

User Interfaces and Interactions

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6.1 - Introduction and Background

Within the past several decades, the way people have been interacting with each other has been changing at an increasing rate; much of this is due to the waves of successful research in Human-Computer Interaction (HCI). As stated by Myers in “A Brief History of Human Computer Interaction Technology,” another effect of the evolution in Human-Computer Interaction is that with every new model of computer, cellular device, or Internet of Things (IoT) device, the process of computing at a fundamental level is changed. A small modern example that has a big impact on society is the way in which cellular devices keep on changing in shape and in size (Myers). Keyboards are getting smaller while screens are becoming larger. All this change emphasizes the importance of user interfaces and interactions.

Technology has progressed because it is taught and emphasized in schools. As a result, there are high schools specialized in science, technology, engineering, and mathematics. Most of the successful stories we hear in the news are from universities that spend the majority of its resources in STEM research, and we should give credit to where it is due.

Some of the most basic interactions are keystones for advancements in technology. For example, direct manipulation of graphical objects, from moving around screens on a monitor and resizing objects to a user’s preference, is very important, because making the user happy in the first place is what drives innovation and upgrades. Someone could say the functionality of being able to resize windows on a computer would be one of the world’s first widgets for a computer. To take this a step further, drawing using a simple paint program was the next step. Watching lines being created in real time by the user was amazing, especially when it was virtual. This helped many artists come up with new ideas of art and pushed that industry to new realms as well. Text editors became the new typewriters (Myers).

Another basic interaction that was a keystone in developing how people interact today was the mouse. Myers says the mouse is as integral as breathing. Sure, someone could still maneuver through a computer without a mouse, but the average user would not be doing that. The average user will be wanting to just point and click instead. When the point-and-click feature came about, this revolutionized the computer industry and made computers more user-friendly, which in return allowed more users able to use computers.

The mouse was just a catalyst though. Now, as technology is advancing more rapidly, users are able to simply touch the screens of their mobile devices and do whatever task they would like to do. There are even further advances now so that users are also able to look at their phones to unlock them and make purchases. There are now gestures you can do in front of devices which will allow certain functions.

6.2 – Interface and Interaction Styles

Direct manipulation is an interaction pattern of real, incremental, and reversible actions. This behavior is instantly visible on the screen. An object in HCI mode refers to the user as though it were handled directly by an action in the real world.

Direct manipulation has many characteristics and is represented as physical procedures rather than complex syntax. Actions are already performed through clicks, button presses, menu selections, and gesture touches. Drag-and-drop file transfers are directly analogous in the real world, and move operations include a valid ID that makes learning and remembering easier. With continuous feedback and incremental reverse action, it is easy to see why the status of the system leads to the correct result for each task. As a result, when a user encounters an error, they can easily see the cause of the error and return easily. Conversely, the command-line interface can contain multiple components that can cause errors in a single user command.

By visually presenting potential activities and activities within the system, users can see what they can do by recognizing processes that are likely to achieve their goals without remembering them. They do not have to learn and remember complex syntax. As a result, the online processing interface may require initial modifications, but the learning required may be less important.

All interfaces are based on the audience of the DM drawing component. As the number of touch devices rapidly increased, the digital user interface DM has changed in many areas away from the metaphor of the original office. Improved reality systems and virtual reality will make Dubai's financial markets a new world. In spite of many negative aspects, large-scale direct processing on most user interfaces is recommended. All interaction methods carry some flaws, and if one does not pay attention to detail, it can result in breakage. UX does not have a magic bullet, but obviously design ideas that can improve usability are obvious.

The user interface is based on the concept of direct manipulation by multi-touch gestures. There are various types of gestures: swiping, tapping, pinching (pinching with two fingers), and reverse pinching (pinching with two fingers). In addition, some applications use a built-in accelerometer to rotate the device vertically to rotate the screen horizontally or vertically.

Direct manipulation is closely related to interfaces that use windows, icons, menus, and the WIMP GUI, as they always incorporate at least some direct manipulation. However, direct manipulation with these other terms should not be confused, because it does not include the use of windows or even output graphics. For example, direct processing concepts can be applied to interfaces for blind or visually impaired users, using a combination of hardware and audio and touch software.

6.3 – General Principles of User Interface Design

When looking to create a user interface design, one must consider what the interface is being designed for. What does the user want, what will the users use it for, and what device will the user use the interface on? Then one will need to mold the interface to what the user has specified and/or what is going to be required from the user, while fitting it into a specified device. When doing this, there are some general principles or rules for design that one can follow when designing an interface for the user.

There is one obvious starting point: the user will have to know and understand how to start the interaction with the interface. In other words, the interface should be “obvious” for the user to start. This can also be defined as being pre-attentively processed: “These preattentive features have been proven to ‘pop-out’ to the user and it includes things like size, value, hue, orientation, shape, enclosure, blurriness and movement.” (*User Interface Design Principles for Interaction Design*) A starting point would be needed for a design, because every new interaction with a new interface involves a certain learning process. Humans can learn through finding a pattern throughout certain details, and when learning an interface this is no different. In order for the user to learn a new interface as easily as possible, the user must know where to begin. An example would include getting a brand new laptop. The user would need to know where a definitive start button is in order to begin to learn the new device/interface. The user when starting the interface should almost get full understanding of the subject matter as soon as they take one look at the interface.

At any given point during the user’s interaction with the interface, the user must know how to reverse an action. This “reverse” includes items such as how to exit a session or end a session or how to return to a previous action. This reverse doesn't necessarily need to “pop-out” as much as the starting action, but it will still need to be obvious to the user: “The reversal should almost be omnipresent and clear, but at the same time subtle.” (*User Interface Design Principles for Interaction Design*)

This leads on to the next principle, Consistency. When designing a new interface you will need to be consistent with the way the interface is designed. Patterns should be consistent throughout the interface. The user will be able to depend on an acceptable level of consistency in order to reinforce the pattern. Consistency is one of the most comprehensive principles when it comes to good interface design.

What makes a good interface is the overall visualization of the interface. The way the information will be presented to the user is very important. It will determine how the user will sense and feel while also putting as much information as possible into a quick, perceptual encounter. The visualization of a large amount of information is incredibly important when designing an interface. The interface should be able to transform large amounts of incomprehensible data into something the user should be able to understand with ease. Not only should they be able to process the data with ease, but the information should be visually engaging to the user. This will assist the user to navigate the interface, because it will engage the user and keep the user interested with the information presented. One of better visual forms is one that reflects the nature of the content in a very stimulating way. (*User Interface Design Principles for Interaction Design*) An interface that has failed to keep the user engaged is poor in practice, because the user will disengage from the interface and will no longer interface with the content provided. A good example of an interface keeping the user engaged would be along the lines of a Museum exhibit. It will show off the information it would like the user to see and relays the information in an engaging form. An application with an engaging interface will make the user want to return and continue to use the application.

To expand further on the general principles listed above, when designing an interface one will have to design it in a supportive rather than a decorative way. This pretty much means that “the information being presented in one medium needs to support, relate to, or extend the information presented in the other medium.”(*Principles of Educational Multimedia User Interface Design*) When one adds very closely related or very supporting images, illustrations, text or sound in the context of information, it greatly improves the learning performance of the user.

Users will want to see multimedia presented synchronously. This means that for example, when a student is in a lecture, they are more likely to grasp the problem or topic at hand if the lecture is accompanied

with a visual aid and or real time problem being solved. The user wants the information to be displayed synchronously. (*Principles of Educational Multimedia User Interface Design*)

The user should not have to wonder whether different words, actions, or styles mean the same thing within an interface. The interface should follow platform conventions. Next the user should be able to recognize rather than recall. This means the interface should “lower the user’s memory load by making objects, actions, and options visible.” (*Usability Heuristics for User Interface Design*) The user should never have to go about and remember information from one part of the interface to another part. There should be instructions to use the system visible or easily retrievable whenever in the interface.

Visibility of system status is critical to a user interface. This means that the user should always know what the system is doing and what is happening through appropriate feedback within a reasonable time. Next, there should be a match between the system and the real world. This in a sense means that the interface should speak to the user with language, words, phrases and concepts that are familiar to the user. The system should do that rather than employing system-oriented terminology. Next is the user control and user freedom. Users will need to have clearly marked ways to navigate the interface: “Users often choose system functions by mistake and will need a clearly assigned ‘emergency exit’ to leave the unwanted state without having to go through an extended dialogue.” (*Usability Heuristics for User Interface Design*) The user doesn't want to have to search for a way to navigate the application, but instead the user would like to know at all times how to get back to a certain page and or how to move forward through the interface without any problems. Another factor to consider is, as stated above, consistency and standards. The user should not have to wonder whether different words, actions, or styles mean the same thing within an interface. The interface should follow platform conventions. Next the user should be able to recognize rather than recall.

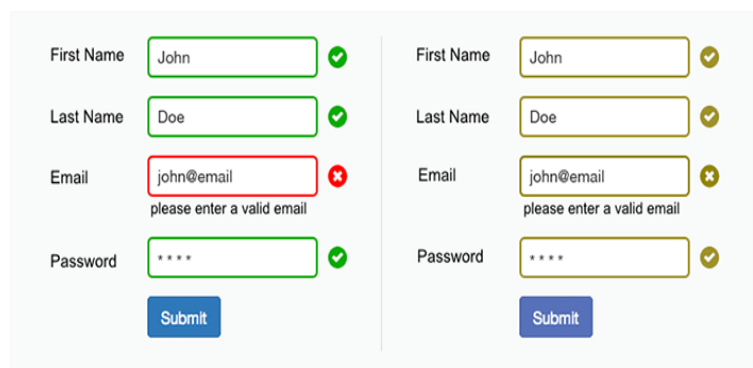
Along with that, the interface should be flexible and efficient as well as aesthetically pleasing to the eyes with minimalist designs. There should not be paragraphs of information being shoved at the user, and the actual design of the interface should be relevant to the information it is trying to convey. Finally, the interface that one is designing should always have a way to help the user send feedback to the creator. This helps the application improve. With user feedback the interface can fix or improve as a whole and make the experience of the user improve as well.

When designing an interface, a user must be presented with options that are clearly described and presented. When done efficiently, the user will be able to intuitively use the interface. The first step of designing a clear UI is removing all unnecessary elements. Remove any irrelevant or rarely used buttons, descriptions, pictures, etc. that do not benefit the interface. With these distractions removed, the user can focus more on productivity and efficiency by reducing his/her cognitive load. Once the correct set of controls have been established, ensure each are labelled clearly and appropriately, avoiding any jargon when available. Any uncertain term used can cause an obscuration of basic information resulting in confusion and frustration for the user.

At this point, a clear and simple but complete interface has been created. With this foundation, some styling effects can further simplify use. The first choice to consider is control size and placement. Ensuring each button, field, textbox, etc., is appropriately sized and placed, and thus draws an appropriate amount of attention, is an important concept to understand and very hard to master. For an exaggerated example: when filling out an online form, one expects a moderately-sized “Submit” button at the end of the form, not the middle. By placing these controls where and in a manner the user expects, he/she will be able to intuitively use the designed interface. Similarly, colors are often an intuitive way of conveying information. In the above

example describing an online form, the user is said to be expecting a moderately-sized “Submit” button at the end of the form. By coloring this control in a vibrant color, the interface designer can draw the user’s attention down to the control to further indicate its position and clarify the final step the user needs to take. By altering size, placement, and color, an interface designer can abstractly guide the user through the interface.

After the above basic principles have been applied, an interface is nearing the end of this design phase. Unfortunately, the aforementioned principles apply only to the average user; user interfaces must support all users. A simple and common example is color blindness. This condition affects 4.5% of people in Britain, and approximately three hundred million people worldwide [19]. As a result, color blind users must be considered while designing interfaces. Now that a target user has been identified, the designer must understand the user’s challenges and provide alternate means of communication. In this instance, any control using color to convey information should also be paired with a visual cue illustrating the same information the color would. The illustration on the right shows a correct design for providing user feedback for an information query [20]. The illustration displays the necessity of visual cues (‘x’ or a check mark) for the color blind and a clear, appropriate way to do so. This one small example is a gateway to understanding the delicate relationship between the human condition and interfaces and how the experience varies from person to person. Designing an interface that accommodates as many people as possible is necessary when developing a well-designed, highly adopted interface.



6.4 - Concise Summary

Within the past several decades, the way or art of how people have been interacting amongst each other has been changing at an increasing rate, and this is all due to the results in the waves of successful research in Human-Computer Interaction (HCI). As stated by Myers in “A Brief History of Human Computer Interaction Technology”, another effect of the evolution in Human-Computer Interaction is that with every new model of computer or mobile device, the process of computing at a fundamental level is changed.

Direct manipulation is an interaction pattern using real, incremental, and reversible actions. This behavior is instantly visible on the screen. An object in HCI mode refers to the user as though it were handled directly by an action in the real world.

All in all, general principles of user interface design are various different ideas or concepts that many people use when designing their interface. When someone is designing an interface there are also a few things they will need to consider beforehand: what the user wants, how the interface will look, how the user will interact, and what device the interface will be hosted on. They will then need to fully design the interface around those parameters while also maintaining with a constant design focus.

What makes a good interface is the overall visualization of the interface. The way the information will be presented to the user is very important. It will determine how the user will sense and feel while also putting as much information as possible into a quick, perceptual encounter. The visualization of a large amount of information is incredibly important when designing an interface. The interface should be able to transform

large amounts of incomprehensible data into something the user should be able to understand with ease. Not only should they be able to process the data with ease but the information should be visually engaging to the user.

When developing an application and user interface not everyone is perfect and one can start to make mistakes. The interface may be too hard to navigate or there is too much information on the screen at once. The creator of the application/interface may never know about these issues unless they implemented a way for the user to send their feedback about their experiences with the application.

6.5 - Extended Resources

Descriptions & Links

1. Video list 10 rules for good UI design.
<https://www.youtube.com/watch?v=RFv53AxxQAo>

2. Video lists 5 ideas of what a good UI design should have.:
<https://www.youtube.com/watch?v=bqq4sdIDXas>

3. Video explain about broadcast of the Direct Manipulation presentation.
<https://www.youtube.com/watch?v=CWgPe8VjTsM>

4. Video addresses cutting-edge issues in human-computer interaction. These broadcasts bring some of the best minds in the field together and question-and-answer sessions.
<https://www.youtube.com/watch?v=cepMzVwLiik>

5. Video shows the 6 common types of UI Users:
<https://www.youtube.com/watch?v=4g3HQoFgTmo>

6. Video shows examples of how to design Modular UIs.
<https://www.youtube.com/watch?v=agPAkIO7sIY>

6.6 - References

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