

Module_1

Prominence of User Interface Design

CS 4712

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Introduction to the Prominence of UI Design

- Today we live in an age in which people can effectively use some of the most advanced pieces of technology without a complete because of the many developments of User Interface Design.
- **User Interface Design:** User interface design is a sub-set of interaction design primarily dealing with the interactions involving people and machinery.
- **User Interaction Design:** “Designing interactive products to support the way people communicate and interact in their everyday and working lives” (Sharp, Rogers, Preece, 2015).
- User interface design became a prominent design focus because it allowed these advance machineries to become *wanted* instead of solely being *needed*.



Introduction to the Prominence of UI Design (Cont.)

Early Computers UI Design

- Unfortunately, the only way to communicate with early computers were to use written words that are typed out for every specific command. Many people were slow on the uptake because due to the unfamiliarity of typing (Galitz, W. O., 2007).
- Through the use of the command prompt, the user interface was mainly in a form of question and answer, but this was a time before autocorrecting (Hopkins, 2017).
- The user interface design's output of these computers was also poor because the computer's output was mainly only coming in the form of new words and symbols on the screen with a lack of auditory changes.



Introduction to the Prominence of UI Design (Cont.)

Modern Computer UI Design

- In the 1970s, Xerox developed the GUI
- Graphical User Interface: A User Interface that uses pictures and other visuals to help aid the user (Galitz, W. O., 2007).
- With the GUI, people can now control where and what they can type instead of having to move the cursor with keys.
- With color, these computers became able to relay important information effectively, and organize data into a beautiful presentation for all to see.
- The new and updated user interface designs became usable because of the control the mouse gave and provided a better user experience because of the new colorful functionality that came with the mouse and colors.



Introduction to the Prominence of UI Design (Cont.)

- Humans and computers have a unique relationship because computers can provide constant feedback for each action the user makes and can lead to a dynamic devices.
- ***human-Computer Interaction (HCI) is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.***
- These devices can be used for multiple situations such as solving equations or help with automation of machinery.
- The user interface is made up of two major components: the input and the output (Galitz, W. O., 2007).
 - **Input:** what the user gives to the computer such as a
 - mouse click or a key press.
 - **Output:** what the computer gives the user after such as
 - a sound response or the changing information on the monitor.

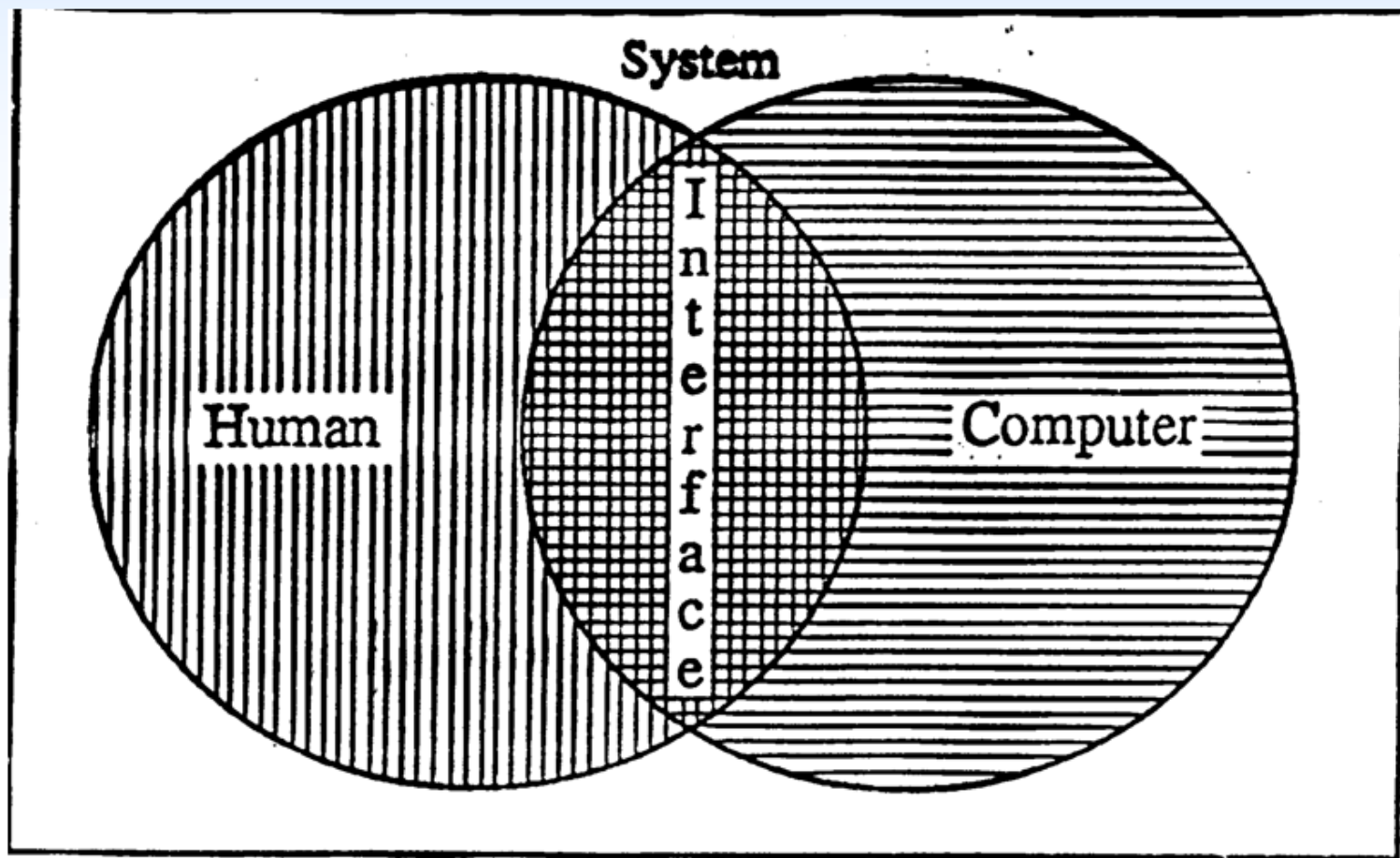


Figure 1-1 Computer-human interaction: a definition.

Human Brain

- You might have only a few gigabytes of storage space in an iPod or a USB flash drive.
- Yet **10 million neurons** combine so that each one helps with many memories at a time, rapidly increasing the brain's memory storage capacity around **2.5 petabytes** (or a million gigabytes), *which computer had less than 1% of human Brian memory.*



A Brief User Interface Timeline (Cont.) (Hopkins, 2017)

- **1760 –1914: The First and Second Industrial Revolution:** Mass-production Machinery were invented so that people can easily complete task such as setting up large railways or using steam to power boats.
- **1939: The First Electronic Speech Synthesizers are Unveiled:** The Volder was a device that could use electrical pulses to recreate human speech. This was one of the first examples of human speech interactions with a machine.
- **1973: Xerox's Palo Alto Research Center (PARC) and the First GUI:** Developers working for Xerox built the Xerox Alto, which was the first Graphical User Interface.
- **1981: The IBM PC, the First Industry-wide Accepted Personal Computer:** "The IBM PC revolutionized business computing by becoming the first PC to gain widespread adoption by industry."
- **1984 -1995: The Macintosh (OS System 1.0)/Win 95:** "Apple crafted that could be welcomed by any type of person, without overwhelming"
- **2001: Microsoft Windows XP and Apple Mac OSX:** These Operating operating systems and help conceptualize how user interface designs
- **Present Day:** Virtual Reality, Holograms, Gyroscopes and more.



Interaction and Interface Design

- The interaction with the machines can be broken down into two main sub categories, Interaction and Interface design. **Interaction is based on how the users (the humans) interact with the computers also known as Human Computer interaction (HCI).**
- Some Examples of HCI include:
 - **Voice Controls**
 - **Mouse and Keyboard**
 - **Gesture based appliances**
- Interface Design focuses more on the designs that users

Interaction and Interface Design (Cont.)

- Even though when Human Computer Interaction first became a thing in 1980s with the use of personal computers, it was initially related to computers, but now it has vastly expanded to cover almost everything that is related to technology.
- **“HCI deals with questions of human perception, cognition, intelligence, decision-making and interactive techniques of visualization, so it centers mainly on supervised methods” (Holzinger, 2013).**



Virtuous User Interface Design

- As we develop new User Interfaces to accompany these new devices, not only do we have to ask,
 - “what is the best way to develop the UI”?
 - “How will the user react to the UI?”
- To make an effective Virtuous User Interface, we must determine
 - if the user should have full freedom;
 - what information is given to them;
 - and how the user interface is presented.
- If we follow these principles, the user will be able to have a positive user experience.



Virtuous User Interface Design (Cont.)

- When interacting a User Interface, the amount of freedom and choices will have a major impact on the user experience before they even interact with the UI.
- These choices can range from every single button on a keyboard to the number of buttons on an elevator.
- To make effective uses for choices in Virtuous User Interface design all depends on the device (Sharp H., Rogers Y., Preece J., 2015).
 - Small choices excel in machines with short interactions and with users that have little to no experience with the product.
 - Having a mass freedom of choices excels with long interactions and users who are experienced with the product.

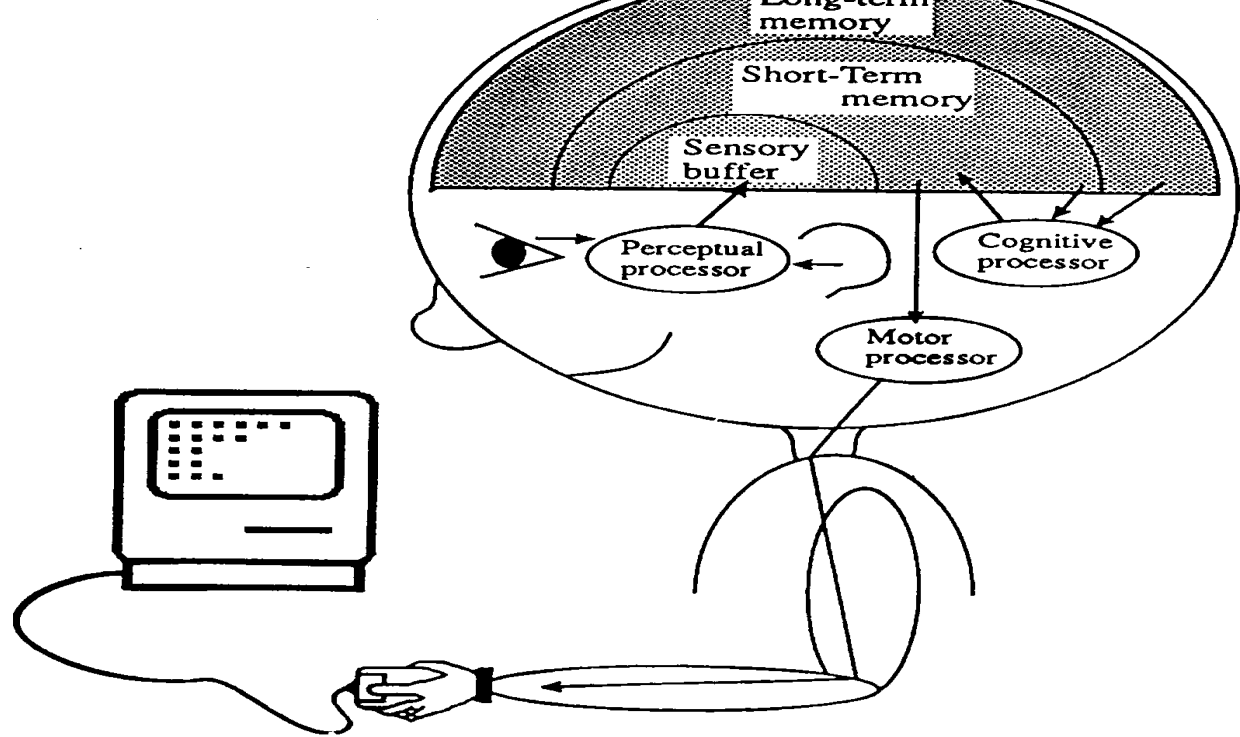


Figure 2-3 The human information processing system. From Card, "The Model Human Processor: A Model for Making Engineering Calculations of Human Performance," *Proceedings of the Human Factors Society 25th Annual Meeting*, 1981, 301-5. © 1981, by the Human Factors Society Inc. Reprinted with permission. All rights reserved.

Reduce Short-term Memory Load

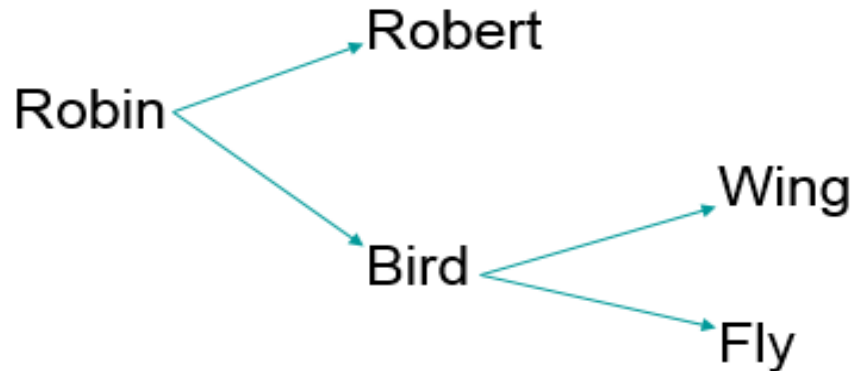
- Rule of thumb: Humans can remember 7 ± 2 chunks of information
- Displays kept simple
- Multiple page displays should be consolidated
- Training if using codes, mnemonics, long sequence of actions
- Online access to command-syntax, abbreviations, codes, etc.

MHP – *Working Memory*

MHP – *Model Human Process*

MAXIM

Chunks in WM can interfere with each other due to LTM associations



MHP (Modern Human Process) – *Long-Term Memory*

- The cognitive processor can **add items to WM but not to LTM**
- The **WM must interact with LTM over a significant length of time** before an item can be stored in LTM
- This increases the **number of cues** that can be used to retrieve the item later
- Items with **numerous associations have a greater probability** of being retrieved



MHP – *Processor Timing*

- **Perceptual**—The perceptual system captures physical sensations by way of the visual and auditory receptor channels
- Perceptual decay is shorter for the visual channel than for the auditory channel
- Perceptual processor cycle time is variable according to the nature of the stimuli

Perceptual Processor cycle time = [50-200] msec

MHP – *Processor Timing*

- **Cognitive**—The cognitive system bridges the perceptual and motor systems
- It can function as a simple conduit or it can involve complex processes, such as learning, fact retrieval, and problem solving
- **Cognitive** coding in the WM is predominantly visual and auditory

Cognition Example: Perception/LTM interaction

Read out the colors and time it T1

Human

Computer

Interface

Impression

Memory

Scheme



Perception Speed: Time it, T_2 , $T_1 > T_2$

Green

Purple

Orange

Red

Blue

Yellow



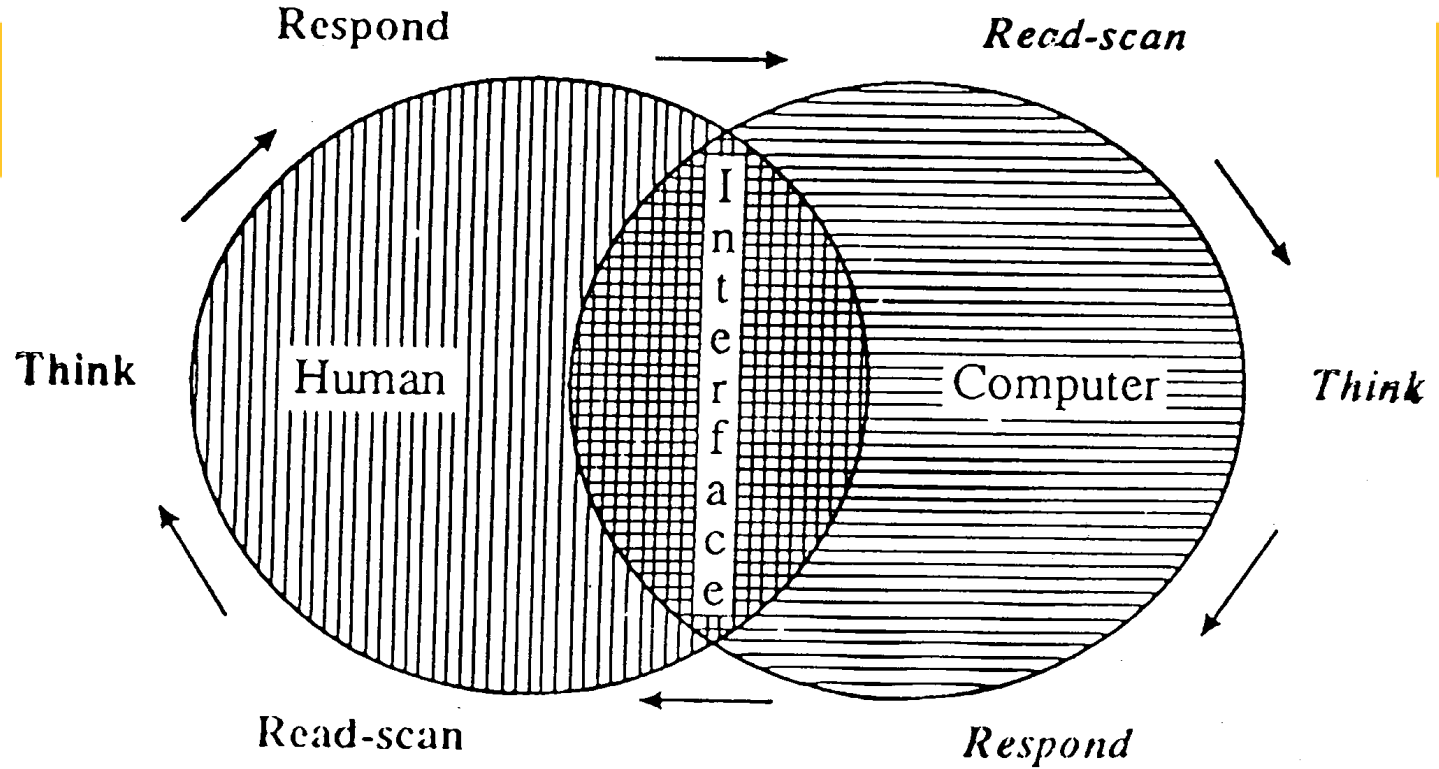


Figure 2-2 A three-phased model of computer-human interaction.

User Experience

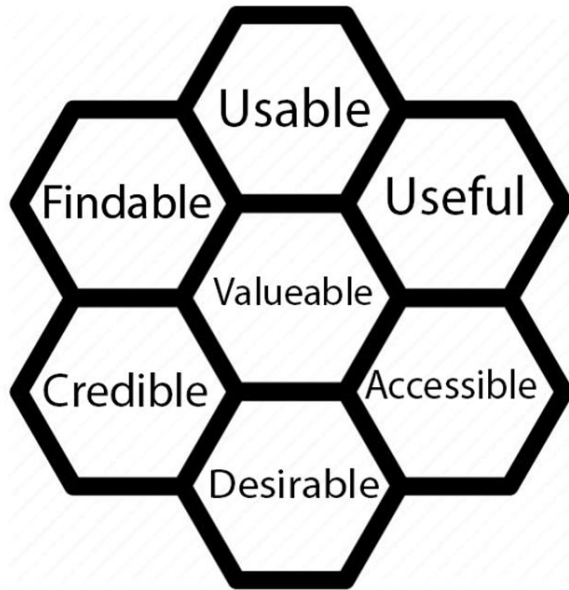


Fig 1.1 Honey Comb UX (Kabir, 2019)

- One of the key elements of User Interface is Design is **user experience**.
- **User Experience:** The overall experience of using an interface and how well did the enjoy the interactions (Morville, 2016).
- **Peter Morville argues that the 7 most important key factors that are related to user's experience can be shaped into a **honeycomb**.**
- These are *usable, findable, useful, valuable, accessible credible, valuable and credible* (Moreville, 2016).



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User Experience (Cont.)

Useful

- If a product, system or service isn't useful to anyone what is the point of bringing in the market?
- A good example of this would be something that's fun, people seem to enjoy different things. A new completely new genre of video game might be loved by some people while completely being hated by the rest.

Usable

- Usable is one of the most important things out of all of these factors, mainly because it allows the users to work efficiently and effectively.
- Usability can range from hardware to software.



User Experience (Cont.)

Findable

- As the name implies findable refers to how easy, or hard it is to find a specific product.
- If the product is a software then it should have content such as toolbars and menu items which are easy to find too.

Desirability

- Desirability in user experience is conveyed through branding, image, identity, aesthetics and emotional design.

Accessibility

- The software should be accessible by all so people with disabilities can also use the product.

User Experience (Cont.)

Valuable

- The product must be beneficial to its user.
- A product that costs \$500 and solves \$10,000 issue will succeed but on the other hand if a \$10,000 product solves a \$500 issue people won't be that inclined to buy that product as it is a waste of money.

Credible

- Credibility relates to how is going to trust you with the product.
- It can depend on a lot of things such as:
 - How long your products last?
 - How long do you keep sending out updates for them?
 - How accurate is your information?



Process of Interaction Design

- User interface and user interaction design are one of the two crucial pillars of User Interface.
- User interface, commonly confused with user experience design is a part of user Experience but is more towards the side of “surface and overall feel of a design”.
- According to the website Interaction-Design.org one analogy is to picture UX design as a vehicle with UI design as the driving console.

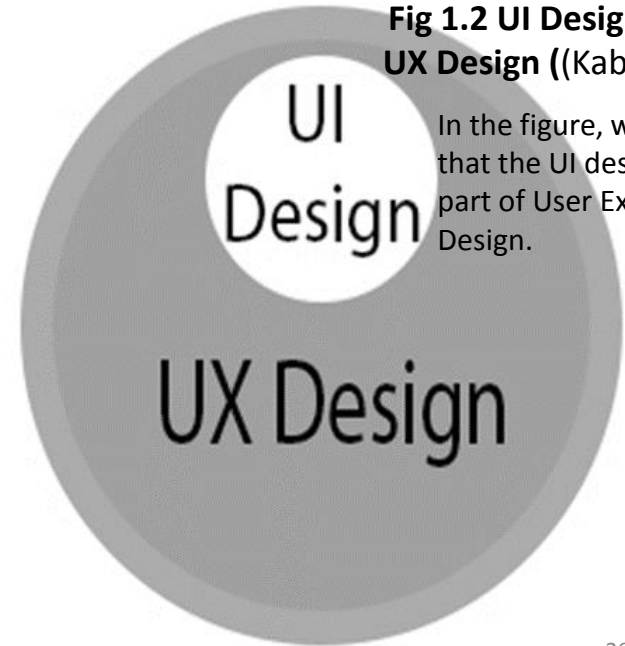


Fig 1.2 UI Design part of UX Design ((Kabir, 2019))

In the figure, we show that the UI design is a part of User Experience Design.

Process of Interaction Design (Cont.)

- For interaction designs it is more than just software, anything that is materialistic or in computer that has some sort of design is related to interaction design.
- According to Interaction design foundation there are 5 dimensions of IxD. These 5 dimensions were defined by Gillian Crampton Smith and Kevin Silver(IDF, 2016).
 - (1d) Words
 - (2d) Visual representations
 - (3d) Physical objects space
 - (4d) Time
 - (5d) Behavior

Process of Interaction Design (Cont.)

(1D) Words - are related to text, basically it consists of whatever the user can read without having any interaction to the user, such as a label. Its only purpose is to provide the user with the right amount of text.

1D: Text

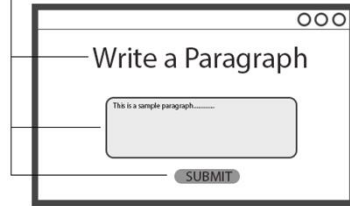
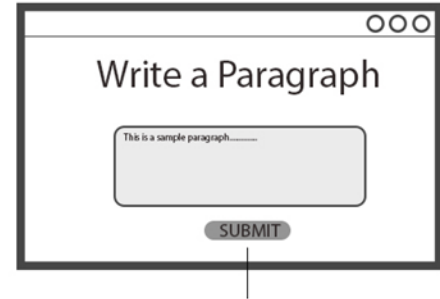


Fig 1.3 UI Design 1D ((Kabir, 2019))

(2D) Visual representations - are items that are graphical elements such as images, typography and icons which are supposed to help the users.



2D: Visual representation

Fig 1.4 UI Design 2D ((Kabir, 2019))

Process of Interaction Design (Cont.)

(3D) Physical Objects - This involves the medium through which the user interacts with the product such as software or a specific product, some examples of this would include laptop, computers, mobile phones, tablets etc.

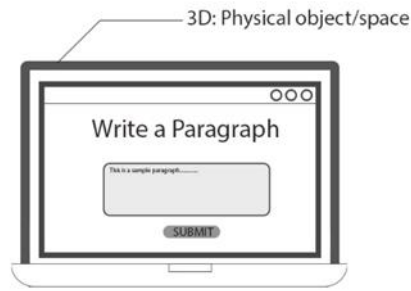


Fig 1.5 UI Design 3D ((Kabir, 2019))

(4D) Time – Time relates to things that change with time, such as media. This would include any animation, videos, and sound



Fig 1.6 UI Design 4D ((Kabir, 2019))

Process of Interaction Design (Cont.)

(5D) Behavior – This is how all of the previous dimensions come together and interact with each other. This also includes users input and output based on that.



Fig 1.7 UI Design 5D ((Kabir, 2019))

Guidelines in Interaction and Interface Design

- As the development test out what design choices improves on the prior design choices, **but there is no true universal set of rules on what makes good User Interface designs.**
- ...Instead, we have
- **Guidelines that help paint a picture on what proper Interface and Interaction design should look like.**

Table I.1 Two Best-Known Lists of User-Interface Design Guidelines

Shneiderman (1987); Shneiderman and Plaisant (2009)	Nielsen and Molich (1990)
Strive for consistency	Consistency and standards
Cater to universal usability	Visibility of system status
Offer informative feedback	Match between system and real world
Design task flows to yield closure	User control and freedom
Prevent errors	Error prevention
Permit easy reversal of actions	Recognition rather than recall
Make users feel they are in control	Flexibility and efficiency of use
Minimize short-term memory load	Aesthetic and minimalist design
	Help users recognize, diagnose, and recover from errors
	Provide online documentation and help

Guidelines in Interaction and Interface Design (Cont.)

- **Most of these guidelines all are similar to each other because these rules have one very common factor: “Psychology”.**
- **All of these guidelines are based off of the human psych or in other words, these guidelines are optimized based on how people perceive, learn and reason with the user interface (Johnson J., 2014).**
 - By focusing on the **structure of the UI**,
 - the **control that the user has**, and
 - how understandable the UI can be, these guidelines  **KENNESAW STATE UNIVERSITY** can be a tool to make design decisions that leads to the best user experience.

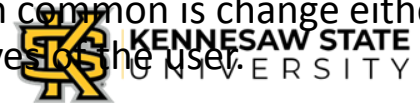
Guidelines in Interaction and Interface Design (Cont.)

- Patterns are universal phenomena that the human brain tends to recognize in most cases and we can use these patterns to make an effective user interface.
- In many different user interface guidelines, a focus on a consistent structure is key to make an improved user interface (Johnson J., 2014).
 - **Norman:** The system should be consistent in its structure and design.
 - **Stone:** The structure must be made so that the content of the user interface is organized sensibly.
- If the user interface is not structured such as having only bulletins or only in a paragraph form, then information can be easily looked over or missed interpreted.



Guidelines in Interaction and Interface Design (Cont.)

- To make a user interface acceptable to all levels, it has to be completely understandable to the user.
- Two major guidelines that are key to make the user interface understandable is:
 - **The interface should have the ability to give quality feed back after a command is sent (Johnson J., 2014).**
 - **The user interface should be visually appealing (Johnson J., 2014).**
- Many common forms of feedback are seen through sound, animations, and changes to color.
- The one thing that all of those three types of feedback have in common is change either from a new sound from silence or a new visual to catch the eyes of the user.



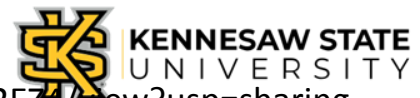
Guidelines in Interaction and Interface Design (Cont.)

- As we look and compare each variation of guidelines, we see that there is no correct version of User Interaction Guidelines.
- These guidelines are merely suggestions that help hone a skill instead of a hard rule to follow (Johnson J., 2014).
- A lot of them have many things in common, but they all are designed for the user.

More Examples from major companies: <https://balsamiq.com/learn/resources/reference/ui-guidelines/>

Extended Resources

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Initial Preparation by: Christopher Budden and Mohsin Kabir