1.Introduction to Interaction Design and User Experience

IT4106 – User Experience Design

Level II - Semester 4

Human Computer Interaction (HCI)

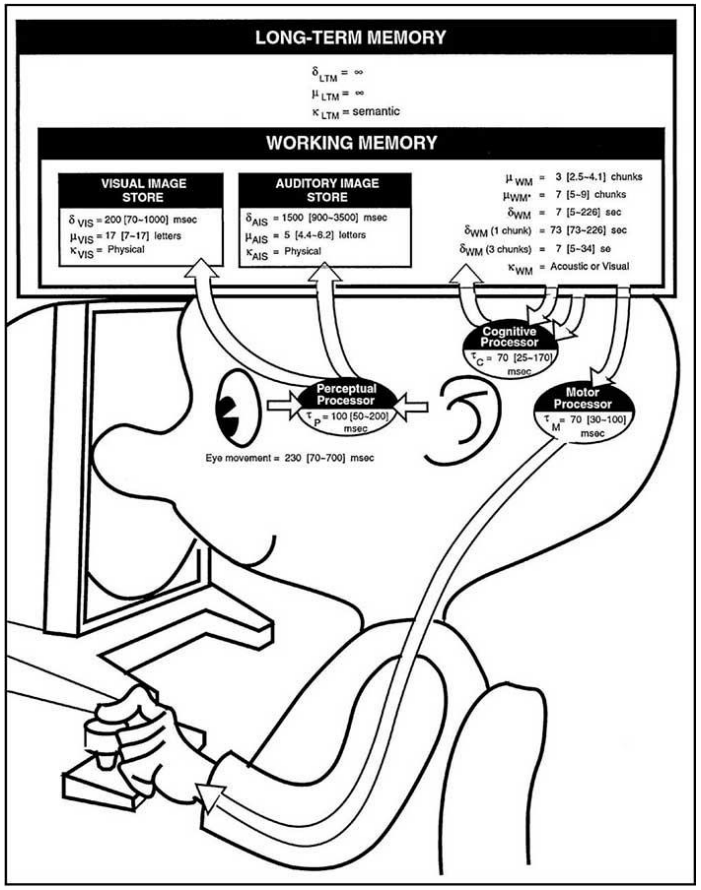
- Human-computer interaction (HCI) is an area of research and practice that emerged in the early 1980.
- HCI has expanded rapidly
- HCI now aggregates a collection of semi-autonomous fields of research and practice in human-centered informatics

https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/human-computer-interaction-brief-intro

History of HCI

- Until the late 1970s, the only humans who interacted with computers were information technology professionals
- Emergence of personal computing
  - personal software
  - personal computer platforms

Personal computing presented the practical need for HCI, cognitive science presented people, concepts, skills, and a vision for addressing such needs through an ambitious synthesis of science and engineering

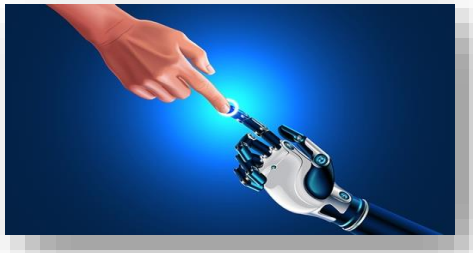


Past and the Present

- In the past, computers were expensive & used by **technical people** only
- Now, computers are cheap and used by **non-technical people** (different backgrounds, needs, knowledge, skills)
- **Interacting with technology** has become an essential part of everyday life for most people.
- People are busy and may spend little or no time actually learning a new system.
- Therefore, computer systems should be **easy to use, easy to learn and with no errors.**
- To design and develop of such a system is a major concern of HCI

Human Computer Interaction

- **Human**
  - The end-user
  - The members of an organization
- **Computer**
  - Hardware
  - Software
- **Human Computer Interaction** is a process of information transfer from
  - User to Machine
  - Machine to User



Human Computer Interaction(HCI)

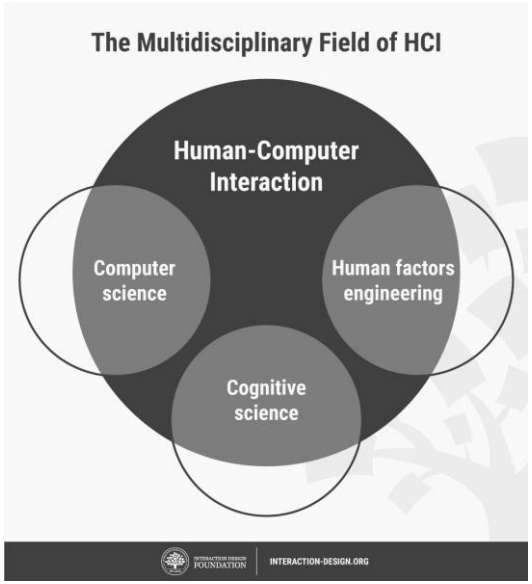
Human-computer interaction (HCI) is a “discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them” (ACM SIGCHI, 1992, p.6)

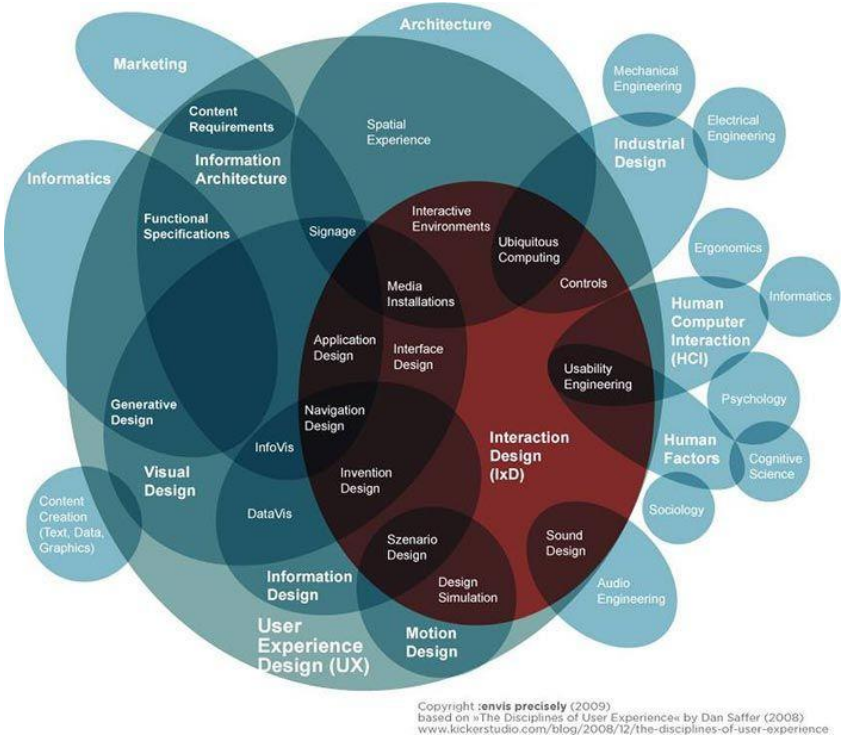
The Goals of HCI

- Create usable software - enabled products and user-interfaces.
- Enhance the usability of existing products
- Identify problems and tasks (such as in the workplace) that can be addressed with software products

HCI is an Interdisciplinary Field

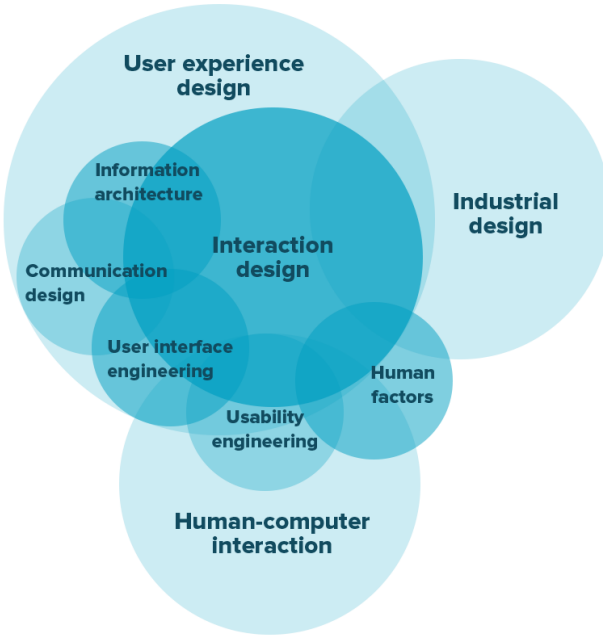
Human Computer Interaction (HCI) is an **interdisciplinary field** in which computer scientists, engineers, psychologists, social scientists and design professionals play important roles.





Human Computer Interaction

- Historically, HCI had a narrow focus on the design and usability of computing systems.
- HCI has greatly expanded in its scope (Churchill et al., 2013)
  - Cars,
  - home appliances
  - furniture,
  - Clothing
  - …



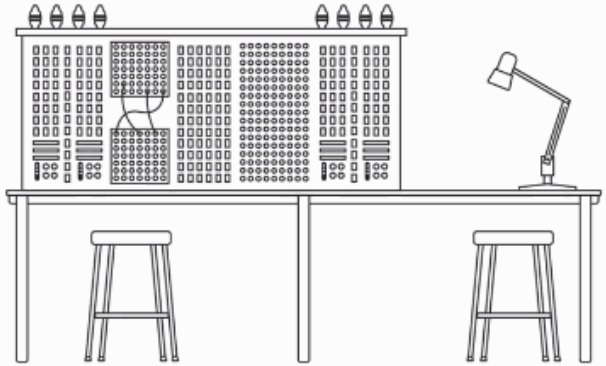
Modern day HCI – 3 Paradigms

	Paradigm 1: Human Factors	Paradigm 2: Classical Cognitivism/ Information Processing	Paradigm 3: Phenomenologically Situated
Metaphor of interaction	Interaction as man-machine coupling	Interaction as information communication	Interaction as phenomenologically situated
Central goal for interaction	Optimizing fit between man and machine	Optimizing accuracy and efficiency of information transfer	Support for situated action in the world
Typical questions of interest	How can we fix specific problems that arise in interaction?	What mismatches come up in communication between computers and people? How can we accurately model what people do? How can we improve the efficiency of computer use?	What existing situated activities in the world should we support? How do users appropriate technologies, and how can we support those appropriations? How can we support interaction without constraining it too strongly by what a computer can do or understand? What are the politics and values at the site of interaction, and how can we support those in design?

Table 1: Paradigms compared

Harrison, S., Tatar, D., & Sengers, P. (2007, April). The three paradigms of HCI. In Alt. Chi. Session at the SIGCHI Conference on human factors in computing systems San Jose, California, USA (pp. 1-18)

Paradigm one

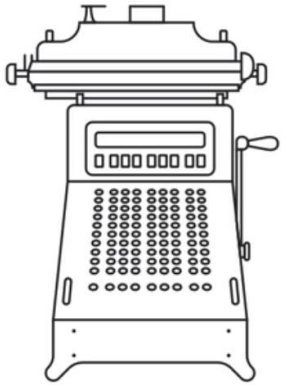


- Man- machine coupling
- **Goal :**
  - Optimize the fit between technology and man to minimize human error

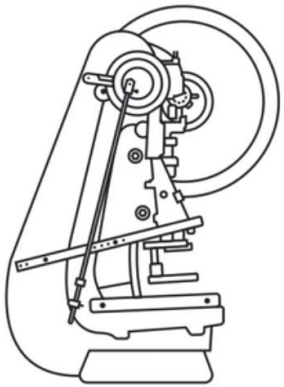
From Industrial revolution **to** World war II

Paradigm one - Questions

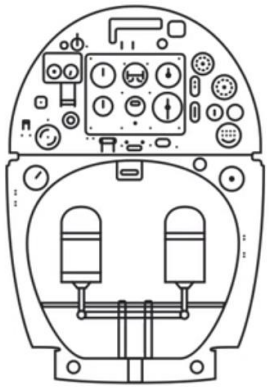
- How can we fix problems that arise in interaction?



ADDING MACHINES

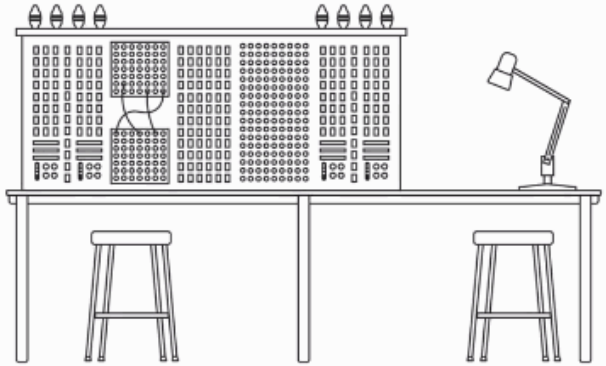


MUNITIONS MANUFACTURING



SUPERMARINE SPITFIRE COCKPIT

Paradigm Two

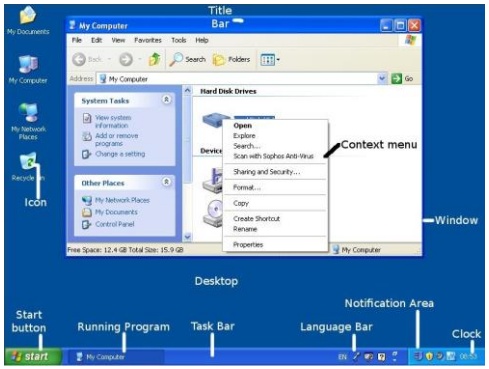


- Dual Processor approach
- Finds its roots at cognitive science
- **Goal**:
  - To bridge the gap between machine processor and human processor

From 1960 **to** 1980

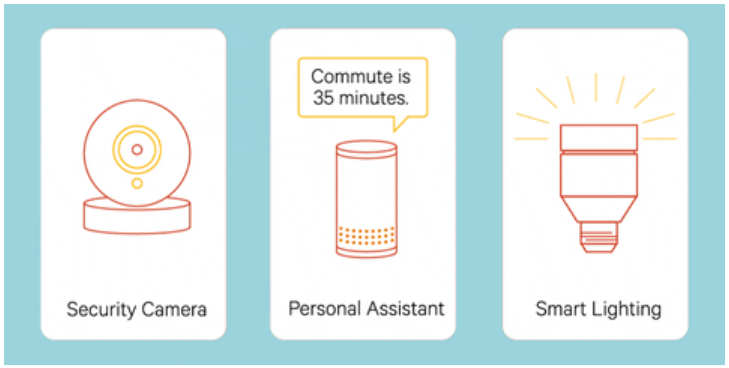
Paradigm Two - Questions

- What mismatches come up in communication between computer an people?
- How can we accurately model what people do?
- How can we improve the efficiency of computer use?



Paradigm Three

- Phenomenological matrix
- Embraces the complexity of interaction
- Humans are a part of a matrix
- Social sciences and User experience design



From 1990 **to** 2010 and beyond

Paradigm Three - Questions

- What existing situated activities in the world should we support
- How do users appropriate technologies
- How can we support those appropriations
- How can we support interaction without constraining too strongly by what can computers do or understand?
- What are the values at the site of interaction and how can we support those in design

Evolution of HCI 'interfaces'

- **50s** - Interface at the hardware level for engineers
  - switch panels
- **60-70s** - interface at the programming level
  - COBOL, FORTRAN
- **70-90s** - Interface at the terminal level
  - command languages
- **80s** - Interface at the interaction dialogue level
  - GUIs, multimedia
- **90s** - Interface at the work setting
  - - networked systems, groupware
- **00s** - Interface becomes pervasive
  - RF tags, Bluetooth technology, mobile devices, consumer electronics, interactive screens, embedded technology

Incidents: Information Overload / User Attention.
Three Mile Island, 1979

Poor interfaces can lead to disaster

- What started as a minor malfunction in the system ended as the largest commercial **nuclear accident** in the USA.

The **Three Mile Island accident** was a partial meltdown of reactor number 2 of Three Mile Island Nuclear Generating Station (TMI-2) in Dauphin County, Pennsylvania, near Harrisburg and subsequent radiation leak that occurred on March 28, 1979. It was the most significant accident in U.S. commercial nuclear power plant history.[2]On the seven-point International Nuclear Event Scale, the incident was rated a five as an "accident with wider consequences".[3][4]

Critical user interface engineering problems were revealed in the investigation of the reactor control system's user interface. Despite the valve being stuck open, a light on the control panel ostensibly indicated that the valve was *closed*. In fact the light did not indicate the position of the valve, only the status of the solenoid being powered or not, thus giving false evidence of a closed valve.[21] As a result, the operators did not correctly diagnose the problem for several hours.[22]

The USS Vincennes Shot Down a Civilian Plane

Homework:
investigate what happened!

Specifically, it's the unintuitive automatic shifter, which can make drivers think they've put the car in park when they haven't. If a driver were to exit the car with the engine not in park, all 5,000 pounds of the vehicle could roll away, crashing into any objects (or people) in its path.

Left: A traditional automatic shifter. (Photo: Robert Couse-Baker/Flickr) | Right: The confusing Fiat Chrysler shifter, shown in a model-year 2015 vehicle, implicated in over 100 crashes (Photo: Fiat Chrysler Automobiles)

https://psmag.com/news/looks-can-kill-the-deadly-results-of-bad-design

Fabuloso comes in a multitude of flavors like lavender, passion fruit, and citrus. Just don't drink it. (Photo: Maqroll/Flickr)

The colorfully packaged multi-purpose cleaner Fabuloso has a record of mistaken identity. In 2006, researchers looked at about four months of data from the Texas Poison Center Network and found 94 cases of people accidentally ingesting the household cleaner.

Human-computer interaction (HCI)

- Human-computer interaction (HCI) is the study of how people interact with computing technology.

"...it no longer makes sense to regard HCI as a specialty of computer science; HCI has grown to be broader, larger and much more diverse than computer science itself. HCI expanded from its initial focus on individual and generic user behavior to include social and organizational computing, accessibility for the elderly, the cognitively and physically impaired, and for all people, and for the widest possible spectrum of human experiences and activities. It expanded from desktop office applications to include games, learning and education, commerce, health and medical applications, emergency planning and response, and systems to support collaboration and community. It expanded from early graphical user interfaces to include myriad interaction techniques and devices, multi-modal interactions, tool support for model-based user interface specification, and a host of emerging ubiquitous, handheld and context-aware interactions."

John M. Carroll, author and a founder of the field of human-computer interaction.

User Experience Design

Usability, User Interface and User Experience

- HCI is a broad field which overlaps with areas such as user-centered design (UCD), user interface (UI) design and user experience (UX) design. In many ways, HCI was the forerunner to UX design.
- "User Experience Design" is often used interchangeably with terms such as "User Interface Design" and "Usability".
    - Usability and user interface (UI) design are important subsets of UX design, they are subsets of it

User Experience Design (UXD)

- "User experience" encompasses all aspects of the end-user's interaction with the company, its services, and its products.
- User experience (UX) focuses on having a deep understanding of users, what they need, what they value, their abilities, and also their limitations.
- It also takes into account the business goals and objectives of the group managing the project.
- UX best practices promote improving the quality of the user's interaction with and perceptions of your product and any related services.

"No product is an island. A product is more than the product. It is a cohesive, integrated set of experiences. Think through all of the stages of a product or service – from initial intentions through final reflections, from first usage to help, service, and maintenance. Make them all work together seamlessly."

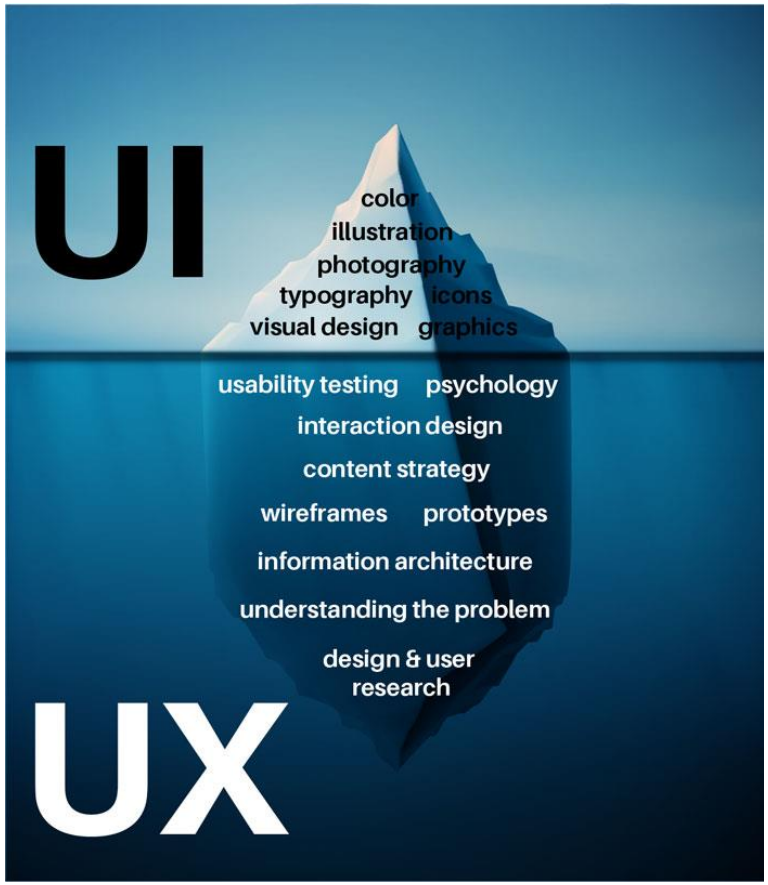
— Don Norman, inventor of the term "User Experience"

User Interface (UI) Design vs User Experience (UX) Design

- UX and UI: Two terms that are often used interchangeably, but actually mean very different things.
- User interface (UI) focus on series of screens, pages, and visual elements—like buttons and icons—that enable a person to interact with a product or service.
- User experience (UX), focus on the internal experience that a person has as they interact with every aspect of a company's products and services.

UI or UX

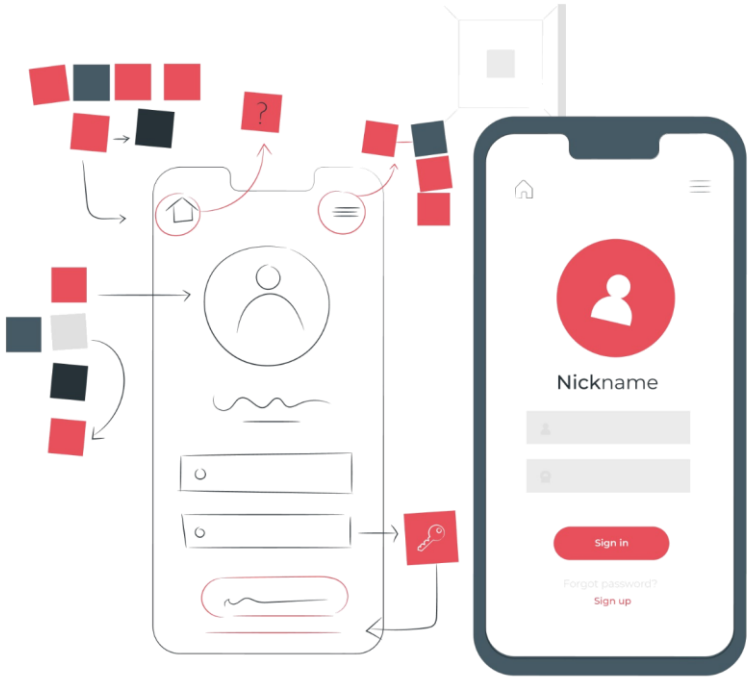
- User Experience : A Human Centered approach to product design
- User Interface: A Human Centered approach to design the aesthetic experience of a product



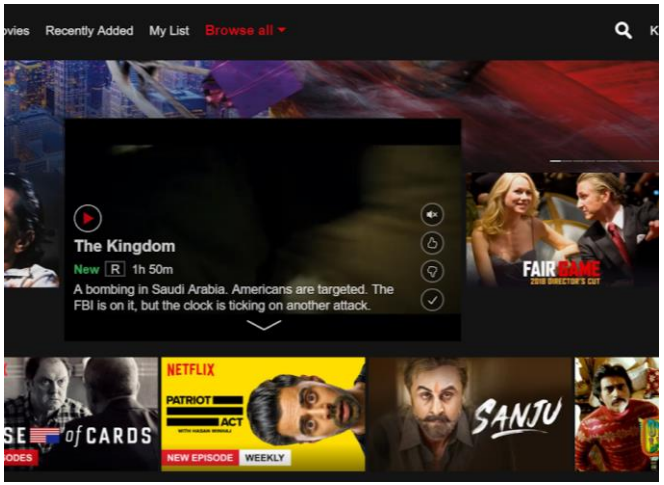
"It is not enough that we build products that function, that are understandable and usable, we also need to build joy and excitement, pleasure and fun, and yes, beauty to people's lives."

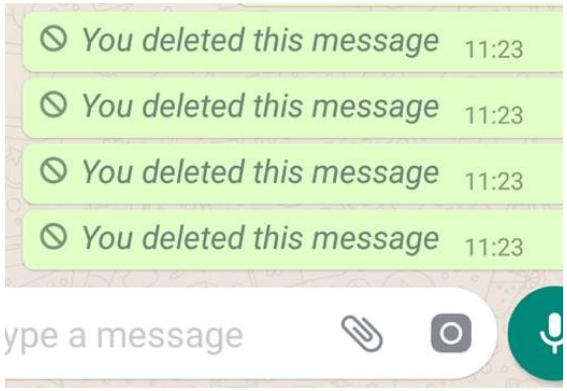
UI vs UX ?? UI and UX

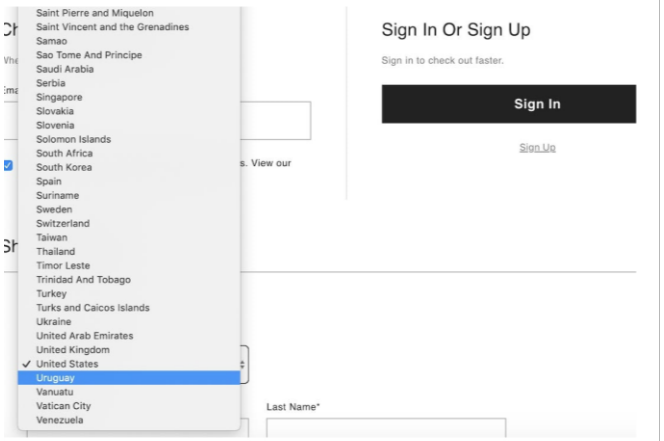
- User experience (UX) design focus more about how a product functions, and how users interact with it
- The user interface design complements user experience



"A UI without UX is like a painter slapping paint onto a canvas without thought, while UX without UI is like the frame of a sculpture with no paper mache on it. A great product experience starts with UX, followed by UI. Both are essential for the product's success."



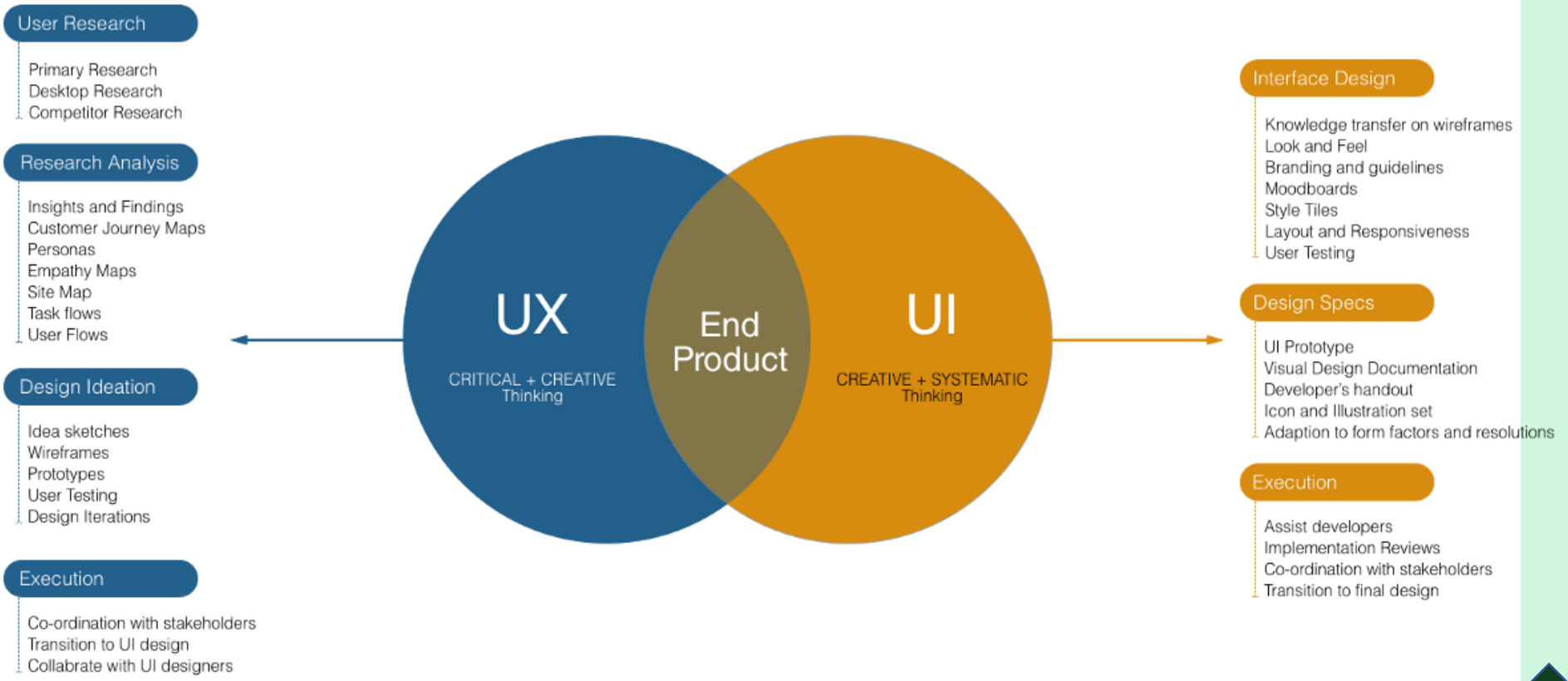




Good UI and Bad UX

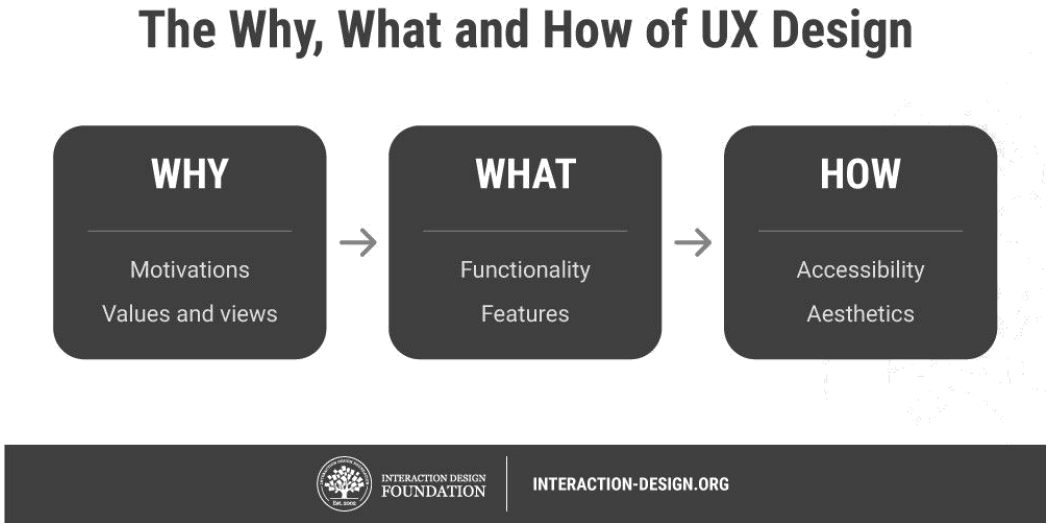
User Interface (UI) Design vs User Experience (UX) Design

A successful product is a result of good UI and UX



Work of an UX Engineer

- A UX designer should consider the Why, What and How of product use.
- Come from a variety of backgrounds such as visual design, programming, psychology and interaction design.
- user research, creating personas, designing wireframes and interactive prototypes as well as testing designs



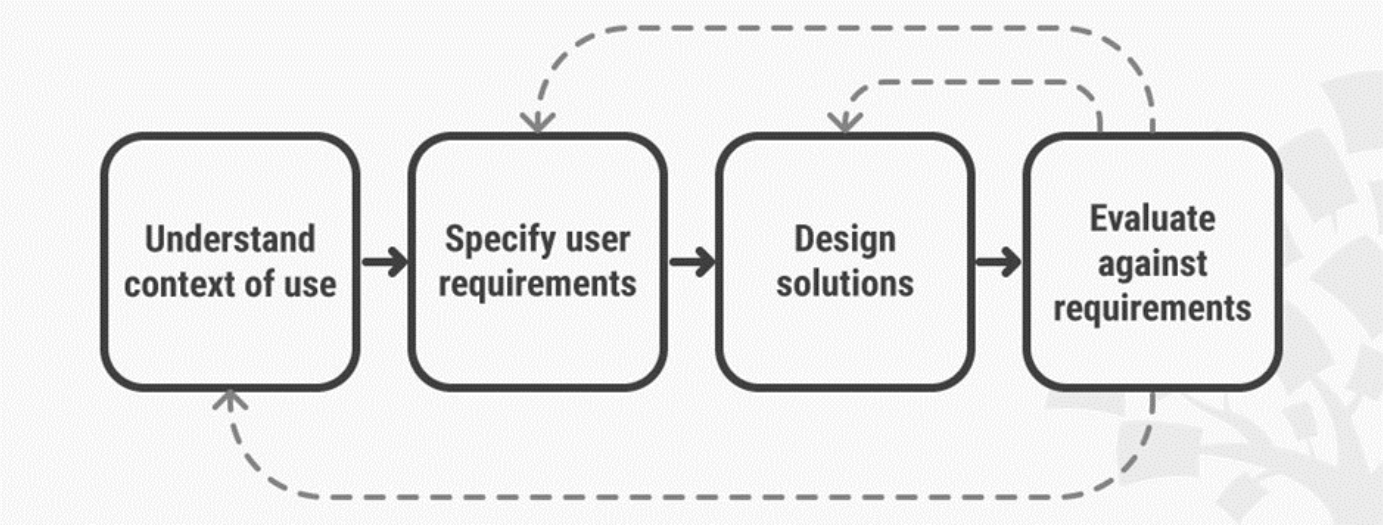
Why, What and How

- ***Why*** tries to clarify the needs and emotions involved in an activity, the meaning, the experience.
- ***What*** reflects the functionality.
  - The things people can do through an interactive product,
    - E.g. making a telephone call, buying a book
  - Tied to the technology itself or a certain product genre
- ***How*** addresses acting through an object on an operational, sensory-motor level
  - E.g. Buttons pressed, knobs turned, menus navigated
  - Tied to the actual object to be designed and its context of use.

User Experience Design starts from the *Why;* tries to clarify the needs, the experience. Only then, it determines functionality that is able to provide the experience (the *What*) and an appropriate way of putting the functionality to action (the *How*).

UX is User Centred

Since UX design encompasses the entire user journey, UX engineers often act as the users' advocate and keep the users' needs at the center of *all*



User-centered design is an iterative process where you take an understanding of the users and their context as a starting point for all design and development

User Centered Development Process

1. First, designers attempt to understand the context in which users may use a system.

2. Subsequently, identify and specify the users' requirements.

3. A design phase follows, where in the design team develops solutions.

4. The team then proceed to an evaluation phase and assess the outcomes of the evaluation against the users' context and requirements to check how well a design is performing.

From here, the team makes further iterations of these four phases, continuing until the evaluation results are satisfactory

User Centered Development

Advantages:

1. Leads to increased sales and lower costs incurred by customer services.
   - With close user involvement, products are more likely to meet users' expectations and requirements. This leads to increased sales.
2. UCD leads to safer products.
   - Systems designers tailor products for people in specific contexts and with specific tasks, thereby reducing the chances of situations with a high risk of human error arising.
3. By focusing on all users of a product, designers can recognize the diversity of cultures and human values through UCD.

Design Principles

- Design principles are used to aid thinking when designing for the user experience.

  - Visibility
  - Feedback
  - Constraints
  - Consistency
  - Affordance

Applying Design Principles in Practice

- Trade-offs can arise among design principles
  - The more you try to constrain an interface, the less visible information become
  - The more an interface is designed to afford through trying to resemble the way physical objects look, the more it can become cluttered and difficult to use

Applying Design Principles in Practice

- Consistency can be a problematic design principle
  - trying to design an interface to be consistent with something can make it inconsistent with something else
  - sometimes inconsistent interfaces are actually easier to use than consistent interfaces

Refer to the Jonathan Grudin's classic (1989) use of the analogy of where knives are stored in a house

Understanding Users

Understanding Users

Having a better understanding of people in the contexts in which they live, work, and learn can help UX engineers to understand how to design interactive products that provide good user experiences or match a user's needs.

- Privacy and Security Issues
- Education and Computer Literacy Level
- Business Needs
- Gender Differences
- Age Difference

Understanding Users

- Government Rules, Needs, Policies
- Technology Diversity /Technological innovation
- Emergencies
- Personal/ Individual needs
- Cultural differences
- Human diversity

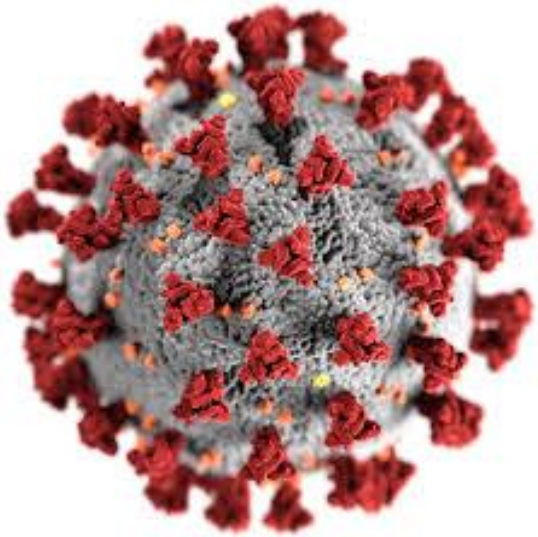
Privacy and Security Issues

Leads to careful and consistent use of language, appropriate default settings, icon design, and the use of layered interfaces

E.g. : Voting Systems

Education and Computer Literacy

- Think:
  - What is the most significant reason that digital learning technologies haven't taken mainstream in the Sri Lankan education system during this Covid-19 situation?
    - Government Schools
    - Tuition industry
- Why is this?



Business Needs

- New business ideas due to Globalization and Commercialization
  - E-Commerce
  - E-Marketing
  - E-Channeling
  - E-Learning

Gender Differences

- Finding from fields such as psychology, neuroscience, education and computer science shows that men and women communicate, problem solving and processing information differently.
- Perception and user experience of male and female on a software is different.

Gender Differences

- Females approach to computers was **soft, tactile, artistic and communicative** compared to males.
- Females values **collaboration over the competition** and use **non-violent rewards over the destruction as rewards.**
  E.g. : Video Games

Age Difference

a. Children

- Age groups will differ between toddler to teenager
- Different age groups will have different preferences.
- Younger children has evolving dexterity, low level of literacy, short attention span
- Younger children prefer colorful interfaces with lot of images as they can not read and write.

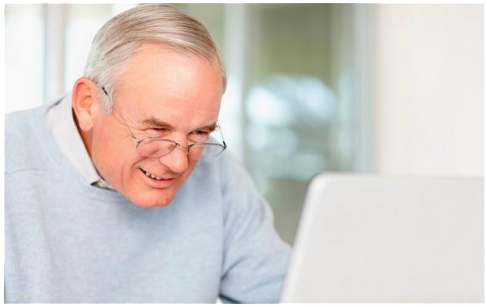
Age Difference

a. Children (Conti..)

- Should be able to handle easily with compared to much older children.
- Parental control and safety must be there.
- Teenagers prefer challenge and competition and can learn by them selves.

  E.g: Games, E-Learning Applications

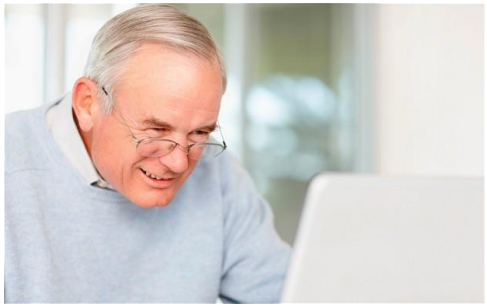
Age Difference



b. Elderly

- Communication is the main reason for many older users to get online.
- E-mail is the most popular application for older users, who may communicate to stay connected with others, especially if their mobility is limited.
- Declining motor and cognitive skills will impact the ability of older users to interact with web sites and communication tools.

Age Difference



b. Elderly

- Older users have more trouble finding information on web sites and dealing with multiple browser windows.
- They find pointing devices challenging to use.
- Errors can be especially problematic and have stronger negative reactions to errors
- Usability guidelines and automated site analysis tools provide assistance in designing web interfaces for older users
- Designers should allow for variability within their applications via settings for sound, color, brightness, font sizes, etc.

Government Rules, Policies, etc.

- Accessibility policy - https://www.eeoc.gov/laws/types/disability.cfm
- E-Government web sites - requires careful design of interfaces for finding appropriate information.
- Need for Advanced Identification Cards.

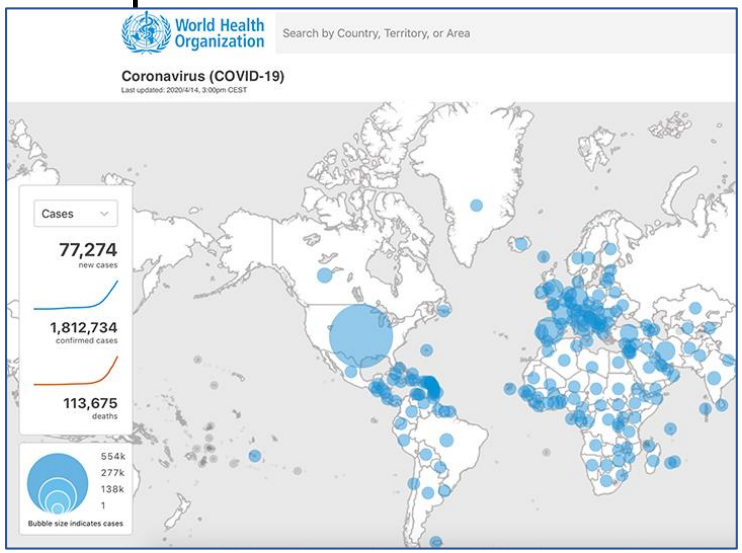
Technology Diversity

- RFID Tags
- Wearable computing
- Mobile computing
- Ubiquitous and context-aware computing
- Social Computing : Social Networks , Video games and virtual environment

Emergencies

Emergencies

- In situations such as Terrorism and Natural Disasters, use visual analytics to develop advanced interfaces to provide situational awareness
- This combines domain configuration details such as network layouts or geographical maps with event timelines.

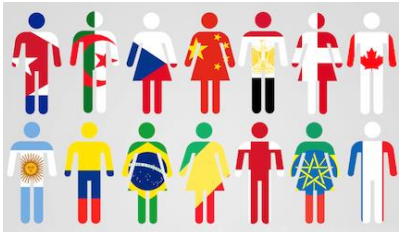


Other Social Issues Influencing HCI

- Personal/individual needs
  - To reduce isolation : through social computing, online communities
  - Personal preferences, values
- Cultural Differences
- Human Diversity

Multi-Cultural Interaction

- Different cultures have different approaches to interact with the computers which may causes different types of problems.
- But Many software companies and designers treat other cultures as inconveniences that cost money to deal with and as a result, the differences in people are ignored.



Multi-Cultural Interaction

- Therefore, people need to adapt to the interfaces instead the opposite.
- Differing cultures requires careful attention to language, colors, layouts, visual depictions, and cultural sensitivity.
- These differences can increase the complexity of empirical evaluations.

Multi-Cultural Interaction

<u>Cultural and international diversity</u>

- Language / Localization
- Date and time formats

  5/21/2015 Versus 21/5/2015?

  Which should be used for international services and online forms?

- Left-to-right versus right-to-left versus vertical input and reading.

Multi-Cultural Interaction

Cultural and international diversity

- Numeric and currency formats
- Characters, numerals, special characters and diacritical.

Comparison of selected modern systems of numerals										
Hindu-Arabic	١	٢	٣	٤	٥	٦	٧	٨	٩	٠
Arabic	۱	۲	۳	۴	۵	۶	۷	۸	۹	۰
Devanagari	৭	২	৩	৪	৫	৬	৭	৮	৯	০
Tibetan	๑	๒	๓	๔	๕	๖	๗	๘	๙	๐
Kashmiri	੩	੩	੩	੪	੫	੨	੭	੮	੯	੦
Bengali	৯	২	৩	৪	৫	৬	৭	৮	৯	০
Siamese	๑	๒	๓	๔	๕	๖	๗	๘	๙	๐

I 1	II 2	III 3	IV 4	V 5
VI 6	VII 7	VIII 8	IX 9	X 10
XI 11	XII 12	XIII 13	XIV 14	XV 15
XVI 16	XVII 17	XVIII 18	XIX 19	XX 20

- Weights and measures

Multi-Cultural Interaction

- Telephone numbers and addresses.
- Names and titles (Mr. , Mrs. , Ms.)
- Capitalization and punctuation.
- Social-security, national identification, and passport numbers
- Aesthetics: use of color, patterns, shapes and textures.

Format	Examples
town, province postalcode	China, India
town province postalcode	USA, Canada, Australia
postalcode town-province	Brazil
postalcode town, province	México
postalcode town (provincia)	Italy
postalcode town	Most other European countries
town postalcode	New Zealand, Thailand, Japan
town, county	Ireland (except Dublin)

Algeria	(+213)
American Samoa	(+1684)
Andorra	(+376)
Angola	(+244)
Anguilla	(+1264)
Antigua and Barbuda	(+1268)
Argentina	(+54)

Multi-Cultural Interaction

- Sorting sequences
- Etiquette, policies, tone, formality, metaphors
- Symbols: food, animals and everyday objects can have symbolic meanings that may convey unintended messages.
- Pluralization, grammar, spelling.

Accommodating Human Diversity

- Humans could be diverse, based on their abilities, disabilities, age etc.

- This has a negative impact on their everyday lives due to the inaccessibility in computing context.

Accommodating Human Diversity

- Accessibility
  - Design of application in a way that it is accessible to disabled or otherwise abled people.
  - A good application of multimodal systems is to address and assist disabled people.

Accommodating Human Diversity

- Disabilities are of different types:
  - Visual disabilities
  - Auditory disabilities
  - Motor disabilities
  - Cognitive disabilities

Accommodating Human Diversity

Visual disabilities

Long-sightedness, blindness, colorblindness, are all forms of visual disabilities you need to cater for in your design.

Designing for blindness and low vision

- Braille keyboards
- Special speech software that reads Web pages and other documents aloud.

Accommodating Human Diversity

- Screen magnifiers that fit over a display to magnify the entire screen.
- Avoid the lines / small symbols

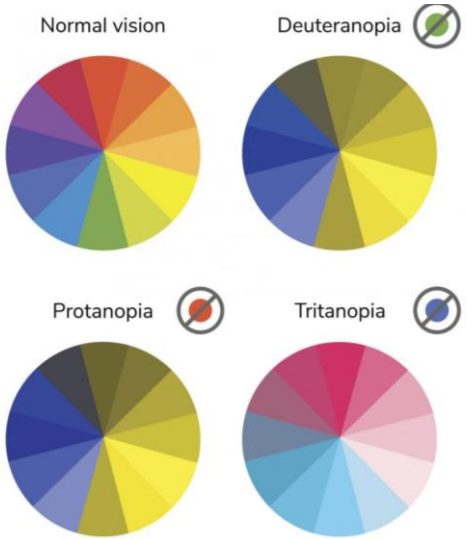
Accommodating Human Diversity

Visual disabilities : Color Blindness

- About 8% of men and 0.5% of women have color blindness of some type.
- Most commonly expressed in red/green deficiency.

Types of Color Blindness

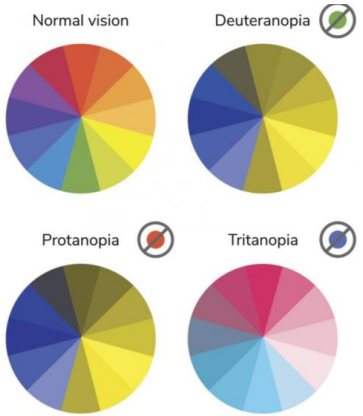
- Protanopia – L-cone (“red weak”)
- Deutanopia – M-cone (“green weak”)
- Tritanopia – S-cone (yellow/blue)



Accommodating Human Diversity

- One proposed palette for color - blindness

	Original	Simulation: Protan	Simulation: Deutan	Simulation: Tritan		Hue	for Photoshop, Illustrator, Freehand, etc. C,M,Y,K (%)	for Photoshop, Illustrator, Freehand, etc. R,G,B (0-255)	for Word, Power Point, Canvas, etc. R,G,B (%)
1					Black	– °	(0,0,0,100)	(0,0,0)	(0,0,0)
2					Orange	41°	(0,50,100,0)	(230,159,0)	(90,60,0)
3					Sky Blue	202°	(80,0,0,0)	(86,180,233)	(35,70,90)
4					bluish Green	164°	(97,0,75,0)	(0,158,115)	(0,60,50)
5					Yellow	56°	(10,5,90,0)	(240,228,66)	(95,90,25)
6					Blue	202°	(100,50,0,0)	(0,114,178)	(0,45,70)
7					Vermilion	27°	(0,80,100,0)	(213,94,0)	(80,40,0)
8					reddish Purple	326°	(10,70,0,0)	(204,121,167)	(80,60,70)



Accommodating Human Diversity

Auditory disabilities

- Auditory disabilities affect the hearing and come in varying degrees of severity, up to and including total deafness.

Designing for Auditory disabilities

- Documents and screens, you design include access to written versions of the audio material.
- Offer transcriptions for audio files. Hearing-impaired users can't use software to read voices. So, help them out and include a transcript.
- Offer captions in videos for the hearing impaired.

Accommodating Human Diversity

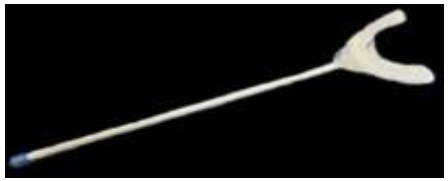
Motor disabilities

- Problems with the mobility and use of the hands and arms thus making the use of hardware of computers impossible.

Designing for Motor disabilities

- Use speech inputs (speech recognition) rather than keyboard inputs.
- Sticky Keys: Use of Keyboard from one hand.
- Eye Tracking devices.

Accommodating Human Diversity



Activity

Find out what these are and what disabilities they address

Accommodating Human Diversity

Cognitive disabilities

- limitations in mental functioning and in skills such as communicating, taking care of him or herself, and social skills.
    - Learning disabilities such as Dyslexia
    - Autism

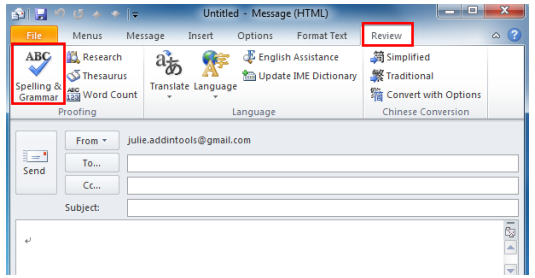
Designing for Cognitive disabilities

- Focus on readable content.
- The simpler the language, the easier it will be to read for learning-impaired users.

Accommodating Human Diversity

Designing for Cognitive disabilities

- People who have difficulty visualizing the structure of an information
  - Visualize the structure for them in the form of a sitemap
  - Let the browser updated the display of the sitemap with the path of the navigation and the location of the current page.



Accommodating Human Diversity

Designing for Cognitive disabilities (Conti..)

- Users with dyslexia may have problems reading long pages
  - By scanning and selecting words with high information content as hypertext anchors will help these users
- Users with spelling disabilities
  - Include a spelling checker.

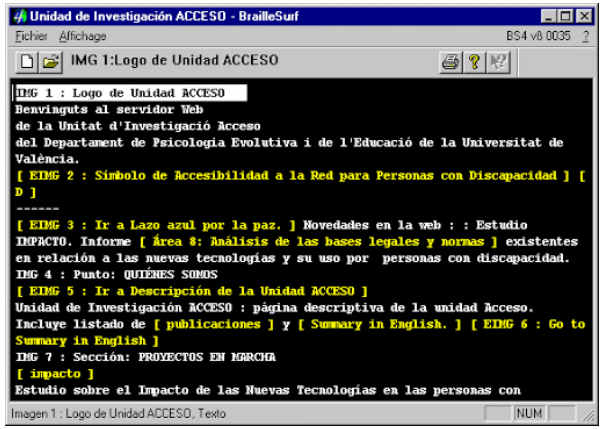
Accommodating Human Diversity

- Braillesurf

  from Braillenet (Windows 95, 98, NT, 2000) speech, Braille, large text.

- BrookesTalk

  Under development by Oxford Brookes University focuses on facilitating intelligent web-searching. Speech output, screen-magnification available.



Accommodating Human Diversity

- EIAD

A browser from Sarsfield Solutions which provides enhancements specifically for people with special needs and learning difficulties.

Touch-screen, simplified language interfaces available.