, in case the user gets lost” (Cristian, 2018, 1). Companies typically have help buttons or the ability to chat with a technician to avoid a person leaving their website. However, if there is an issue with the website this will deter many people from coming back to it.

Most of the time, products are created for a company to distribute to users or simply to help run a business more efficiently. Determining the functionality a business needs for a product is crucial to the overall product success. Some common business functions are research, marketing, accounting, and production. A business is going to have a defined goal in mind. Most companies will have extensive research into a product to avoid any costly errors.

Research includes important components such as what the user wants, how much it will cost, and whether there are similar products available. If there are similar products available, the designer will know what the pros and cons of that product is. Most businesses will categorize a product in stages, including requirements, collection, and analysis. These three steps parallel the three UI design stages.

Furthermore, a business function will include a cycle of accounting, marketing, human resource and production. Most businesses will focus on marketing, as the average consumer is subjected to advertisements throughout the day. Furthermore, the same department that deals with marketing will also “reach out to prospects, potential and existing partners, investors, and more” (Picincu, 2019, 1). Maintaining the relationships between the investor and the main company making the product is extremely important. Without funding help, a product is less likely to be huge in the market. So many products have a competing product, and every product on the market is competing for shelf space in the bigger chain stores (Walmart, Target, etc.).

9.3 - Requirements Collection and Analysis

A key step in UI design is determining the requirements for a project. A requirement is typically dispositioned across multiple parties before obtaining business approval, as building the end-product requires overhead expenses (software development time). For example, a company may want a website built with specific requirements. Some requirements for a website may be what colors the website incorporates, how easy it is to navigate the site, the overall page layout and how to advertise the product in a way that makes users want to buy it. There are even several methodologies used for requirements.

Planning is an integral part of a project lifecycle. Without it, a project is sure to have slower progress and run into unintended difficulties. Before an application is designed (and later built), stakeholders of the end-product gather requirements that define the future-state goal(s) of building the application and their costs. An important aspect of the planning stage is the collection and analysis of project requirements. When developing a good-looking and functional UI for a customer, it is vital to know and understand what said customer is looking for in a UI. This requires the developer to acquire as much information about the customer and their use case for the application as possible prior to the development stage.

The complexity of the UI being developed is also a factor in the length and difficulty of the requirements. It’s important to keep the scope of the project limited. Otherwise, the difficulty of being able to visualize the entirety of the UI will increase as the UI (in its conceptual state) grows (Stone, 2005, p. 103).

Techniques used to gather project requirements may vary from project to project. If the project is for a specific use case requested by a single or small number of customers, some phone calls and face-to-face discussions may be enough to gather sufficient coverage of the project requirements. If the project is a broad topic that isn’t meant for one specific demographic, then more thorough strategies such as surveys and focus groups may be necessary (Stone, 2005, p. 103).

The two types of gathered usability requirements are qualitative and quantitative: “Qualitative usability requirements are concerned with the desired usability goals for a computer system; for example, ‘the system should be easy to use’ or ‘there should be user satisfaction’” (Stone, 2005, p. 103). However, these types of requirements can be opinionated, which can cause difficulty for the developer when trying to fully understand and implement the requirement. Quantitative usability requirements generally are things that can be measured and observed, usually involving performance, which are also known as “usability metrics” (Stone, 2005, p. 103).

Use Cases and Use Scenarios are assigned to each requirement to provide further justification/clarification to the requirement. For the above requirement example, a general Use Case could be, “Analyze Financial Data”, and a User Scenario could be, “Financial Analyst measures financial performance to prepare for monthly budgetary review.” Both of these additional pieces of information allow for easy categorization of large-scale software development projects and allow for a technical development team to quickly get the product out.

9.4 – Conceptual Model Development

Conceptual design is the next step to requirements gathering and analysis. Once an appropriate and thorough list of requirements has been made, constructing conceptual designs from said requirements helps begin the process of creating plans, modals, and visuals. “A conceptual model is an outline of what people can do with a product and what concepts are needed to understand how to interact with it” (Preece, 2015, p. 397). Conceptual designs have their ups and downs from the ease that they bring along with the difficulty and complication they can bring.

One of the positives they bring is that all the user preferences and opinions that were gathered from the requirements stage can now be visualized. Because of the analysis stage during the requirements gathering, “a picture of what you want the users’ experience to be when using the new product will emerge and become more concrete” (Preece, 2015, p.397). This is a major milestone to reach, because figuring out where and how to start on a product can be one of the biggest challenges.

Conceptual designs can be difficult to accomplish and be made thorough. “One of the reasons for this is that conceptual models take many different forms and it is not possible to provide a definitive detailed characterization of one” (Preece, 2015, p. 397). Another potential drawback is that often there can be conflicting views between team members when coming up with designs for various aspects of the product. While it is generally regarded as a positive to have multiple brains discussing and planning together, it can still be a challenge to come to an agreement.

Sometimes this can also bring about reiterations of concepts, which takes up even more time. Because of this, there are important principles to keep in mind for creating these designs: being open-minded while retaining focus of what the users want, thoroughly discussing with stakeholders about ideas, taking advantage of prototyping for rapid feedback, and reiterating the process as many times as necessary (Preece, 2015, p. 398).

In order to be most efficient in the conceptual model development phase of the design process, it’s crucial to fully understand what conceptual models are and what they are not. First, let’s establish what they are: “Concept models are diagrams that describe the relationships between different abstract ideas. They are also known as ‘concept maps’ or ‘affinity diagrams’. They are meant to capture all of the different types of

information to represent, and to visualize their structure” (Lapierre, 2017). This is your planning phase where you get to visualize how all of the bits and pieces of the interface work together. Being as thorough as possible will help you down the road by bringing down the chances of redesign and redevelopment because you created something before realizing that it needs to work a different way.

Now that we have established what conceptual models are, let’s talk about what conceptual models are not. It is important to understand the purpose and value of this phase of the design process so that you do not give yourself more work than necessary and so you do not start overlapping with another phase of the process. First and foremost, “The conceptual model of an interactive system is not the user interface. It is not about how the software looks or how it feels. It does not mention keystrokes and mouse-actions, screen graphics and layout, commands, navigation schemes, dialog boxes, controls, data presentation, or error messages” (Johnson, 2002). Remember that this step is purely for understanding the foundation and the structure of the UI, rather than being able to visualize the UI.

In compliment to the last point, “Concept models are not meant to be shown to clients or to be a design deliverable...They are simply tools to help you frame the design problem, to facilitate your own creative process” (Lapierre, 2017). This actually simplifies this phase of the design process in that it relieves the worry of having to present the conceptual model to the client.

9.5 - Guidelines and Screen Design

Screen design is incredibly important to the interaction between a user and the product. If the user and the product do not interact well, then the user will most likely not use the product. There are guidelines to follow when designing a product. Some of these guidelines include user control and freedom, consistency, error prevention, flexibility, aesthetics, and help buttons.

User control and freedom “offer users a digital space where backward steps are possible including undoing and redoing previous actions” (Wong, 1). An example of this could be a user searching a catalog for an item and then searching for it again after switching pages. Furthermore, it is important for a website to be consistent. If the website changes color or style to frequently it will be harder to use and navigate. Another key guideline is help buttons. If the user is experiencing difficulty using the website, a help button is crucial for them coming back to the website. A help button could include frequently asked questions or more advanced help such as communicating with an operator through a chat box.

Most users enjoy a visually appealing website especially when shopping. The calmer the website, the more likely a user will continue to use it. Any obnoxious colors or animation will deter users for the most part. For instance, YouTube has simple layout and search function for videos. YouTube is extremely easy to navigate, and they have users frequently coming back. Furthermore, YouTube allows easy interaction between creators and viewers.

There are some things to keep in mind when coming up with screens designs. The designer *should* provide similar experiences regardless of the device; this means that whether the user is using a tablet, a desktop or a phone, they should get the same experience across all platforms. Another important thing to keep in mind is that the thing that a product is displaying should be the focal point on the screen. Also, the user should be able to locate the main thing they are looking for as quickly as possible, and they are most likely to scan over big things before reading any detail, so it is very important to make the main thing the focal point. One last

thing to keep in mind to make the experience of the user a pleasant one is that they should feel like they are the ones in control of their experience; try to avoid auto-play videos and aggravating pop-ups ads. These take the control of the user when navigating the screen.

There are things that will frustrate the user when navigating a program. The following are some tips that should help you avoid a user's leaving the product prematurely. Do not fill the screen with non-related content; users want to see content they searched for without distractions and interferences. Second, do not make the user wait for content to load; the world is at a point where the attention span and patience is thin when navigating through sites. Optimization of certain features of the website is key for keeping the user engaged in the product. Do not have several things competing for attention, as this can cause unnecessary confusion and nervousness for the user. When more than one thing is taking the main focus of the screen, use some type of hierarchy to avoid this problem.

Taking a good look at the product before showcasing it to the user can be of great help and a big step in developing a user-friendly product. These guidelines are not all of the key components to develop a great website, but they should definitely be kept in mind to have a step forward in the right direction.

9.6 – Menus and Navigation Schemes

System and web applications require menus and navigation schemes to allow users to move around the product and locate whatever it is needed in a short period of time. Because of this, the focus should be on simple and intuitive tools. Websites provide a lot of information of all sorts. Whether a user wants to buy an item, access resources, or learn about a certain topic, all users depend on navigation tools to locate whatever it is they are looking for. When navigating through a website, the majority of users rely on clicking on links rather than using the search bar; links have names that match what people are generally looking for and it is easier and faster to click than to search. This is why when creating a product, the primary goals are to focus and create well-structured menus and navigation schemes to provide the user with an easy and user-friendly experience. There are some rules to keep in mind when creating navigation schemes: prioritizing consistency, designing clear interactions, and avoiding deep navigation.

When designing a program or website, it is always a good practice to keep the theme and structure of the product consistent. Consistency allows the consumer to make sense of the product right away, perhaps in a matter of seconds. The user will expect the program's pages or windows to be similar in terms of design and structure. If a product's navigation system alters from window to window or page to page, the user will have to relearn and make sense of the program every time with every page they come across, this will only bring frustration. Inconsistencies could be result of content not fitting in a certain category or links that are buried deep in the interface. There are some solutions to these inconsistency problems, including landing pages and subpages. If content still does not fit under available any section, then perhaps rearranging the entire hierarchy should be considered.

The second step for creating a well-structured navigation scheme is the design of clear interactions; this means making it clear for the user which items are interactive. This is done by making visual changes to menu indicators, using icons with labels, using different icons for different links, and using colors. This will allow the user to see which items can be clicked on or not. According to a Nielsen Norman Group study, a research-based user experience group, "users are roughly 37% faster at finding items... when visual indicators vary both in color and icon compared to text alone" (NNG, 2013). The point is to "combat confusion by thoughtfully designing interactions to be clear and understandable" (Lin, 2017).

The final step, and one that it is definitely key in accomplishing an effective navigation scheme, is the avoidance of deep navigation. This means that users can access the deepest nested page or window within one or two clicks. It is ideal to avoid deep navigation because according to the Nielsen Norman Group, “the deeper a hierarchy becomes, the more likely the visitors are to become disoriented” (NNG, 2013). The number of levels within the page must be limited; most websites operate with three to four levels of hierarchy, allowing content to be quickly accessible.

It is easy to get lost and have a “bag of worms” when it comes to designing a navigation scheme for content in a web or system application. But with proper information architecture (structure and labeling) and hierarchy, it is easy to develop a product in which the user will have a fast and natural experience.

9.7 - Prototype Design and Iterations

By definition, a prototype is a preliminary model of a project from which other forms are developed or copied. Prototypes can come in different shapes and forms, including a series of sketches, PowerPoint slides, cardboard mock-ups, storyboards, or software with limited functionality to achieve the desired goal. All of these examples can be put into two categories: low-fidelity and high fidelity. For now, let’s focus on why prototyping is so important for the design of a project.

Prototypes allow consumers to evaluate a project and allow designers to gain feedback on a specific portion of the project. This step is essential in the interaction design process. Prototypes are built with the purpose to answer questions and to give designers ideas about their approach to specific parts of projects. Because a prototype allows consumers to interact directly with the product, consumers and people interested in the project can give more accurate feedback; this is why it is “often said that users can’t tell you what they want, but when they see something and get to use it, they soon know what they don’t want” (Book p. 538).

One example of a famous prototype was IBM’s Simon. It was created in 1992 and was the world’s first smartphone. This phone had a touch screen and applications. Furthermore, it was the first touch screen phone with predictive typing. However, there were many downfalls: no app store, low memory, an expensive price tag, and a weak battery. Overall, it was not a success among users, as it was not the easiest device to interact with: “Simon spent a mere six months on the market, with around 50,000 units sold” (Aamoth). However, this could be considered a revolution to the market of smart phones that are available today.

Low-fidelity prototypes are ones that are nothing like the final version of the product; they are quick, cheap to make and can be altered easily. For example, sketches, storyboards, and base cards are all low-fidelity prototypes. Low-fidelity prototypes are created for exploration only (book p.542), meaning they are not to be integrated in the final version, and they are only there to allow designers to explore ideas and encourage modifications.

In the case of storyboarding, they are often used early in design and show through the means of sketches how a user should progress through a task. Sketching is a handwritten prototype, but one that consumers cannot even roleplay with, as in storyboarding; it is a more basic version, requiring nothing more than simple boxes, stars, and stick figures. Finally, card-based prototypes, are used more in website development and consist of 3x5-inch cards representing different windows or parts of the website.

High-fidelity prototypes, unlike the low-fidelity versions, are closer to the final version of the product. They will offer some of the functionality of the final product, but with a smaller set of functions or with fewer details.

To recap, low-fidelity prototypes are cheap, are used to evaluate concepts and explore modifications. But they are poorly detailed and are very limited in terms of usefulness for usability tests. High-fidelity prototypes are interactive; consumers can navigate through the product and get a look and feel of a final product, but require more resources compared to low-fidelity prototypes. It could be costly and time consuming to develop the prototype. Whichever is chosen, both are used to gather feedback to optimize final product.

9.8 – Evaluation and Usability Tests

UI evaluation and usability testing are vital in finalizing a UI design. When the implementation of a project is completed, the next step, and one that gets overlooked at times, is the evaluation and usability testing phase. These two things can play a big role in the success of the product. As a UI designer, one cannot predict how a user who was not involved in the creation of the product would interact with all the features available. Having third-party members involved in the evaluation of the product is almost guaranteed to provide an increase in the level of customer satisfaction. As stated earlier, evaluation and usability testing are very important because it gives programmers key user feedback and helps with finding problems when they are at an early stage and perhaps simple to fix. This step can go far to save the company money.

Every method of evaluation and usability testing has its advantages and disadvantages, depending on the nature of the UI design itself. Certain evaluation and usability testing methods may be favored. The early stages of the evaluation process tend to repeat until all basic system and user requirements are met. During this stage, cheaper methods of evaluation and testing are favored. The UI design iterates between the design/prototype phase and evaluation phase frequently. In the later stages of evaluation, the focus of evaluation shifts specifically to the study of user interaction with the UI itself. This phase generally conducts a large variety of usability tests to gather data on user interaction and satisfaction with the product (Minocha, Jarrett, Stone, & Woodroffe, 2005).

An extremely common method of evaluating a UI design is heuristic evaluation (HE). HE is best conducted by a small team of professional UI designers and evaluators. The professionals individually conduct an HE on the prototype UI for usability issues using a list of heuristic usability principles. According to a study conducted on the effectiveness of HE on UIs, relying on a single person to conduct the HE results in finding twenty to fifty percent of all usability errors within a system. However, when using a team of five evaluators to conduct HE individually, fifty-five to ninety percent of all usability errors were discovered. HE is very inexpensive, quick to conduct, and can be used very early in the evaluation process (Nielsen, & Molich, 1990). HE is a highly effective tool for uncovering usability errors within a UI design.

The goal of usability testing is to generate data that help measure the usability and user satisfaction of the UI design. A multitude of usability tests could be conducted (experiments, surveys, interviews, observations, etc.) to gather data on user groups specific to the targeted audience of the UI design. These tests could be conducted in controlled settings within a lab or a privately shared network. Controlled settings are good for revealing user-level usability problems but tend to be more expensive and may not translate to the setting in which the UI is meant to be implemented. Natural settings tests are usually conducted in public

settings where user behavior is uncontrolled and unpredictable. A natural setting is advantageous for gathering data on how certain user groups may interact with the UI design (Preece, Rodgers, & Sharp, 2015). The disadvantage of a natural setting is inconsistent data that results from free action by users.

There are 4 steps that can be taken to achieve a successful and efficient usability testing: creating a test plan, facilitating the test, analyzing the data from the test, and creating a report for each test.

Creating a test plan consist of creating a scope, recruiting the users that will be testing the product, identifying the objective, and establishing metrics. When creating a scope, the company must determine what area of the product is to be tested. After that, a number of users are to be selected demographically depending on the audience the program is aimed for. Next, it must be identified what the company wants to accomplish with the usability test, and finally, metrics are established to determine in what areas the program needs to be better by keeping track of success rate and goals reached.

Facilitating the test, the second step, is done by observing the users as they navigate the product without leading them with the intention to reach the desired goal. The test must be as close to a real-life scenario as possible. Testers must recognize if there are any problems users come across and come up with quick solutions for them. Finally, testers have an interview with the users post-test to determine how the product could be better.

The third step for a successful evaluation and usability test is analyzing the data collected from the testing. This data comes from the numbers gathered from the established metrics calculated while implementing the test plan phase of this 4-step process. Once all the information is gathered, it is time to look for patterns and trends that may arise, problems that may emerge, and solutions to be made.

The last step is to create test reports; they are to be made every time a usability test is completed. These reports must be kept together and consist of background summaries, explaining that was tested, and the desired goal for the session. The reports must also have descriptions of how the tests were conducted, describing the scenarios and what metrics where established.

Test results are key to a good report. All the results determined by the data metrics gathered are to be present in the report, and finally, the report is to have all the findings, the problems that emerged, and the solutions to them. This will help the company understand if the product is on the right track or needs modifications to meet the user expectations.

9.9 - Concise Summary

Building a software product can be a difficult task that contains many different components. Designing a UI can be broken down into phases that help building an entire interface more manageable. The first phase of the UI design process is determining business functions. The main objective of the UI should be determined by the business it is being created for. Before the UI design process begins, determining the intended business function of the interface will drastically affect the UI design process. The business functions that the UI could be used for are accounting, marketing, human resources, and production. The UI could be designed to help a specific business function or a mixture of multiple functions.

The second phase is determining and analyzing the requirements of the UI design. Qualitative usability requirements are general system requirements that pertain to usability standards that the UI must possess. Quantitative usability requirements are measurable system requirements like speed or capacity. Determining

the requirements of a UI design should be thorough and clear. The requirements will become a strict guide for the rest of the process. The UI must satisfy all requirements before being officially released.

Conceptual model development is the next phase in the design process. The conceptual models can be seen as generic blueprints for the UI. The models are created from the requirements gathered in the previous phase. The model creates a general architecture for the UI that satisfies all system requirements.

Next, the guidelines and screen design must be determined. The screen design is crucial for a positive user experience. Specifying guidelines like user control/freedom, error prevention, flexibility and aesthetics can help improve user experience as well as help the design process. The use of menus and navigation schemes can make user's ability to navigate a system much more enjoyable. Rules for navigation schemes are consistency, clear interactions, and avoiding deep navigation that require multiple steps to attend a page.

After all the conceptual designing is finished, the next phase is prototype design and iterations. A prototype is a primitive model of a system. Building prototypes can answer questions, and allow designers to gain a new perspective of a UI design now that a basic level of implementation has begun. Low-fidelity prototypes are cheap and quick—great for beginning the prototype designs. High-fidelity prototypes are more robust models that tend to look a lot like the final product. These prototypes take more time and resources to make, so they are usually included later in the prototyping phase.

The final phase of the UI design process is evaluation and usability testing. The evaluation process is to ensure that the product itself meets all requirements and everything works properly. Evaluation of a UI design is crucial for getting the desired effect and quality of a product. Usability tests are conducted on the product to gather data on the intended user and their experiences using the product. These tests could reveal a problem with the design's usability. The UI design may reiterate to and from the prototyping phase and evaluation phase if the evaluation of the design proves that it should be redesigned. When the UI design passes the evaluation and usability testing phase, it should be a good design that meets all requirements and satisfies its intended business functions.

9.10 - Extended Resources

Descriptions & Links

1. Key Principles for User-Centered Systems Design
<https://www.tandfonline.com/doi/abs/10.1080/01449290310001624329>

2. Interactive Sketching for the Early Stages of User Interface Design
<https://apps.dtic.mil/dtic/tr/fulltext/u2/a285339.pdf>

3. Four Stages of UI Design
<https://www.youtube.com/watch?v=7LZ14xtfOc>

4. 5 Phases for UX Designer
<https://www.youtube.com/watch?v=hEE-RjvvoqQ>

5. 10 Rules of Good UI Design to Follow
<https://www.youtube.com/watch?v=RFv53AxxQAo>

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