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Discover Your Future

IT3060 – Human Computer Interaction

Lecture 01

Overview of HCI and UX

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FACULTY OF COMPUTING

Agenda

- Introduction to human computer interface (HCI) and User Experience (UX)
- User Centered Design
- Contexts for human computer interface
- Process for the user centered development
- Social issues influencing human computer interface design and use
- Multi-cultural interaction and communication
- Accommodating human diversity

Introduction

- 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.

Introduction

- 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

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)

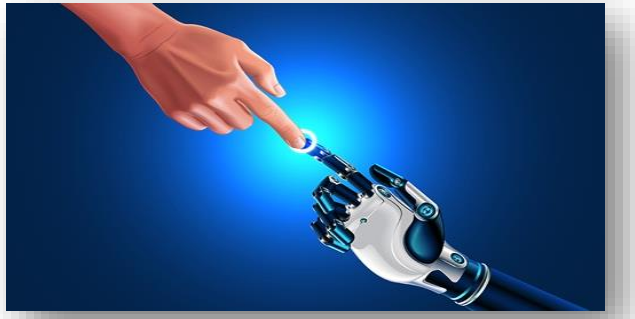
Human-computer interaction (HCI) is the study of how people interact with computing technology.

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)

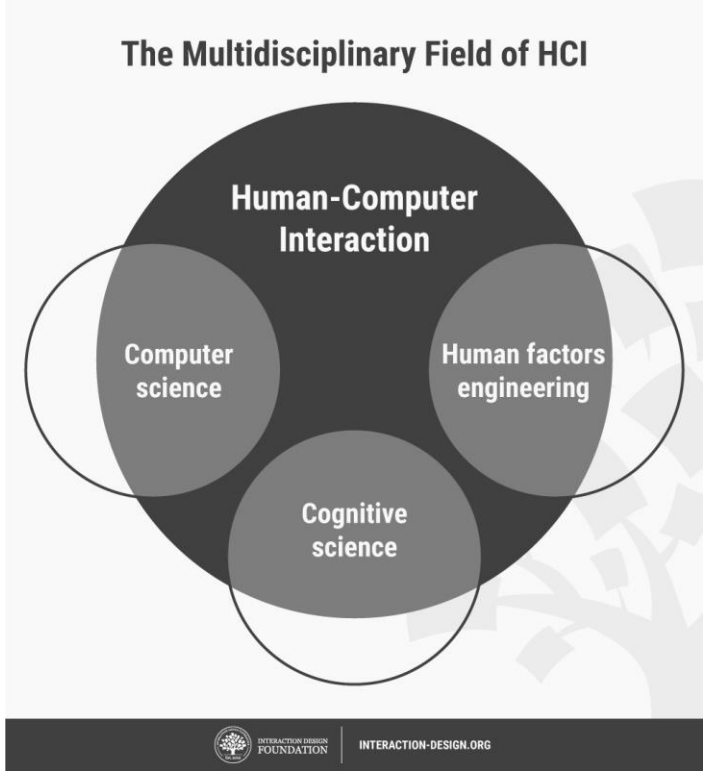
Human-computer interaction (HCI) is a “discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them” (ACM SIGCHI, 1992, p.6)

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.



Evolution of HCI ‘interfaces’

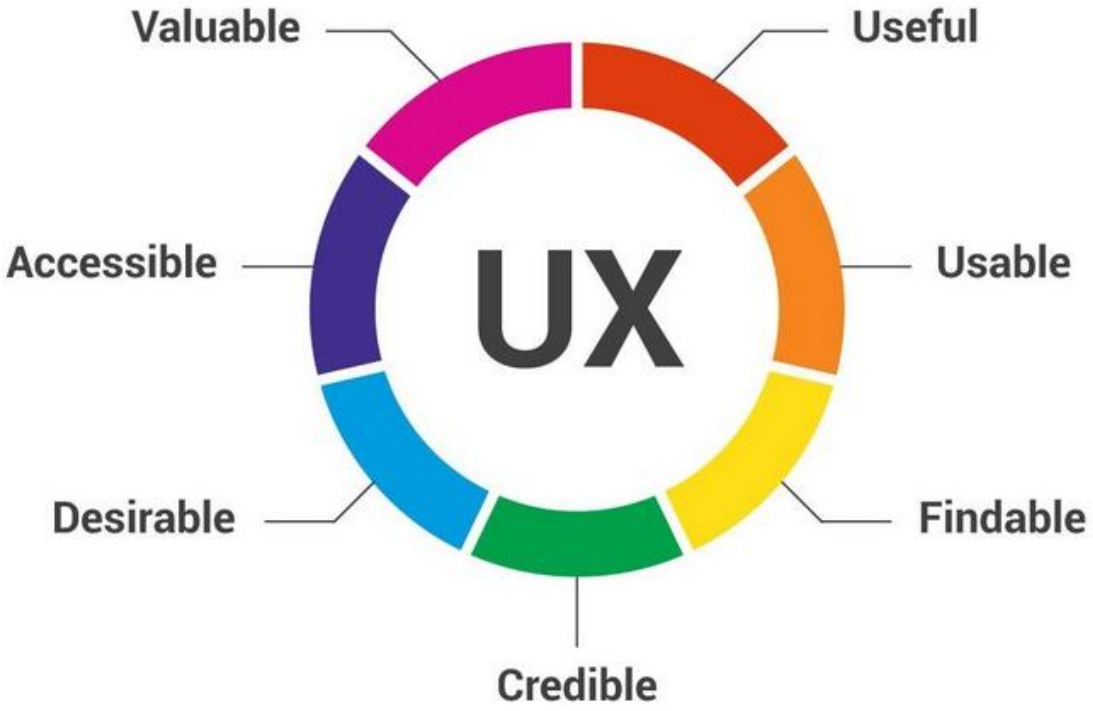
- **50s** - Interface at the hardware level for engineers
  - switch panels
- **60-70s** - interface at the programming level
  - COBOL, FORTRAN
- **70-90s** - Interface at the terminal level
  - command languages
- **80s** - Interface at the interaction dialogue level
  - GUIs, multimedia
- **90s**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

User experience (UX)

"User experience" encompasses all aspects of the end-user's interaction with the company, its services, and its products. - by Don Norman and Jakob Nielsen

- 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.

User experience



- There are 7 factors that describe user experience, according to Peter Morville a pioneer in the UX field who was written several best-selling books and advises many Fortune 500 companies on UX.

- Useful
  - If a product isn't useful to someone why would you want to bring it to market?
- Usable
  - Usability is concerned with enabling users to effectively and efficiently achieve their end objective with a product.
- Findable
  - Findable refers to the idea that the product must be easy to find and in the instance of digital and information products; the content within them must be easy to find too.
- Credible
  - Credibility relates to the ability of the user to trust in the product that you've provided.
- Desirable
  - Desirability is the tendency that a user picks the product among other alternatives
- Accessible
  - Accessibility is about providing an experience which can be accessed by users of a full range of abilities – this includes those who are disabled
- Valuable
  - product must deliver value

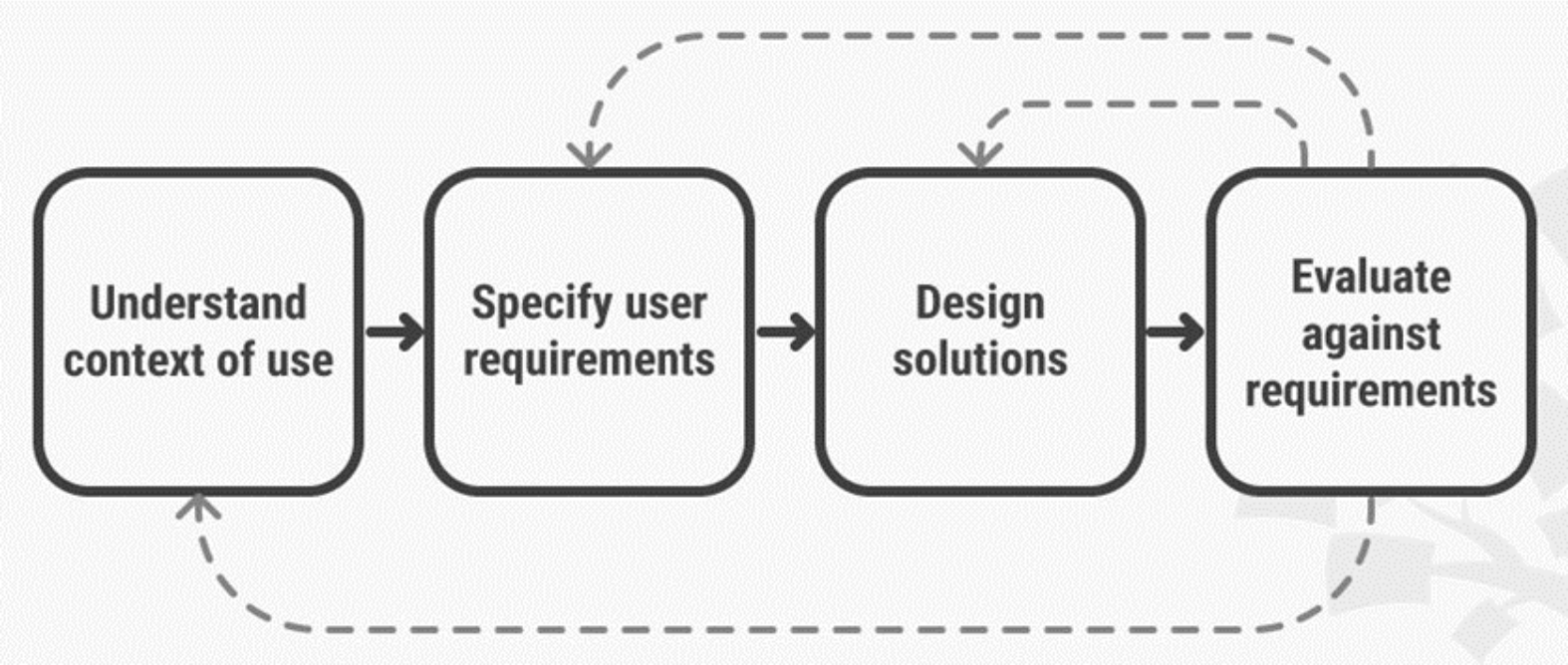
User Centered Design (UCD)

User Centered Design (UCD)

- User-centered design is an iterative design process in which designers focus on the users and their needs in each phase of the design process.
- UCD calls for involving users throughout the design process via a variety of research and design techniques
- UCD helps to create highly usable and accessible products for them.

User Centered Development Process

User Centered Development is an **iterative process** consists of 4 phases/steps.



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.

Contexts for HCI

Contexts for HCI

- In HCI studies, the context describes the actual conditions under which the software system is used.
- Determining the context of the system means describing how the software system interacts with the user in normal day to day situations.
- It is important to carry out usability tests, prototyping sessions, meetings, user studies and other "user-dependent sessions" in the correct context of the system to get the most accurate results from your findings.
- Most commonly recognized are the **User Context**, the **Time Context**, the **Physical Context** and the **Computing Context**.

Contexts for HCI

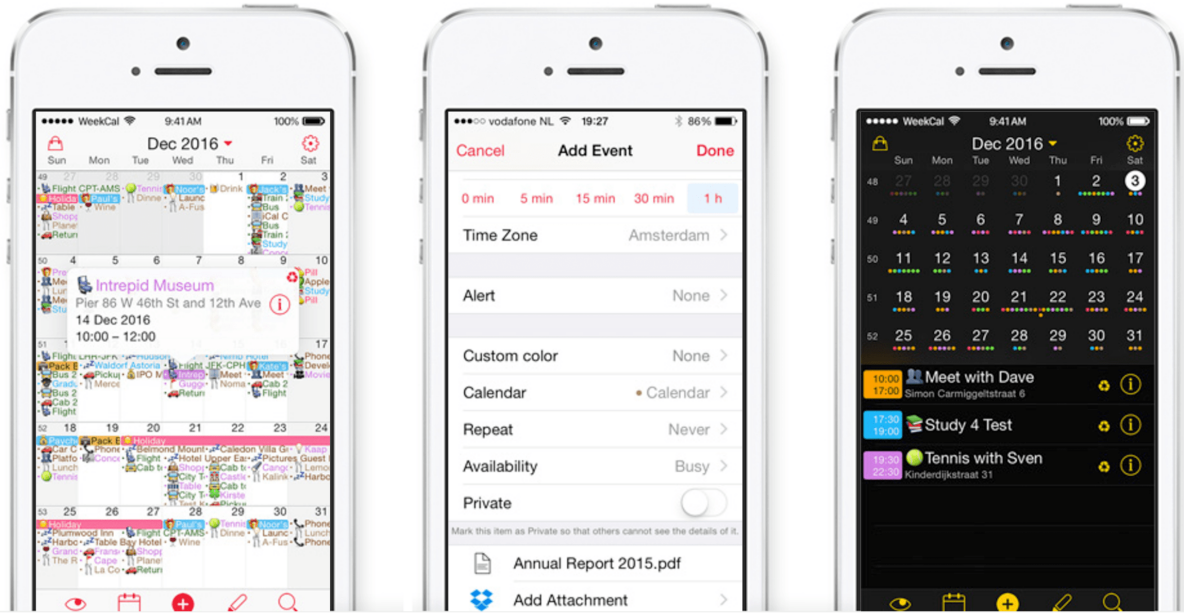
User Context

- The user context (also known as *personal context*) represents information about the end-user, which interacts with the system.
- This includes information such as:
  - user profile (age, preferences)
  - user's location(absolute position, indoors, outdoors) and orientation
  - nearby objects
  - people nearby
  - social situation.

Contexts for HCI

Time Context

- The time context covers relevant information related to time such as absolute time, date, day of the week and season.
  E.g. When the user travels through different time zones, the calendar should display all of the tasks and appointments with the proper time zone.



Contexts for HCI

Physical Context

- The physical context includes everything which is measurable in the environment of the system with which the user interacts.
- This includes temperatures, noise levels, lighting situations, traffic conditions, etc.
    - E.g.: The ambient light sensor in the iPhone 3G automatically brightens the display when one is in sunlight or a bright room and dims it in darker places.

Contexts for HCI

Computing Context

- The computing context contains everything related to computational resources.
- This can include things such as available networks, network bandwidth, communication costs and nearby computational resources such as printers or fax machines.
- E.g. In high bandwidth situations, the device should be able to update all the user's feeds, send/receive mail and do any necessary system updates.
- In low bandwidth situations, only the bare minimum of networking tasks should be completed.
- Most mobile devices can recognize when the user is not using the device and can turn off the display to save power.
- Some of the newer devices can even detect when the device is lifted to your ear.

Social Issues Influencing HCI Design and Use

1. Privacy and Security Issues
2. Education and Computer Literacy Level
3. Business Needs
4. Gender Differences
5. Age Difference
6. Government Rules, Needs, Policies
7. Technology Diversity /Technological innovation
8. Emergencies
9. Personal/ Individual needs
10. Cultural differences
11. Human diversity

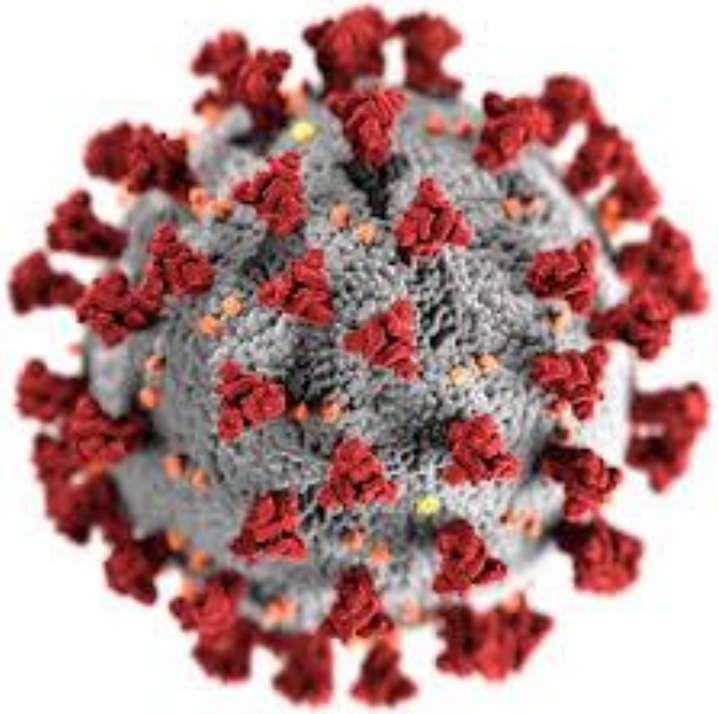
Privacy and Security Issues

- 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.
- 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.
- 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

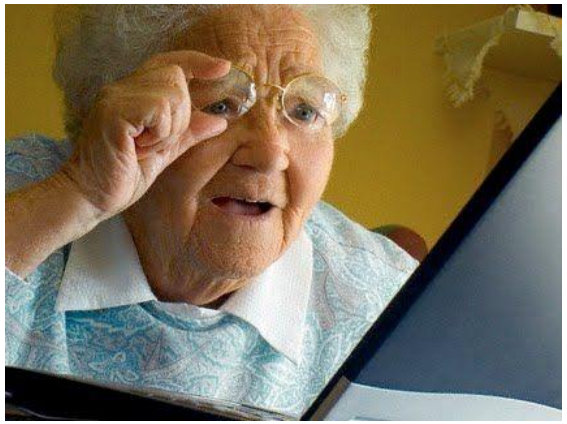
b) Elderly

- 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.

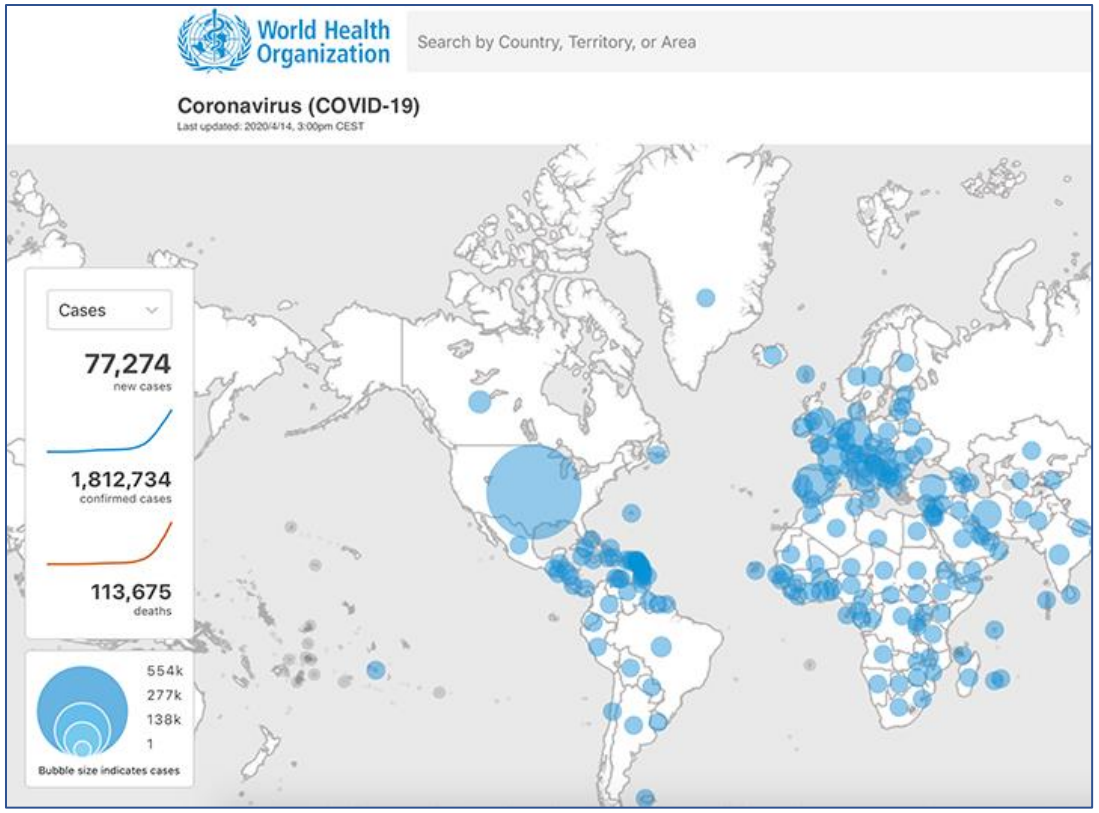
- Accessibility policy - https://www.eeoc.gov/laws/types/disability.cfm
- E-Government web sites - requires careful design of interfaces for finding appropriate information.
- Need for Advanced Identification Cards.

Technology Diversity

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

Emergencies

8. 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

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.
- 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

Cultural and international diversity

- 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	1	2	3	4	5	6	7	8	9	0
Arabic	١	٢	٣	٤	٥	٦	٧	٨	٩	٠
Devanagari	१	२	३	४	५	६	७	८	९	०
Tibetan	༡	༢	༣	༤	༥	༦	༧	༨	༩	༠
Kashmiri	۱	۲	۳	۴	۵	۶	۷	۸	۹	۰
Bengali	১	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

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.

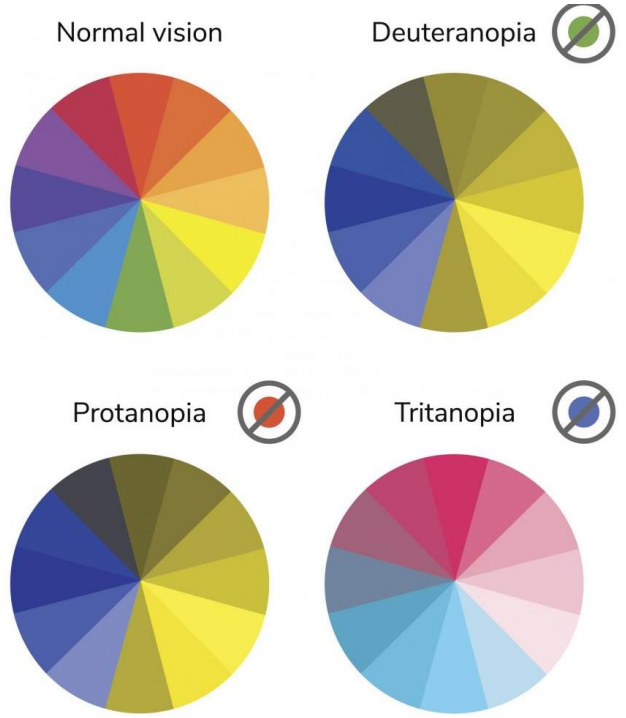
Designing for blindness and low vision

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



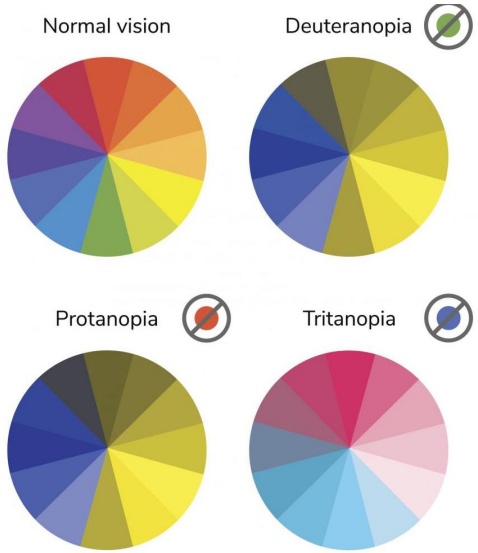
Types of Color Blindness

- 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					for Photoshop, Illustrator, Freehand, etc.		for Word, Power Point, Canvas, etc.
		Protan	Deutan	Tritan		Hue	C,M,Y,K (%)	R,G,B (0-255)	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

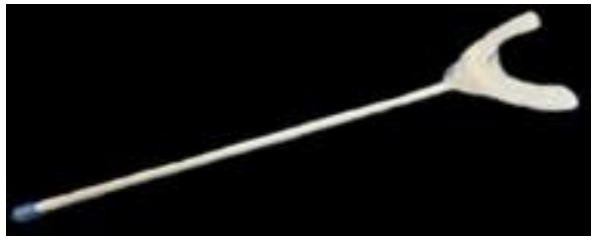
Motor disabilities

- 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

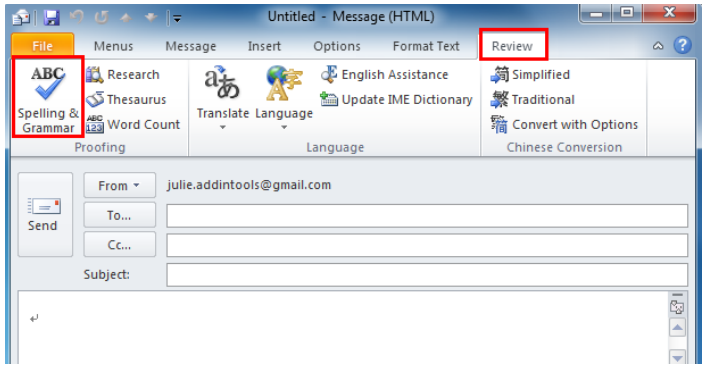
Designing for Cognitive disabilities

- 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.
- 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

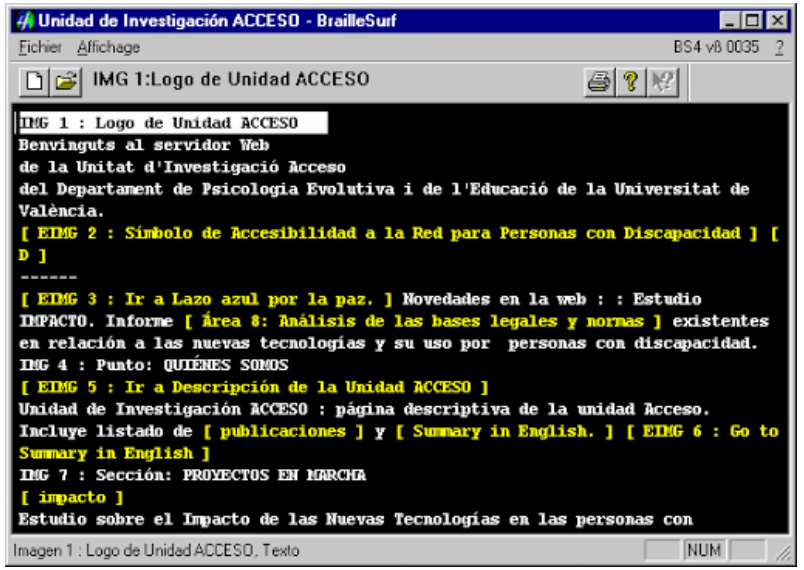
  from Braillenet (Windows 95, 98, NT, 2000) speech, Braille, large text.

- BrookesTalk

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

- EIAD

  A browser from Sarsfield Solutions which provides enhancements specifically for people with special needs and learning difficulties. Touch-screen, simplified language interfaces available.



Benefits of HCI

- Increase in productivity
- Reduce the need for training, workshops, user manuals, knowledge transfers
- Good quality product
- Customer satisfaction
- Increased market share

Summary

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- Accommodating human diversity

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