

SE 365

Human Computer Interaction (HCI)

Overview

- Introduction
- Human Computer Interaction (HCI) definition
- The importance and scope of HCI
- The evolution of HCI
- The process of Interaction Design
- Usability
- User experience (UX)
- Design principles

Based on material from:

Sharp, H., Preece, J. and Rogers, Y.(2019). *Interaction Design Beyond Human-Computer Interaction*. 5th Ed. Sussex: John Wiley & Sons Ltd.

Learning Outcomes

- Define HCI
- Explain the importance and scope of HCI
- Discuss the evolution of HCI
- Describe usability in HCI
- Explain the process of interaction design, design principles

Introduction

How many interactive products are there in
everyday use? *a lot*

(Think for a minute about what you use in a typical day)

Phones - ATM - Microwave - smartwatch - laptop

How many are actually easy, effortless and
enjoyable to use?

*Phones - Netflix? - Apple Pay
(touch screen)*

What's the Problem?

- Good programmer/designer need to understand the nature and needs of the computer

*Developers look at richness
But we look more at tailoring to our needs*

- But the nature and needs of computer are utterly alien to the nature and needs of the human being who will use it
- When the programmer/designer overlook how bad the the product it is – instead they see how rich the product is in features and functions



What's the Problem? (cont)

- They ignore how difficult it is to use, how many hours it takes to learn etc

Time, effort wasted

struggles: elderly, children unable to navigate or design causes them confusion

Shift from dev pov to user pov

- Programmer/designer work hard to make their product easy to use --> unfortunately their frame of reference is THEMSELVES, so they only make it easy to use for other software engineers, BUT not for normal human beings



Bad Design

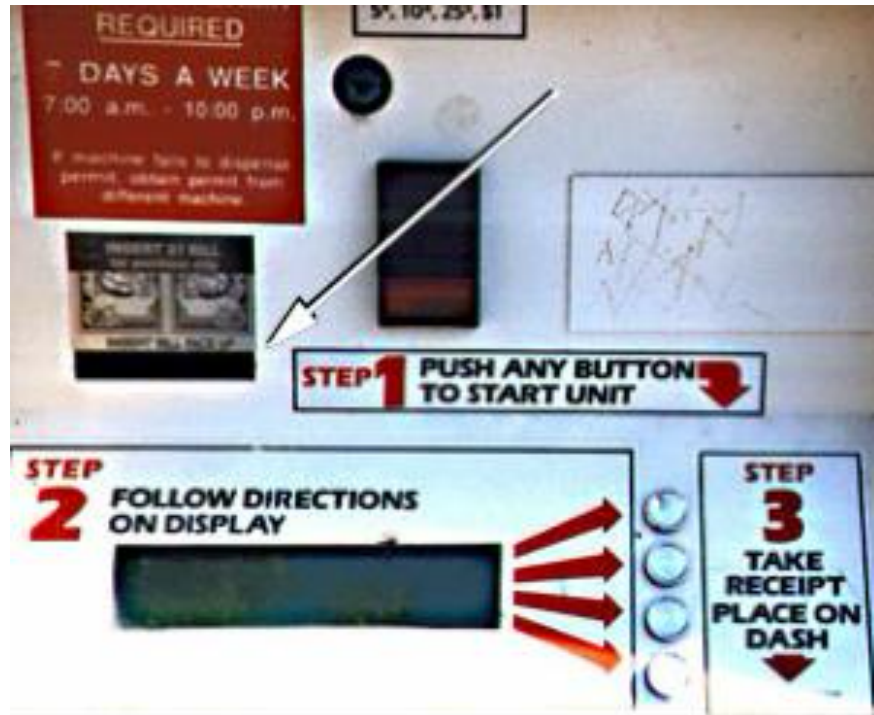
Elevator controls and labels on the bottom row all look the same, so it is easy to push a label by mistake instead of a control button



People do not make same mistake for the labels and buttons on the top row. Why not?

Why is this vending machine so bad?

- Need to push button first to activate reader
- Normally insert bill first before making selection
- Contravenes well known convention



Good and Bad design

Instill sense of familiarization by using stop go
UX → user experience
emotions during interaction

- Spacing
- colors
- letters bigger
- layout



- What is wrong with the remote on the right?
- Why is the TiVo remote so much better designed?
 - Peanut shaped to fit in hand
 - Logical layout and color-coded, distinctive buttons
 - Easy to locate buttons

What to design

- Need to take into account:

- Who the users are 
- What activities ^{reflects functions} are being carried out
- Where the interaction is taking place

U
A
I

U're AI

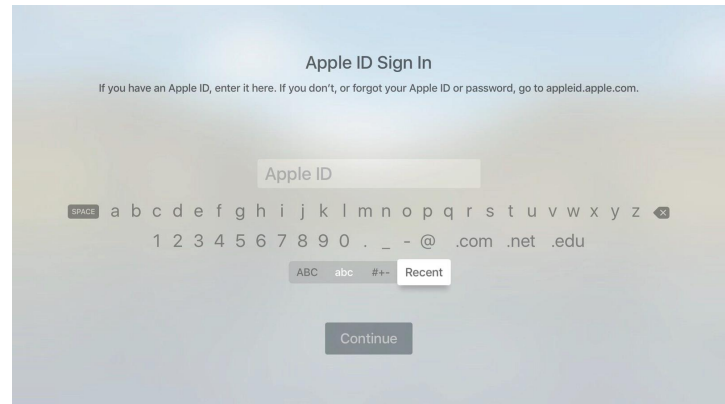
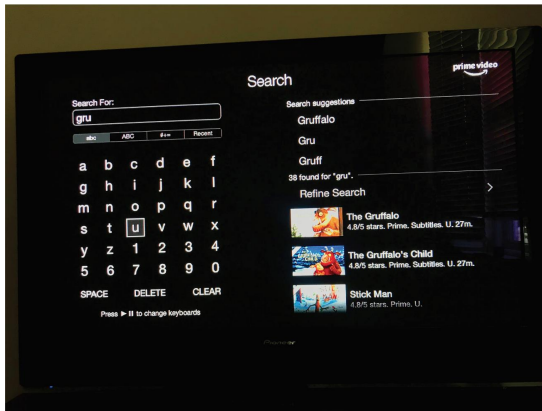
Good product offers multiple ways to interact
iphone: touch
voice
press

- Need to optimize the interactions users have with a product
 - So that they match the users' activities and needs

Dilemma

Which is the best way to interact with a smart TV? Why?

- Pecking using a grid keyboard via a remote control
- Swiping across 2 alphanumeric rows using a touchpad on remote control
- Voice control using remote or smart speaker



Understanding user's needs

- ① • Need to take into account what people are **good** and **bad** at *Create user profile, who use prototype?*



No terms
"Briefly explain...."
• can say wtv

keywords to exhibit in answers
Human
Computer
Interaction → area bridge

- ② • Consider what might **help** people in the way they **currently do** things

- ③ • Think through what might provide **quality user experiences**

- ④  Listen to what people want and get them involved

- ⑤ • Use **tried** and **tested** **user-centered** methods

What is HCI?

The study of all aspects of how people interact with computers and to what extend people-computer interaction influence each other



ERROR: TO HEAR
"SOUNDS OF THE OCEAN"
YOU MUST FIRST DOWN-
LOAD AND INSTALL
WINDOWS MEDIA PLAYER,
QUICKTIME, OR REALPLAYER
MULTIMEDIA SOFTWARE...

Here I
could use
name



What is HCI? (cont)



“concerned with the ^①design, ^②evaluation and ^③implementation of ~~interactive computing systems~~ for human use and with the study of major phenomena surrounding them” (ACM SIGCHI, 1992, p.6)

What is HCI? (cont)

An “**interdisciplinary design science**”, Shneiderman

lowKey what we are doing

Began by “combining data-gathering methods and intellectual frameworks of experimental psychology with the powerful and widely used tools developed from computer science...”

... “contributions accrued from educational and industrial psychologists, industrial and graphic designers, technical writers, experts in human factors or ergonomics, information architects, and adventuresome anthropologists and sociologists.”

What is HCI? (cont)

Dix: “HCI is study of people, computer technology and the ways these influence each other. We study HCI to determine how we can make this computer technology more usable by people” (1998)

Carroll: “HCI is the study and practice of usability. It is about understanding and creating software and other technology that people will want to use, will be able to use, and will find effective when used.” (2002)

ATM users → Human
ATM machine → computer
interface → Displayed screen
interaction → Keyboard

Good usable product gives multiple way to do stuff
Expert → need Shortcut
Beginner → step-by-step

copy
Ctrl + C
Command + C
Function

Mobile user → Human
Mobile phone → Computer
interface → mobile screen
interaction → touching
→ Swiping

What is HCI? (cont)

Human:

- Individual user, a group of users working together, a sequence of users in an organization

Computer:

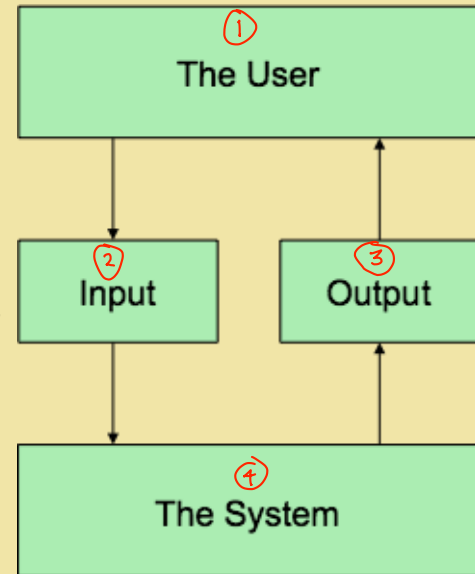
- Desktop computer, large-scale computer system, Pocket
- PC, embedded system (e.g., photocopier, microwave oven),
- Software (e.g., search engine, word processor)

User interface:

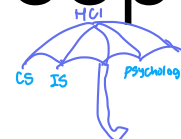
- Parts of the computer that the user contacts with

Interaction:

- Usually involve a dialog with feedback & control throughout
- performing a task (e.g., user invokes “print” command and
- then interface replies with a dialog box)

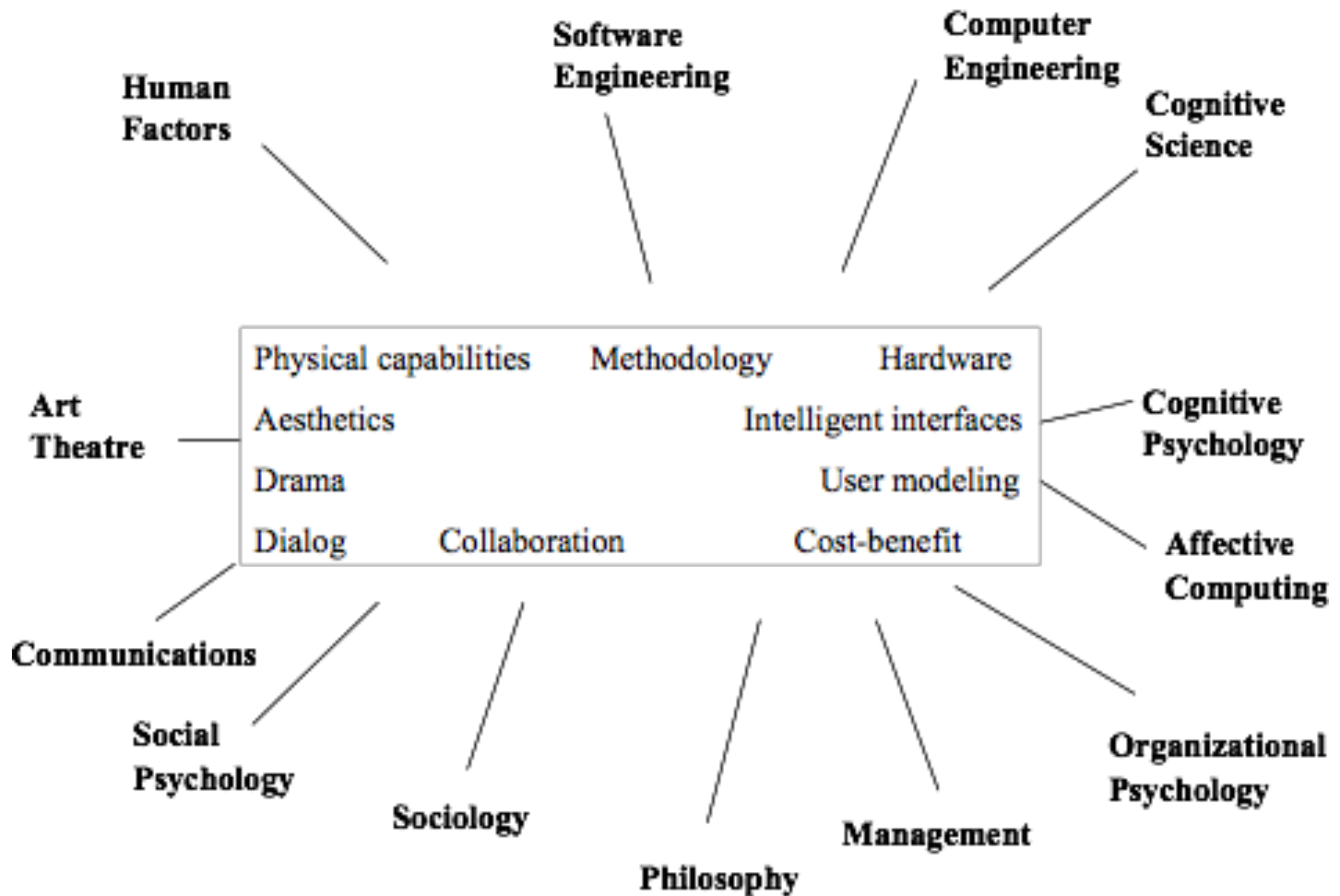


The importance & scope of HCI



- HCI is the kind of discipline bridging between the human and the technology
- What can the technology do? How can you build it? What are the possibilities?
- What are people doing and how would this fit in? What would they do with it?
- Need to consider the issue of
 - Efficiency/Effectiveness
 - *Stress X an emotion* Emotion
 - Economy *SHEEE*
 - Health
 - Safety
- Example: a navigation system with poor HCI

Interdisciplinary & scope of HCI



Typical topics in HCI

- *Next week*
Human cognition
 - Perception; Visual/auditory cognition; Motion cognition; Memory & attention; Learning; Language understanding; Mental model and metaphors
- *After it, imp in project*
Designing for collaboration & communication
 - Information visualization; Online communities; Presentation styles; Group dynamics; Groupware and discussion-ware

Typical topics in HCI (cont)

- Understanding how interfaces/technology affect users
 - Ergonomics; safety-critical systems; work environments; social and behavioural impact (individual and group); diversity and the digital divide
- User-centered approaches to interaction design
 - Identify needs and establish requirements; integrate users into design; prototyping and construction phases

Typical topics in HCI (cont)

- Usability evaluation
 - Observing users; testing and modeling users; expert evaluations
- Interaction styles
 - Virtual environments; Menus and forms; Commands and natural language; hands-free input
- Interaction devices
 - Keyboards; Pointing devices; Speech I/O; Image and video I/O; other sensory devices; Mobile devices

The evolution of HCI (cont)

- The range of current devices?
 - Keyboard
 - Light pen, stylus
 - Mouse, Touchpad, touch screen
 - Microphone
 - Headphone



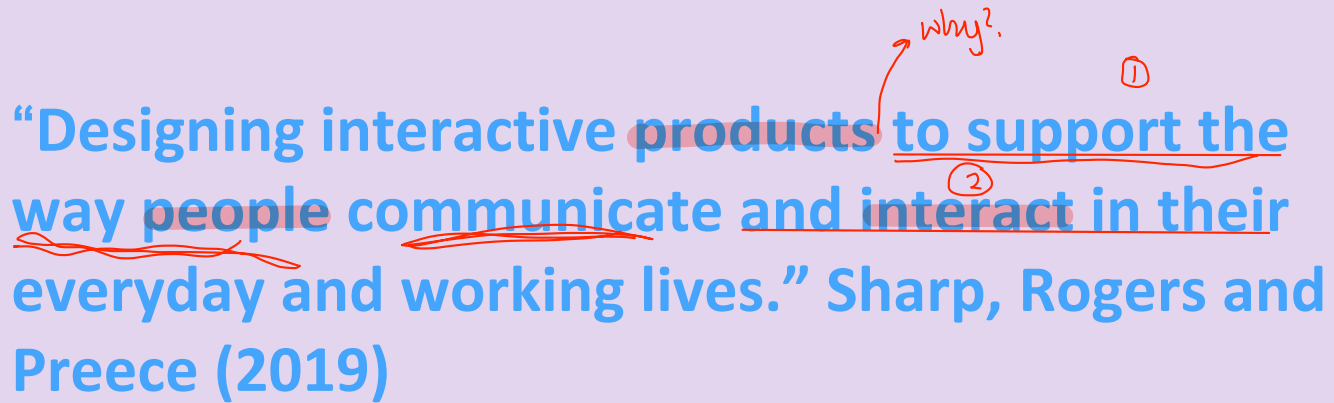
The evolution of HCI (cont)

- Future devices? Common use soon?
 - Data gloves/suits (wearable computing)
 - Natural language
 - Head-up display



What is interaction design?

“Designing interactive products ^① to support the
way people communicate and interact ^② in their
everyday and working lives.” Sharp, Rogers and
Preece (2019)



“The design of spaces for human communication and interaction.” Winograd (1997)

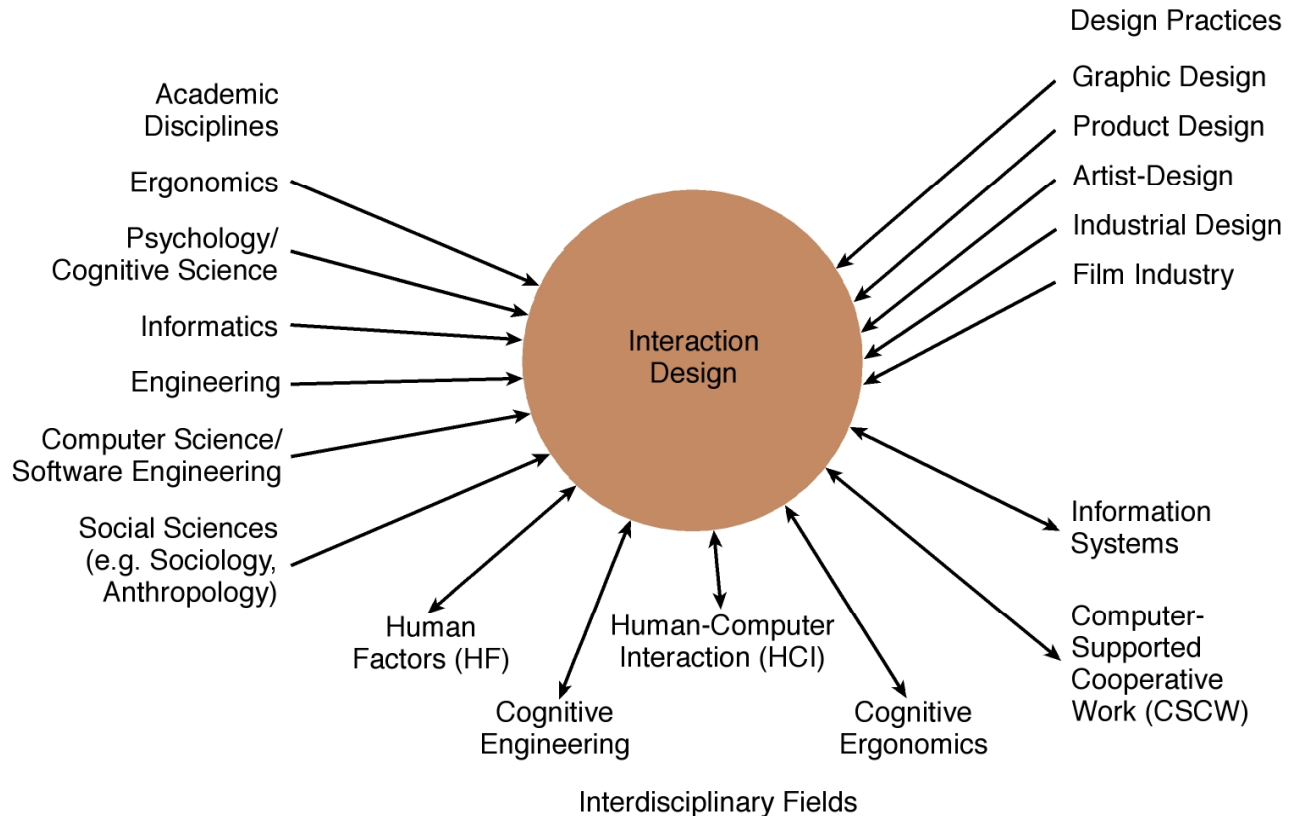
Goals of interaction design

- Develop usable products
- Usability means ^①easy to learn, ^②effective to use and provide an ^③enjoyable experience
- Involve users in the design process

Which kind of design?

- Number of other terms used emphasizing what is being designed, e.g.
 - user interface design, software design, user-centered design, product design, web design, experience design (UX)
- *acts as umbrella*
Interaction design is the umbrella term covering all of these aspects
 - fundamental to all disciplines, fields, and approaches concerned with researching and designing computer-based systems for people

Interaction design



Relationship between ID, HCI and other fields

Academic disciplines contributing to ID:

- Psychology
- Social Sciences
- Computing Sciences
- Engineering
- Ergonomics
- Informatics

I SEE PC

Relationship between ID, HCI and other fields

Design practices contributing to ID:

- Graphic design
- Product design
- Artist-design
- Industrial design
- Film industry

IF GPA

Relationship between ID, HCI and other fields

Interdisciplinary fields that 'do' interaction design:

- HCI
- Ubiquitous Computing
- Human Factors
- Cognitive Engineering
- Cognitive Ergonomics
- Computer Supported Co-operative Work
- Information Systems

HUM 1 C³

Working in multidisciplinary teams

- Many people from different backgrounds involved
- Different perspectives and ways of seeing and talking about things
- Benefits
 - *Take into account diff majors w/ me (I think Haya might also be SE)*
 - *commonly miscom to progress w/ difference*
 - **more ideas** and designs generated
- Disadvantages
 - difficult to **communicate** and progress forward the designs being create

Interaction design in business

- Large number of ID consultancies, examples of well known ones include:
 - **Nielsen Norman Group:** “help companies enter the age of the consumer, designing human-centered products and services”
 - **Cooper:** “From research and product to goal-related design”
 - **IDEO:** “creates products, services and environments for companies pioneering new ways to provide value to their customers”

The User Experience

- How a product behaves and is used by people in the real world
 - the way people feel about it and their pleasure and satisfaction when using it, looking at it, holding it, and opening or closing it
 - “every product that is used by someone has a user experience: newspapers, ketchup bottles, reclining armchairs, cardigan sweaters.” (Garrett, 2010)
 - “all aspects of the end-user's interaction with the company, its services, and its products. (Nielsen and Norman, 2014)
can't create one single experience for all users but I can create a user experience
- Cannot design a user experience, only design for a user experience
golden statement

Defining User Experience

Remind Dr to talk ab something related to User XP

- how users ^①perceive a product, such as whether a smartwatch is seen as sleek or chunky, and ^②their emotional reaction to it, such as whether people have a positive experience when using it. (Hornbæk and Hertzum, 2017)

Why was the iPod user experience such a success?



Figure 1.6 The iPod Nano Touch

Source: ©Press Association, reproduced with permission.

- Quality user experience from the start
- Simple, elegant, distinct brand, pleasurable, must have fashion item, catchy names, cool, etc.

Core characteristics of interaction design

Photos app, recently saved get lost
but I associate it w/ memories so I don't mind handling it
which make me happy
not totally satisfied/make me if have + UXP

- 1 • Users should be involved through the development of the project
- 2 • Specific usability and user experience goals need to be identified, clearly documented and agreed at the beginning of the project
- 3 • Iteration is needed through the core activities
Going back & forth

ppl differ
thumb sizes differ
interactive product should
disabilities must be accounted

satisfy

permanent: wheelchair

temp: injured but can go

situational:

hearing disability: adhd

cerebral palsy

autism

dyslexia

★ elderly

★ children

Why?

need designers??

- Help designers:

- understand how to design interactive products that fit with what people want, need and may desire

①

②

③

- appreciate that one size does not fit all XL

e.g., teenagers are very different to grown-ups

- identify any incorrect assumptions they may have about particular user groups



e.g., not all old people want or need big fonts

- be aware of both people's sensitivities and their capabilities

Accessibility and Inclusiveness

- *Accessibility* – the extent to which an interactive product is accessible by as many people as possible
pleasurable, can be accessed
already existing & I make a version that helps many groups
- focus is on people with disabilities, e.g. Android OS, Apple VoiceOver
- *Inclusiveness* – making products and services accommodate the widest possible number of people
Make it in the first place accommodate as many people
- e.g. smartphones designed for all and made available to everyone regardless of their disability, education, age, or income

Disabilities

- Whether someone is disabled **changes over time with age**, or recovery from an accident
- The severity and impact of an impairment can vary over the course of a day or in different environmental conditions
- Disabilities can result because technologies are designed to necessitate a certain type of interaction that is impossible for someone with an impairment

Understanding Disability

- Disabilities can be classified as:
 - CPS*
 - *5 senses* **Sensory** impairment (such as loss of vision or hearing)
 - **Physical impairment** (having loss of functions to one or more parts of the body after a stroke or spinal cord injury)
 - walk wheelchair*
 - *old → forget* **Cognitive** (e.g. learning impairment or loss of memory/cognitive function due to old age)

Understanding Disability

- Each type can be further defined in terms of capability
 - e.g. someone might have only peripheral vision, be color blind, or have no light perception
- Impairment can be categorized:
 - PT5
 - permanent (e.g., long-term wheelchair user)
 - temporary (e.g. after an accident or illness) recovery after
 - situational (e.g. a noisy environment means a person can't hear) Disabled when enter coffee & it's too loud

Being Cool About Disability

- Prosthetics can be designed to move beyond being functional (and often ugly) to being desirable and fashionable
- People now refer to “wearing their wheels,” rather than “using a wheelchair”



Fashionable leg cover designed by Alleles Design Studio

Cultural Differences

- ^{US} 5/21/2015 versus ^{Saudi UK} 21/5/2015?
 - Which should be used for international services and online forms?
- Why is it that certain products, like smartphones, universally accepted by people from all parts of the world whereas websites are reacted to differently by people from different cultures?

Languages
Dates
Terms
Spelling
Left-to-right (eng)
Right-to-left (arabic)

What is involved in the process of interaction design

- Establishing requirements *Milestone 1*
- Developing alternatives
- Prototyping *Milestone 2
Low-fidelity*
- Evaluating *Milestone 3
Testing / evaluating*



Usability goals

LMS

- doing it's job?
product performance
 • Effective to use - how good product is doing?
 always available
crashes with load
more performance
- does it best way?
 • Efficient to use - the way a product supports user
 more features
right features support user
create quizzes
submit assignment
- Safe to use - protecting users from undesirable condition
- Have good utility - to the extent to which the product provides the right kind of functionality
- Easy to learn - how easy a system is learn to use
- once seen know how to use
 • Easy to remember how to use - how easy a product is to remember how to use

Usability dimensions vary is importance

- So, what are the elements of usability?
- It depends on the user
 - ^{Beginner (Noob)} Novice users need learnability
 - Infrequent users need memorability
 - Experts need efficiency
support users by shortcuts
- But no user is uniformly novice or expert
 - Domain experience
 - Application experience
 - Feature experience

*Expert in windows
Novice in MAC*

*Basically expertise level varies
no one is expert in everything*

DAF

User Experience Goals

Desirable aspects +

satisfying
enjoyable
engaging
pleasurable
exciting
entertaining

helpful
motivating
challenging
enhancing sociability
supporting creativity
cognitively stimulating

fun
provocative
surprising
rewarding
emotionally

Undesirable aspects -

boring
frustrating
making one feel guilty
annoying
childish

unpleasant
patronizing
making one feel stupid
cutesy
gimmicky

Usability and User experience goals

- Selecting terms to convey a person's feelings, emotions, etc., can help designers understand the multifaceted nature of the user experience

*Twitter: usable
happy → good user xp*

Netflix

- How do usability goals differ from user experience goals?
- Are there trade-offs between the two kinds of goals?
 - e.g. can a product be both fun and safe?
- How easy is it to measure usability versus user experience goals?

Design principles

Guidelines

- Generalizable abstractions for thinking about different aspects of design
- The do's and don'ts of interaction design
- What to provide and what not to provide at the interface
- Derived from a mix of theory-based knowledge, experience and common-sense

Design principles (cont)

1) Visibility • Keyboard • Elevator

- This is a control panel for an elevator
- How does it work?
- Push a button for the floor you want?
- It is not visible as to what to do!



Design principles (cont)

1) Visibility (cont)

...you need to insert your room card in the slot by the buttons to get the elevator to work!

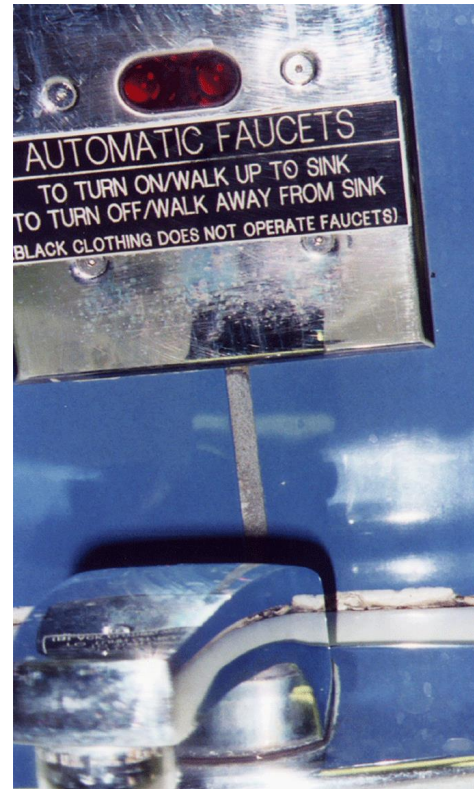


How would you make this action more visible?

- make the card reader more obvious
- provide an auditory message, that says what to do (which language?)
- provide a big label next to the card reader that flashes when someone enters
- make relevant parts visible
- make what has to be done obvious

What do I do if I am wearing black?

Invisible automatic controls can make it more difficult to use



Design principles (cont)

2) Feedback phone calling PC something wrong

- Sending information back to the user about what has been done
- Includes sound, highlighting, animation and combinations of these
- e.g. when screen button clicked on provides sound or red highlight feedback:

 → “ccclchhk”

 → 

Design principles (cont)

3) Constraints

password
Face ID
sound

- Restricting the possible actions that can be performed
- Helps prevent user from selecting incorrect options
- e.g. deactivate certain menu options by shading them gray - thereby restricting the user only to actions permissible at the stage of the activity
- Physical objects can be designed to constrain things ^{key}
- e.g. only one way you can insert a key into a lock

Logical or ambiguous design?



www.baddesigns.com

- Where do you plug the mouse?
- Where do you plug the keyboard?
 - top or bottom connector?
- Do the color coded icons help?

How to design them more logically



www.baddesigns.com

- (i) A provides direct adjacent mapping between icon and connector
- (ii) B provides color coding to associate the connectors with the labels



www.baddesigns.com

Design principles (cont)

operation X change

4) Consistency

1 text
2 arrangement
3 font
4 icons
5 colors

- Design interfaces to have similar operations and use similar elements for similar tasks - easier to learn and use
- e.g. always use ctrl key plus first initial of the command for an operation - ctrl+C (copy), ctrl+S (save)
- Main benefit is consistent interfaces are easier to learn and use

When consistency breaks down

- What happens if there is more than one command starting with the same letter?
 - e.g. save, spelling, select, style
- Have to find other initials or combinations of keys, thereby breaking the consistency rule
 - e.g. ctrl+S, ctrl+Sp, ctrl+shift+L
- Increases learning burden on user, making them more prone to errors

Internal and external consistency

internal { Ctrl C → Windows
Command X → MAC

external: next slide

- Internal consistency refers to designing operations to behave the same within an application
 - Difficult to achieve with complex interfaces
- External consistency refers to designing operations, interfaces, etc., to be the same across applications and devices
 - Very rarely the case, based on different designer's preference

Design principles (cont)



4) Consistency (cont)

- A case of external inconsistency

(a) phones, remote controls

1	2	3
4	5	6
7	8	9
	0	

(b) calculators, computer keypads

7	8	9
4	5	6
1	2	3
0		

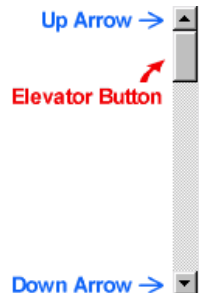
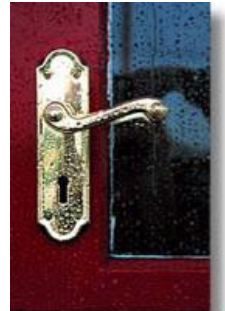
Design principles (cont)

IMP, but why?

*we want to make useable
to make sure accessible to
all*

5) Affordances: to give a clue

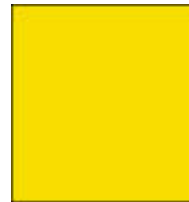
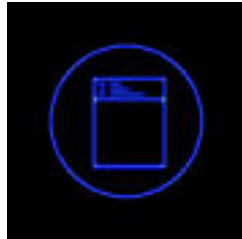
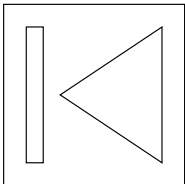
- Refer to an attribute of an object that allows people to know how to use it
- Physical affordances - e.g. door affords pulling, a cup handle affords grasping
- Virtual affordances - e.g. icons to affords clicking, scrollbars to affords moving up and down



Activity

Virtual affordances

- How do the following screen objects afford?
- What if you were a novice user?
- Would you know what to do with them?



Key points

Mental model
capture info, store

external: mm: click holder on elevator buttons

Short/long-term
info processing | & Decaying

- Interaction design is concerned with designing interactive products to support how people communicate and interact in their everyday and working lives
- It is concerned with how to create quality user experiences for services, devices and interactive products
- It is multidisciplinary, involving many inputs from wide-reaching disciplines and fields
- Optimizing the interaction between users and interactive products requires consideration of a number of interdependent factors, including context of use, types of activity, UX goals, accessibility, cultural differences, and user groups.
- Design principles, such as feedback and simplicity, are useful heuristics for informing, analyzing, and evaluating aspects of an interactive product.