Human Computer Interaction

Lecture 1: introduction

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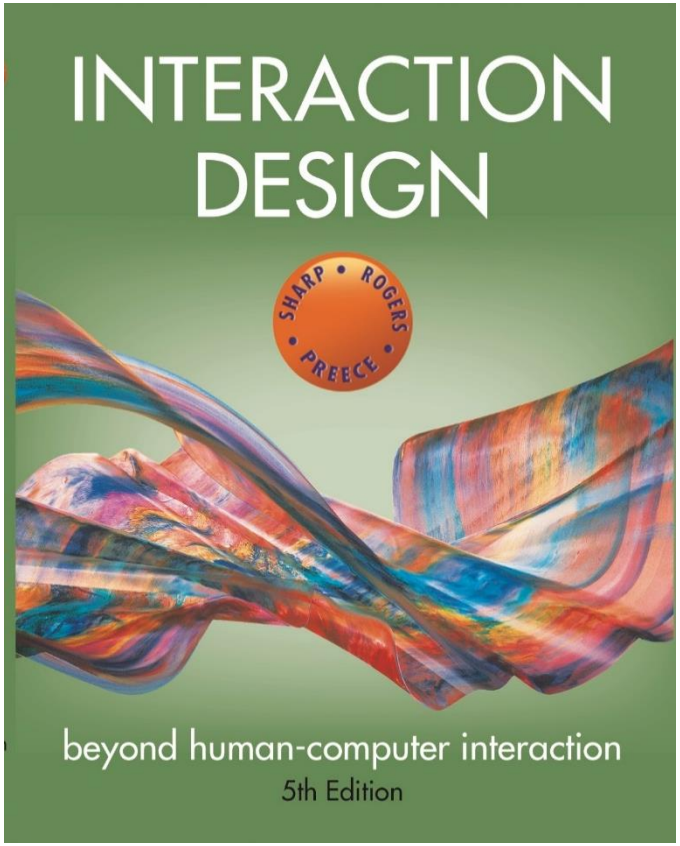
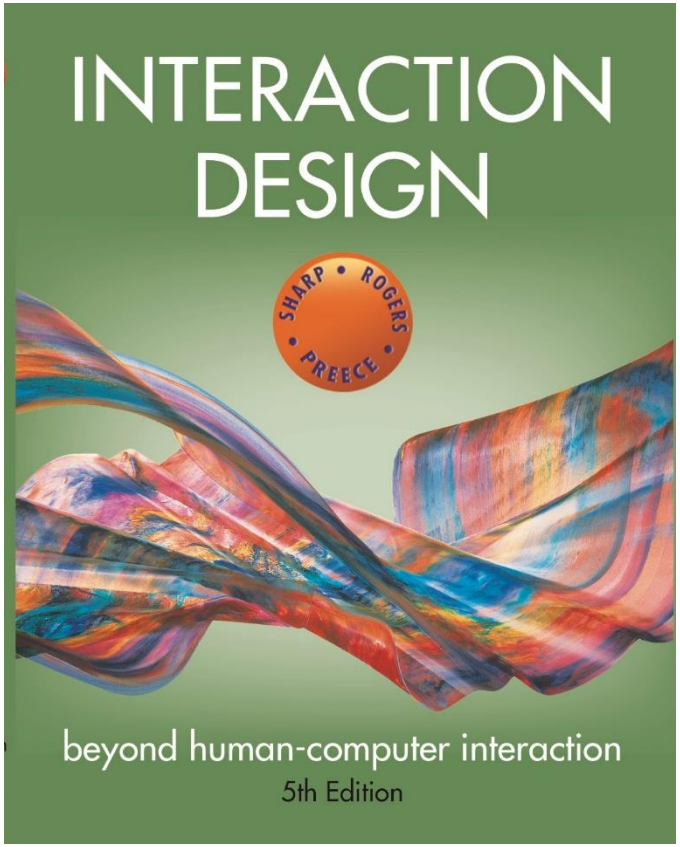
Reference


INTERACTION
DESIGN
SHARP • ROGERS • PREECE
beyond human-computer interaction
5th Edition

Course Description

- WHAT IS INTERACTION DESIGN?
- Human
- THE PROCESS OF INTERACTION DESIGN
- COGNITIVE ASPECTs
- INTERFACES
- DESIGN, PROTOTYPING and CONSTRUCTION
- EVALUATION



Chapter 1

WHAT IS INTERACTION DESIGN?

Interactive Products

How many interactive products are there in everyday use?

Ex: iPad, Smart Phone, TV, Clock alarm, ATM, Websites

What do you think about their usability?

Why there is a difference?

- Usability vs Functionality

Goal: "Design products that are easy, effective, and pleasurable to use"

Bad designs

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.

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

Why is this vending machine so bad?

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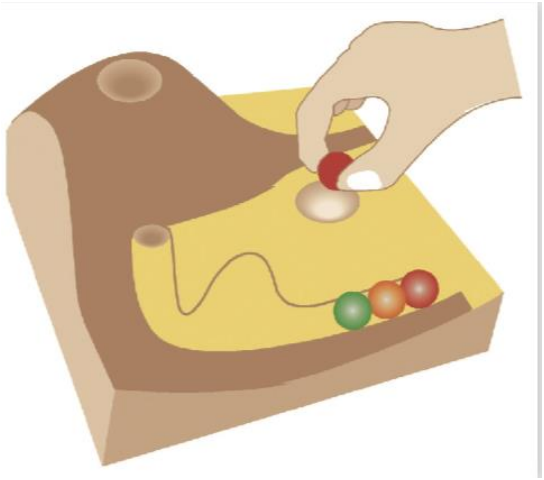
- Need to push button first to activate reader
- Normally insert bill first before making selection
- Contravenes well known convention

Poor & Good Designs

vs.

Good design



- Marble answering machine (Bishop, 1995)
- Based on how everyday objects behave
- Easy, intuitive, and a pleasure to use
- Only requires one-step actions to perform core tasks

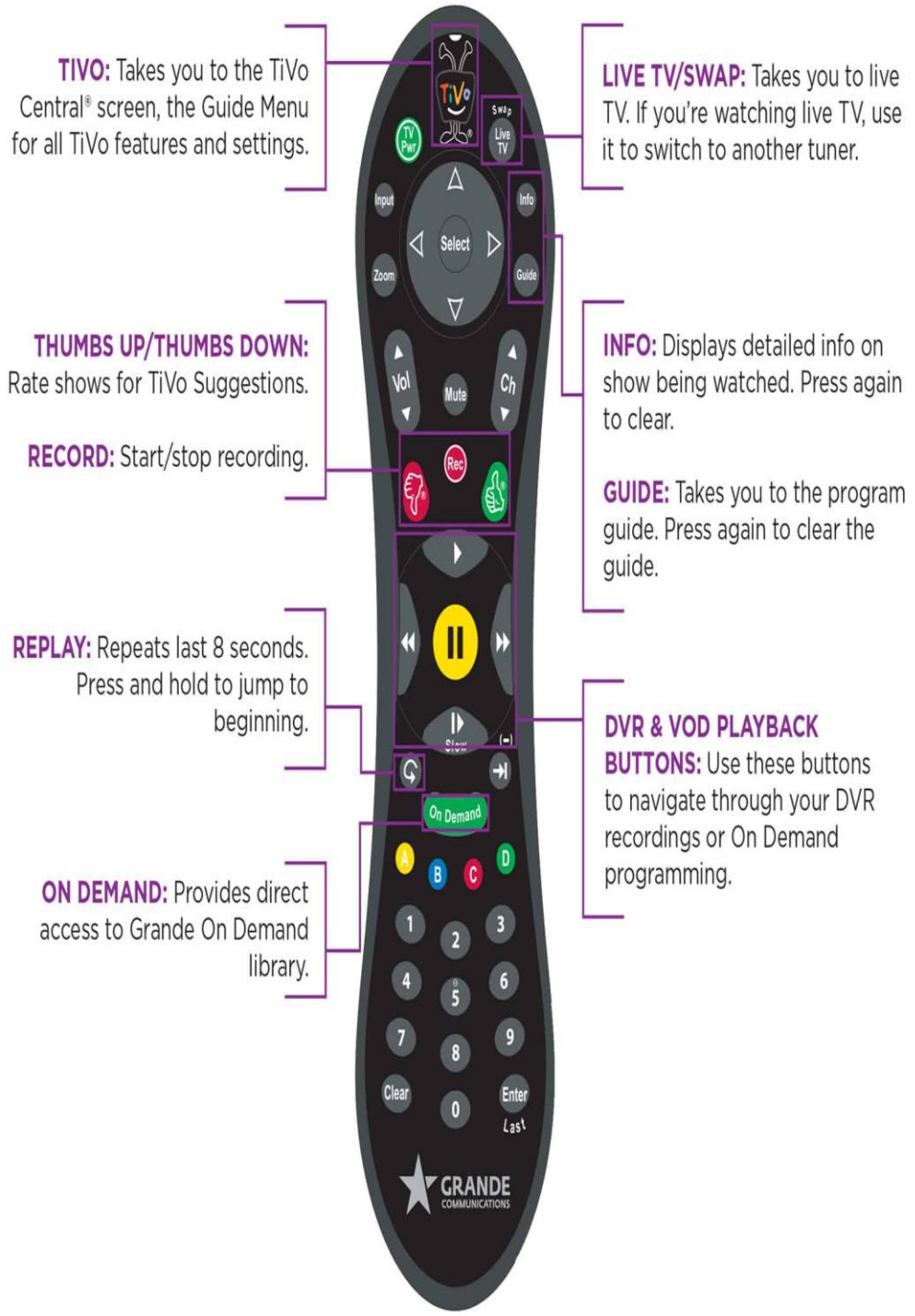
Poor & Good Designs

1 2 3 4 5 6 7

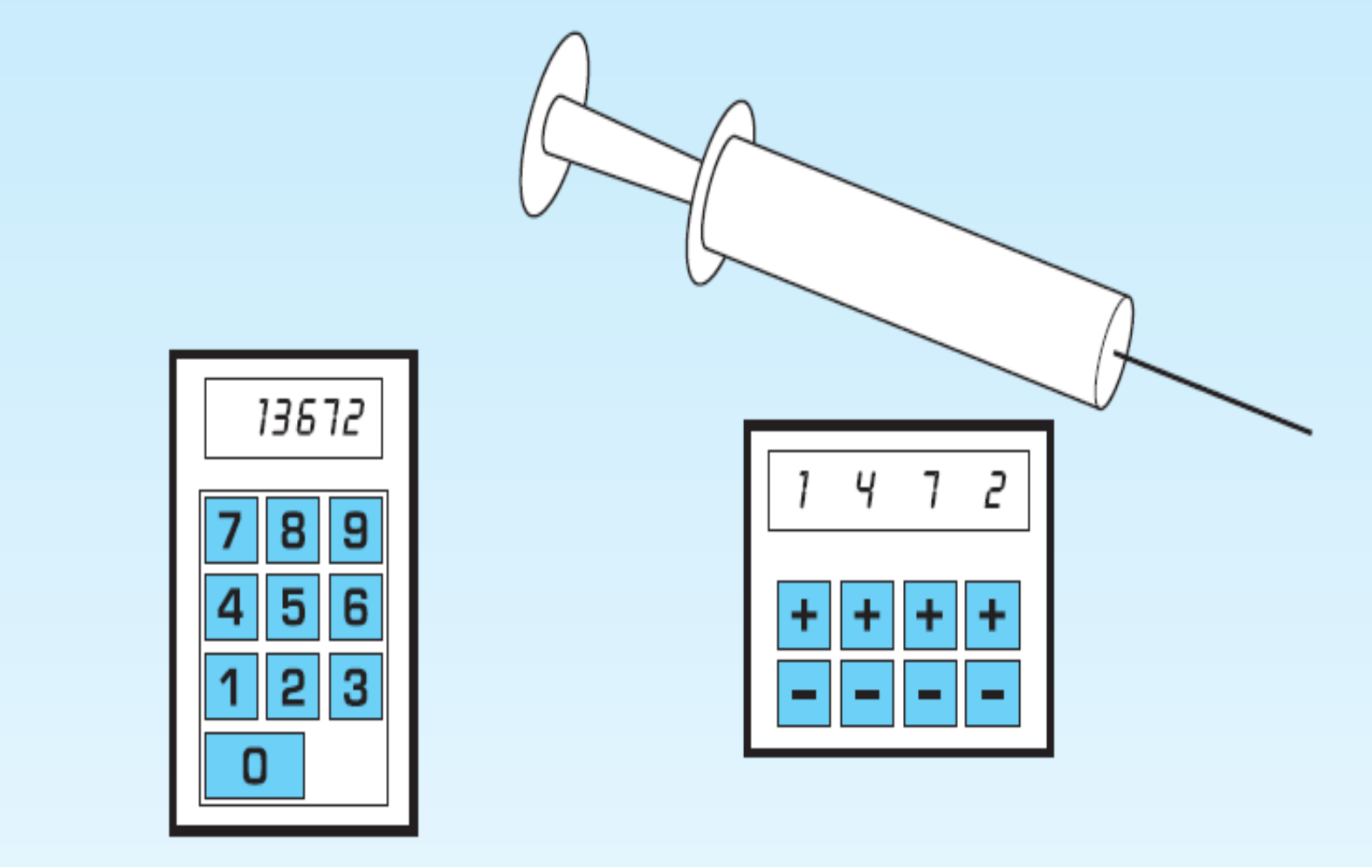
Poor & Good Designs

Why is the TiVo remote much better designed than standard remote controls?

- Peanut shaped to fit in hand
- Logical layout and color-coded, distinctive buttons
- Easy-to-locate buttons



Poor & Good Designs



Interactive Design

"Designing interactive products to support the way people communicate and interact in their everyday and working lives"

"The design of spaces for human communication and interaction"

How this is different from other methods such as "Software Engineering"?

Interactive Design

Who is going to be using?

How they are going to be used?

Where they are going to be used?

Goal:

- Develop usable products
  - Usability means easy to learn, effective to use, and provides an enjoyable experience

- Involve users in the design process

Interactive Design

Why?

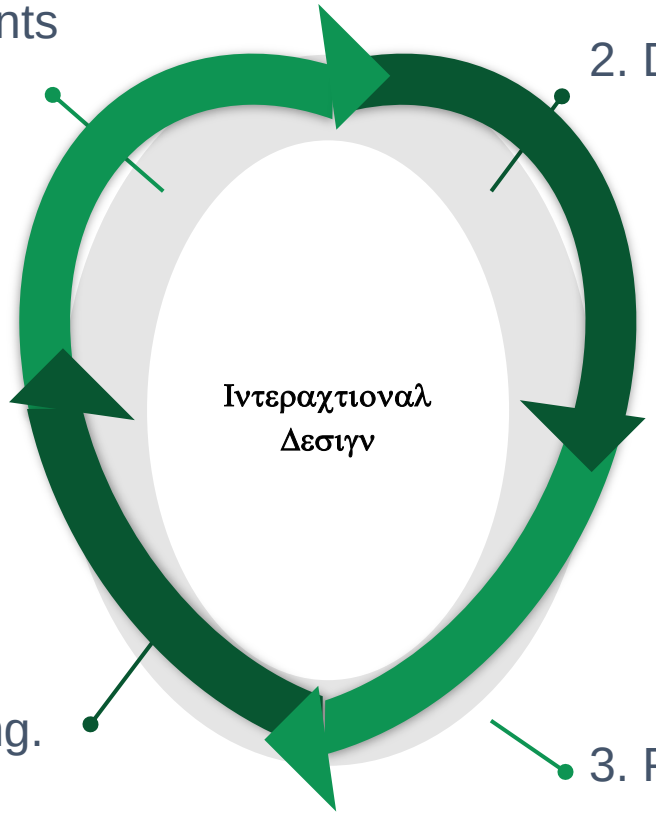
1. Transforming human–human transactions into solely interface-based ones
   Examples: Self-checkouts at grocery stores, airports, and libraries

1. Extend the users' activities in effective, pleasurable, useful, and usable ways
   Examples: cameras, microwave ovens, and washing machines

The Process of Interaction Design

1. Establishing requirements

2. Designing alternatives

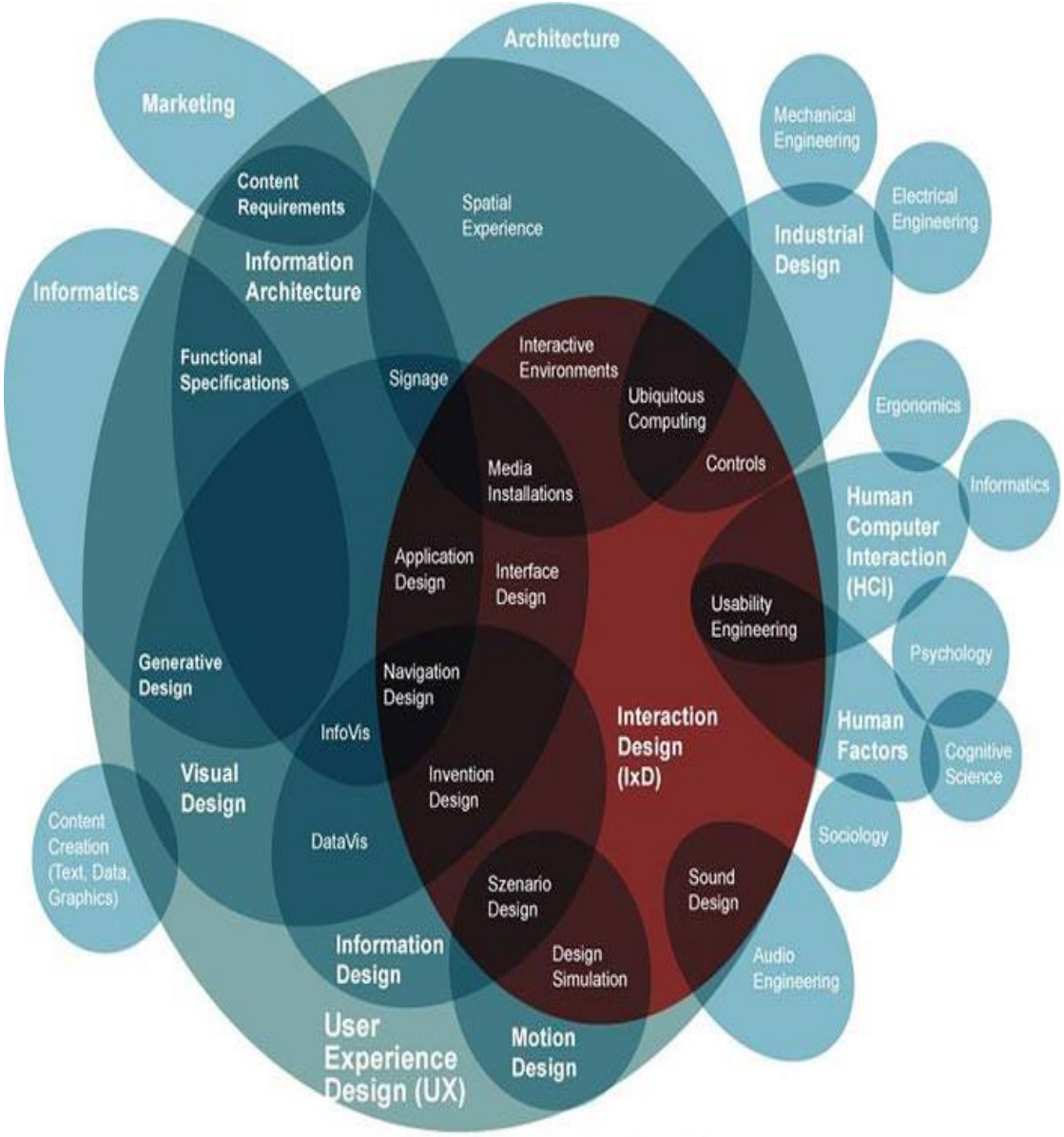


4. Evaluating.

3. Prototyping

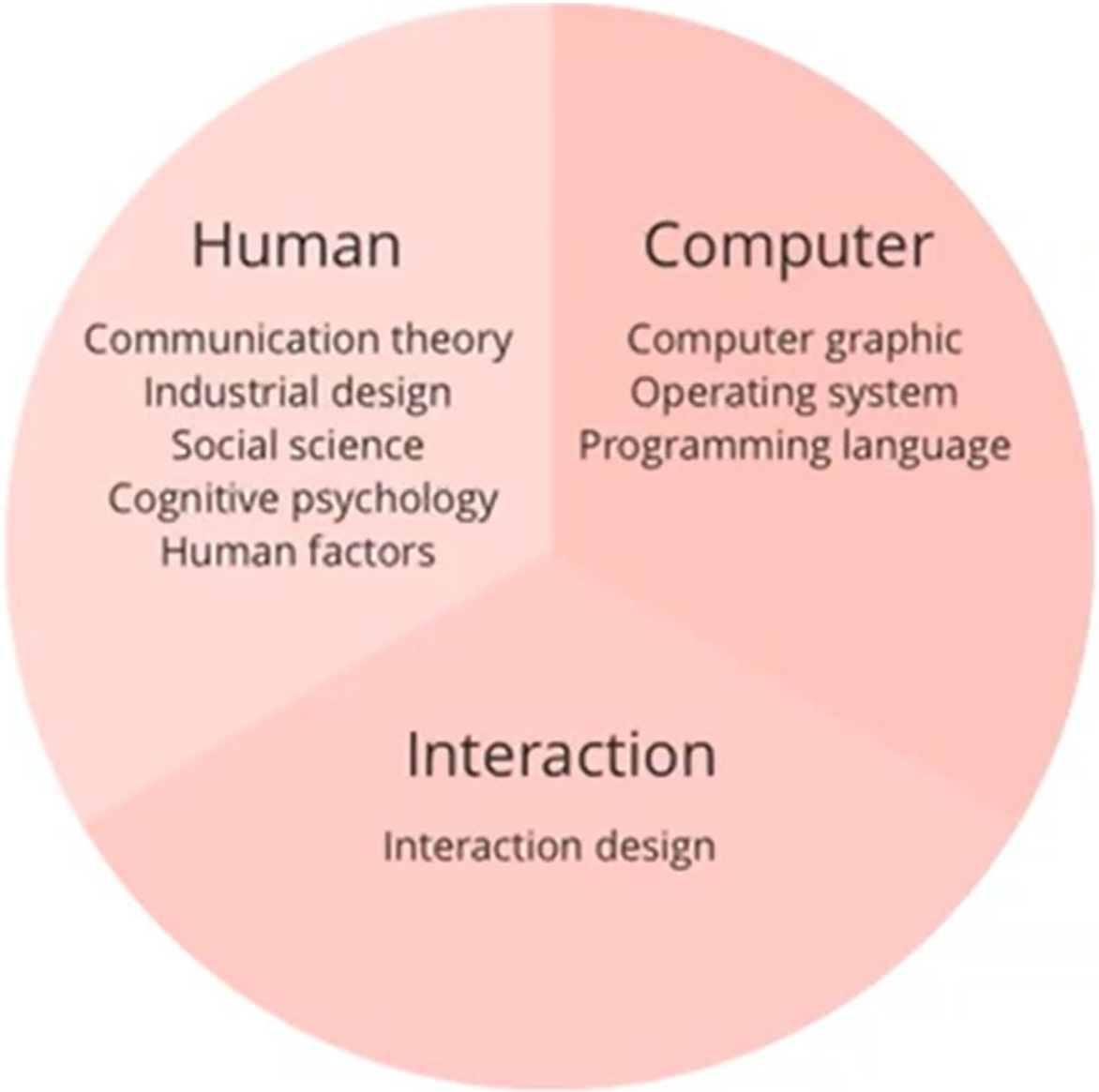
Human-Computer Interaction (HCI)

"The design, evaluation, and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them"



Human computer interaction

Human Computer Interaction (HCI) is a multidisciplinary field of study focusing on the design of computer technology and, in particular, the interaction between humans (the users) and computers. While initially concerned with computers, HCI has since expanded to cover almost all forms of information technology design.


Human
Communication theory
Industrial design
Social science
Cognitive psychology
Human factors
Computer
Computer graphic
Operating system
Programming language
Interaction
Interaction design

User Experience (UX)

“How a product behaves and is used by people in the real world. How people feel about a product and their pleasure and satisfaction when using, looking at, holding, opening or closing it.”

User Experience (UX)

Every product that is used by someone has a user experience: newspapers, ketchup bottles, reclining armchairs, cardigan sweaters

Positive experiences drive curiosity. They help motivate us to grow as individuals.

Negative experiences help us prevent repeated mistakes.

User Experience (UX)

Watch the small details!!

- How smoothly a switch rotates
- The sound of a click
- The touch of a button when pressing it
- The colors selection
- The weight of the device
- ….

User Experience (UX)

Factors of UX are

1. Usability
2. Functionality
3. Aesthetics / Look and feel
4. Content
5. Emotional appeal (Norman’s model: visceral, behavioral, reflective)

Norman’s model

Visceral

Users’ gut reactions to or their first impressions of your design; e.g., an uncluttered user interface suggests ease of use.

Behavioral

Users subconsciously evaluate how your design helps them achieve goals, and how easily. They should feel satisfied that they’re in control, with minimum effort required.

Reflective

After they encounter your design, users will consciously judge its performance and benefits, including value for money. If they’re happy, they’ll keep using it, form emotional bonds with it and tell their friends.

Usability

"Ensuring that interactive products are easy to learn, effective to use, and enjoyable from the user's perspective"

Usability Goals:

- Effectiveness
- Efficiency
- Safety
- Utility
- Learnability
- Memorability

Usability - Effectiveness

Doing The Right Things

How good a product is at doing what it is supposed to do?

Question: Is the product capable of allowing people to carry out their work, access the information they need, or buy the goods they want?

Usability - Efficiency

Doing Things Right

Refers to the way a product supports users in carrying out their tasks

Question: Once users have learned how to use a product to carry out their tasks, can they sustain a high level of productivity?

Examples:

- Marble answering machine
- Saving profiles in online system

Usability - Safety

Protecting the user from dangerous conditions and undesirable situations

Question: What is the range of errors that are possible using the product and what measures are there to permit users to recover easily from them?

Examples:

- Menu items positioning
- Undo
- Warning messages

Usability - Utility

Provides the right kind of functionality so that users can do what they need or want to do.

Question: Does the product provide an appropriate set of functions that will enable users to carry out all their tasks in the way they want to do them?

Examples:

- Drawing tool without freenhand support
- Remote control to move cursor

Usability - Learnability

How easy a system is to learn to use

Question: Is it possible for the user to work out how to use the product by exploring the interface and trying out certain actions? How hard will it be to learn the whole set of functions in this way? How long does it take?

Examples:

- GPS
- Autocad / Photoshop

Usability - Memorability

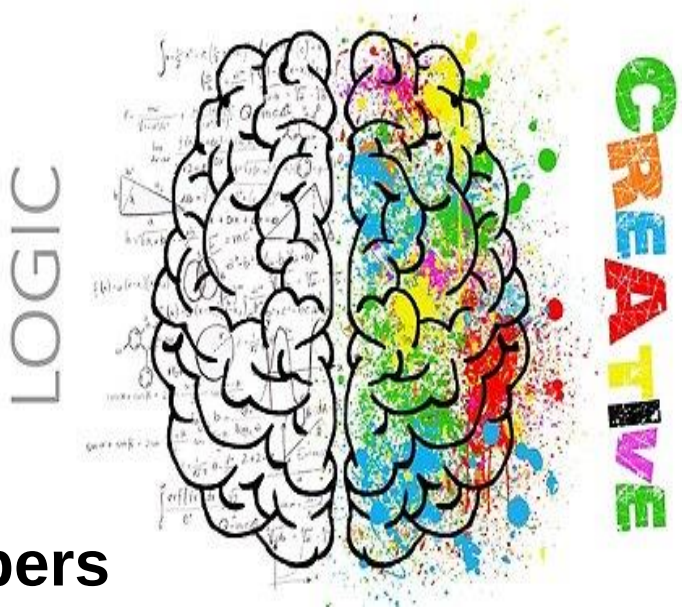
How easy a product is to remember how to use, once learned.

Question: What kinds of interface support have been provided to help users remember how to carry out tasks, especially for products and operations they use infrequently? What is the number of errors made when carrying out a given task over time?

Examples:

- Menu items placement

Who is involved



Developers

Understand

- The business side,
- The technical side,
- The manufacturing side

Designers

- How people act and react to events?
- How they communicate and interact with each other?
- How emotions work?
- Create engaging user experience

How easy is it to work in multidisciplinary teams?

Working in multidisciplinary teams

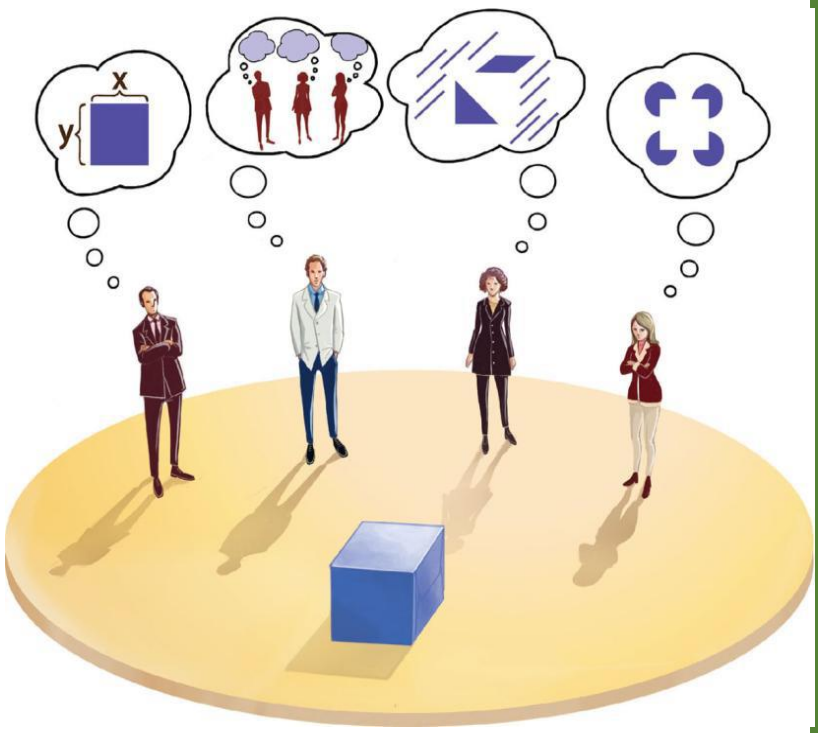
- Many people from different backgrounds involved
- Different perspectives and ways of seeing and talking about things

Benefits

- More ideas and designs generated

Disadvantages

- Difficult to communicate and progress forward the designs being create



What do professionals do in the ID business?

- **interaction designers** - people involved in the design of all the interactive aspects of a product
- **usability engineers** - people who focus on evaluating products, using usability methods and principles
- **web designers** - people who develop and create the visual design of websites, such as layouts
- **information architects** - people who come up with ideas of how to plan and structure interactive products
- **user experience designers (UX)** - people who do all the above but who may also carry out field studies to inform the design of products

Core characteristics of interaction design

- Users should be involved throughout the development of the project
- Specific usability and user experience goals need to be identified, clearly documented, and agreed to at the beginning of the project
- Iteration is needed through the core activities

Why?

Help designers:

- Understand how to design interactive products that fit with what people want, need, and may desire
- Appreciate that one size does not fit all (for example, teenagers are very different to grown-ups)
- Identify any incorrect assumptions they may have about particular user groups. (for example, 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

- Focus is on people with disabilities; for instance, those using android OS or apple voiceover

Inclusiveness: making products and services that accommodate the widest possible number of people

- For example, 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:

- 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)
- Cognitive (including learning impairment or loss of memory/cognitive function due to old age)

Each type can be further defined in terms of capability:

- For example, someone might have only peripheral vision, be color blind, or have no light perception

Impairment can be categorized:

- Permanent (for instance, long-term wheelchair user)
- Temporary (that is, after an accident or illness)
- Situational (for example, a noisy environment means that a person can’t hear)


Any
Questions
.co.nz

Design principles

- 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 Strategy

1. Make use of affordance (how do I use it?)
2. Make use of constraints (why can't I do that?)
3. Provide a good conceptual model
4. Make things visible
5. Use a good mapping – a natural one if possible (where am I? and where can I go?)
6. Provide feedback (what is it doing now?)
7. Keep the number of features, actions and controls balanced

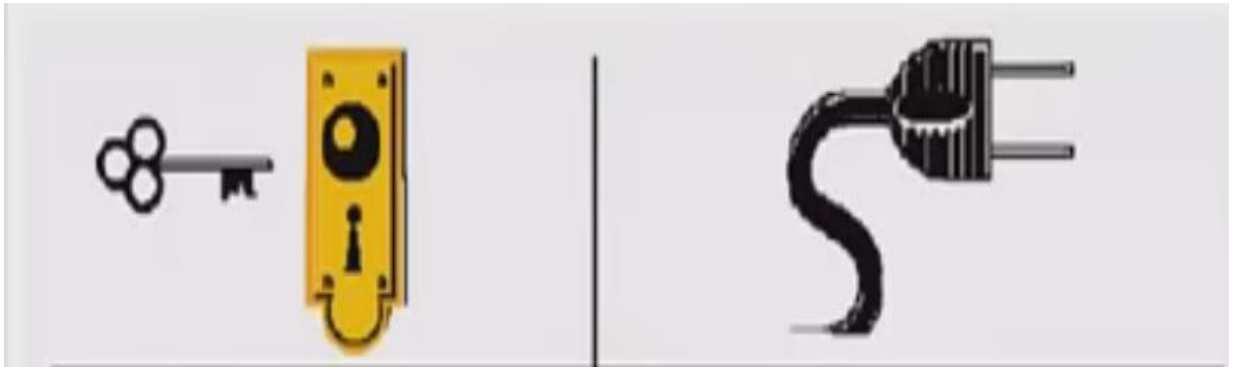
Affordances: to give a clue

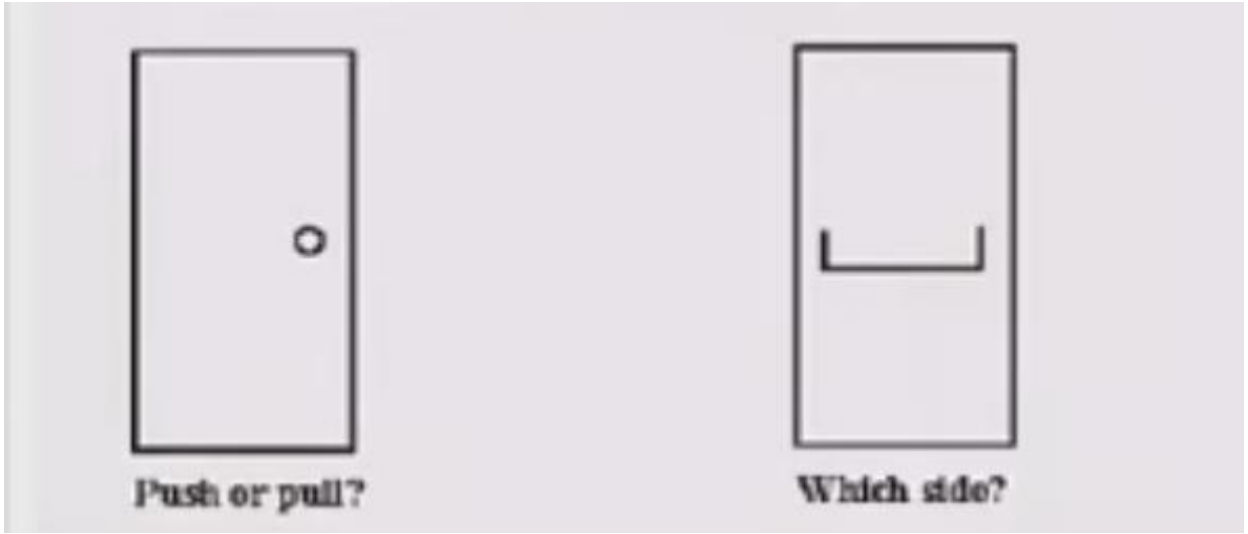
- Refers to an attribute of an object that allows people to know how to use it.
  - Button affords pushing
  - Handle affords grasping
  - Chair affords sitting
  - Knob affords turning
- Just by looking at the object, a user should know how to use it
  - Example: The doors with handles to push
- Norman (1988) used the term to discuss the design of everyday objects
- Has since been popularized in interaction design to discuss how to design interface objects (for example, scrollbars to enable moving up and down; icons to click on)

What does “affordance” have to offer interaction design?

- Interfaces are virtual and do not have affordances like physical objects
- Norman argues that it does not make sense to talk about interfaces in terms of ‘real’ affordances
- Instead, interfaces are better conceptualized as ‘perceived’ affordances:
    - Learned conventions of arbitrary mappings between action and effect at the interface
    - Some mappings are better than others

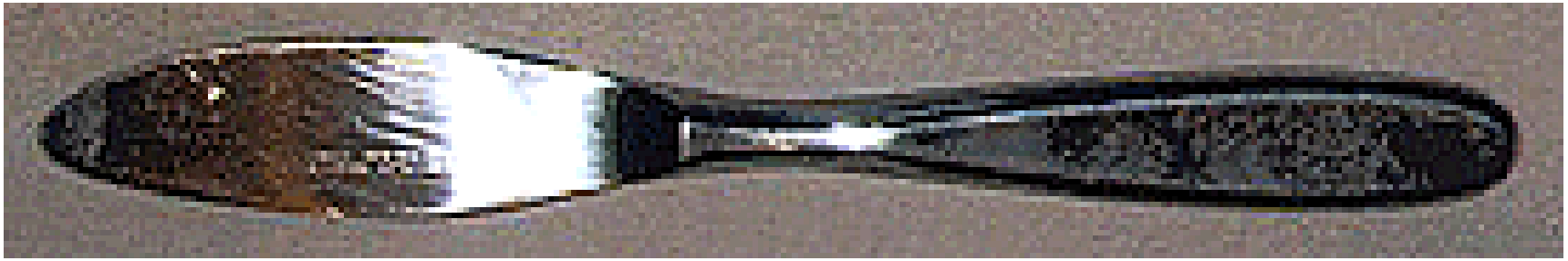
Examples





How do you open this drawer?

Which side do you use for cutting?



2. Constraints

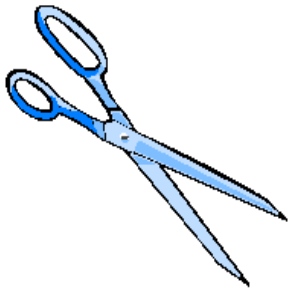
- Constraints limit the ways in which something can be used
  - Restricting the possible actions that can be performed
  - Helps prevents user from selecting incorrect options

  The more constraints, the less opportunity for error

- Constraints can be
  - Physical
  - Cultural
  - Logical

Physical constrain

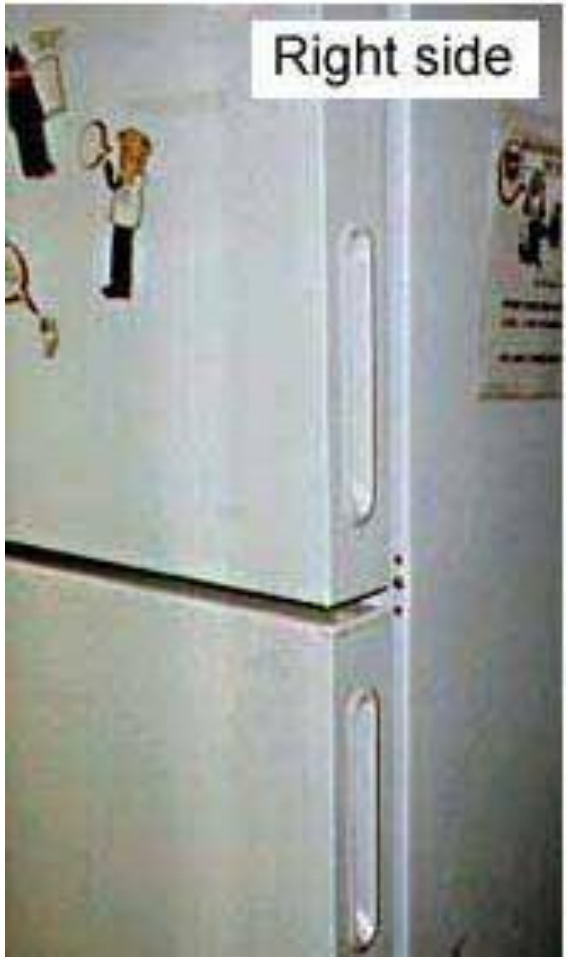
- The physical properties of an object constrain the possible operations:
  - The order in which parts can go together
  - the ways in which an objects can be picked up , moved, manipulated
- Examples: Scissors, doors, drawers



Paper scissors

Barber scisssors

On which side does the door open?



Example (physical constrains)

- The design of floppy disk drives allows the disk to be inserted in the correct way only
- The design of video cassette drives allows the cassette to be inserted in the correct way only
- Bank card can be inserted in certain way, keys on a pad can only be pressed in certain way. (ATM machine)

Culture constrains

- Cultural Constraints relay on **learned conventions** (e.g red for warning, certain audio signals for danger, smiley face for happy emotions)
- Once accepted by more than one cultural groups, they become universally accepted conventions.
  - Tighten screws by turning clockwise
  - loosen screws by turning anti-clockwise
  - desktop metaphor used in GUIs

Logical constrains

- Where do you plug the mouse and keyboard?
- top or bottom connector? trial and error? experience?
- Do the colour coded icons help?

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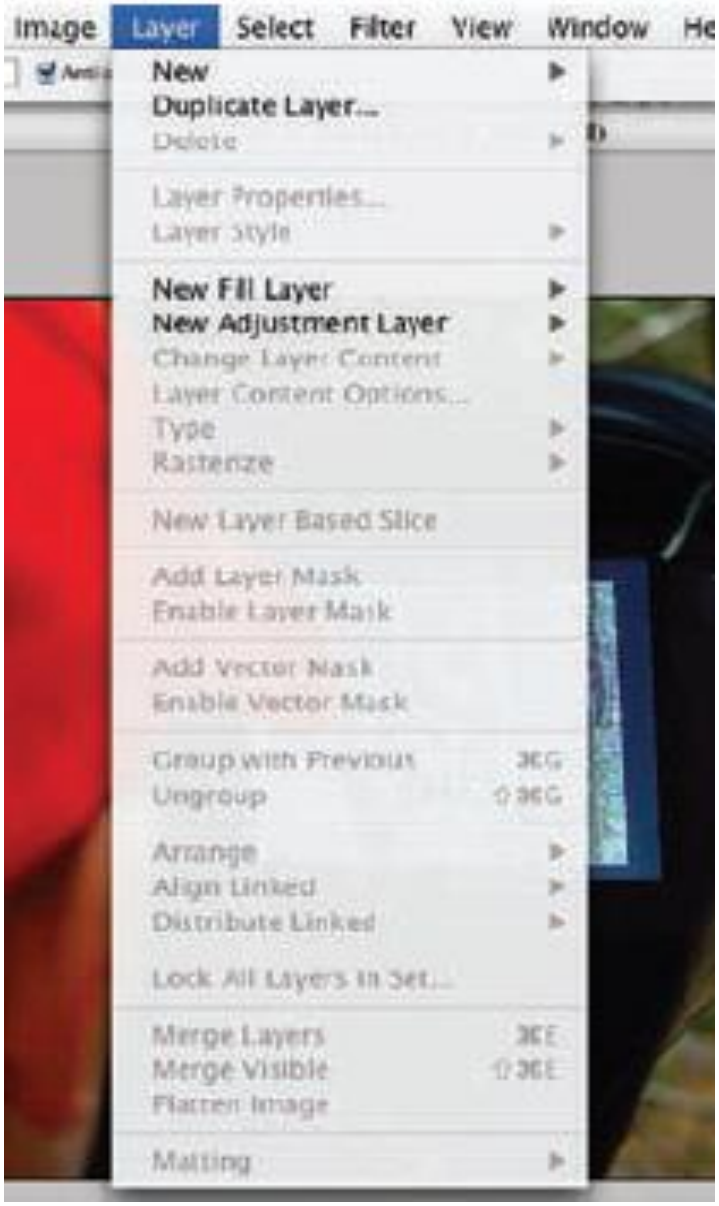

How to design them more logically

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(A) provides direct adjacent mapping between icon and connector

(B) provides color coding that associates the connectors with the labels

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3.Conceptual model

- Conceptual models are mental models, Models that people have of themselves, others, the environment and the things with which they interact.

- People from mental models (experience, **training** and instruction)

Conceptual model effect

- A good conceptual model allows users
  - To predict the effect of their actions
  - to understand the relationship between the controls of a device and the outcome

- A poor conceptual model
  - force users to operate by role, blindly
  - make it difficult to determine the effects of actions
  - make it difficult to figure out what to do in novel situation

Conceptual model : **Metaphor**

- Often designers employ metaphors to help the user from a suitable mental model
- metaphors can be used to develop interfaces for applicant
- desktop, office

Conceptual model : **Visibility**

- visibility is an important principle of design and is used to
  - Make the operations of device understandable
  - act as a reminder of what can and cannot be done
  - make the state of the system clear

- Visibility is achieved by
  - Making the correct parts or controls visible
  - Conveying the correct message

- when the number of possible actions exceeds the number of controls, some functions become invisible, resulting in complexity

Conceptual model : **Visibility**

- Good visibility leads to objects/devices that are:
  - Easier to understand
  - Easier to use
  - Easier to remember
  - quick to learn

- How to make things visible
  - Employ natural signals
  - use good mappings
  - good placement of control

- Principle of visibility
  - it should be obvious what a control used for

Visibility examples

GIMP

Visibility - poor interface

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- This is a control panel for an elevator
- How does it work?
- Push a button for the floor you want?
- Nothing happens. Push any other button? Still nothing. What do you need to do?
- It is not visible as to what to do!

Visibility - Improving on a poor interface

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…with this elevator, 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?

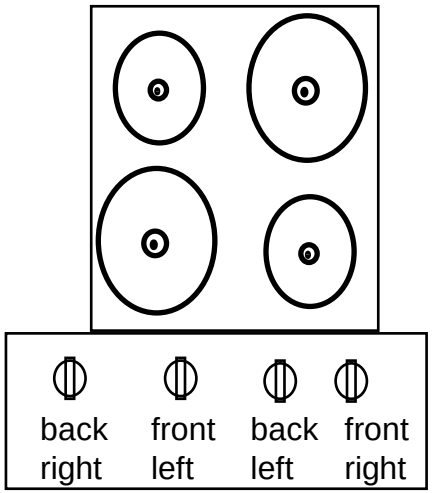
- Make the card reader more obvious
- Provide an auditory message that says what to do (which language?)
- Provide a big label next to the card reader that flashes when someone enters
- Make relevant parts visible
- Make what has to be done obvious

Conceptual model : **Mapping**

- Controls and displays should exploit natural mapping
- Natural mapping takes advantage of physical analogies and cultural standards
  - Physical: Steering wheel
  - Cultural: red means stop, green means go

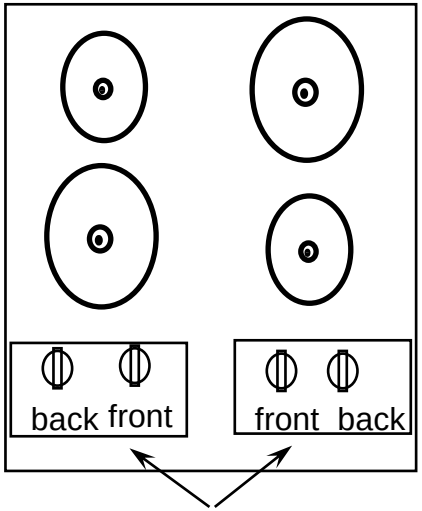
Mapping

arbitrary



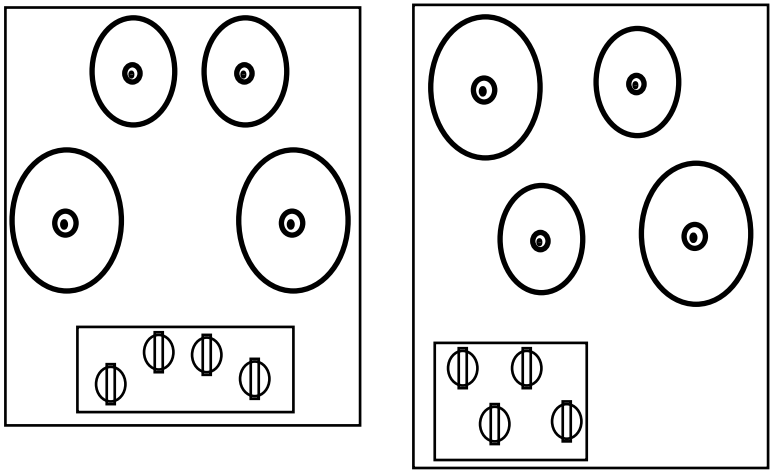
24 possibilities, requires:
-visible labels + memory

paired



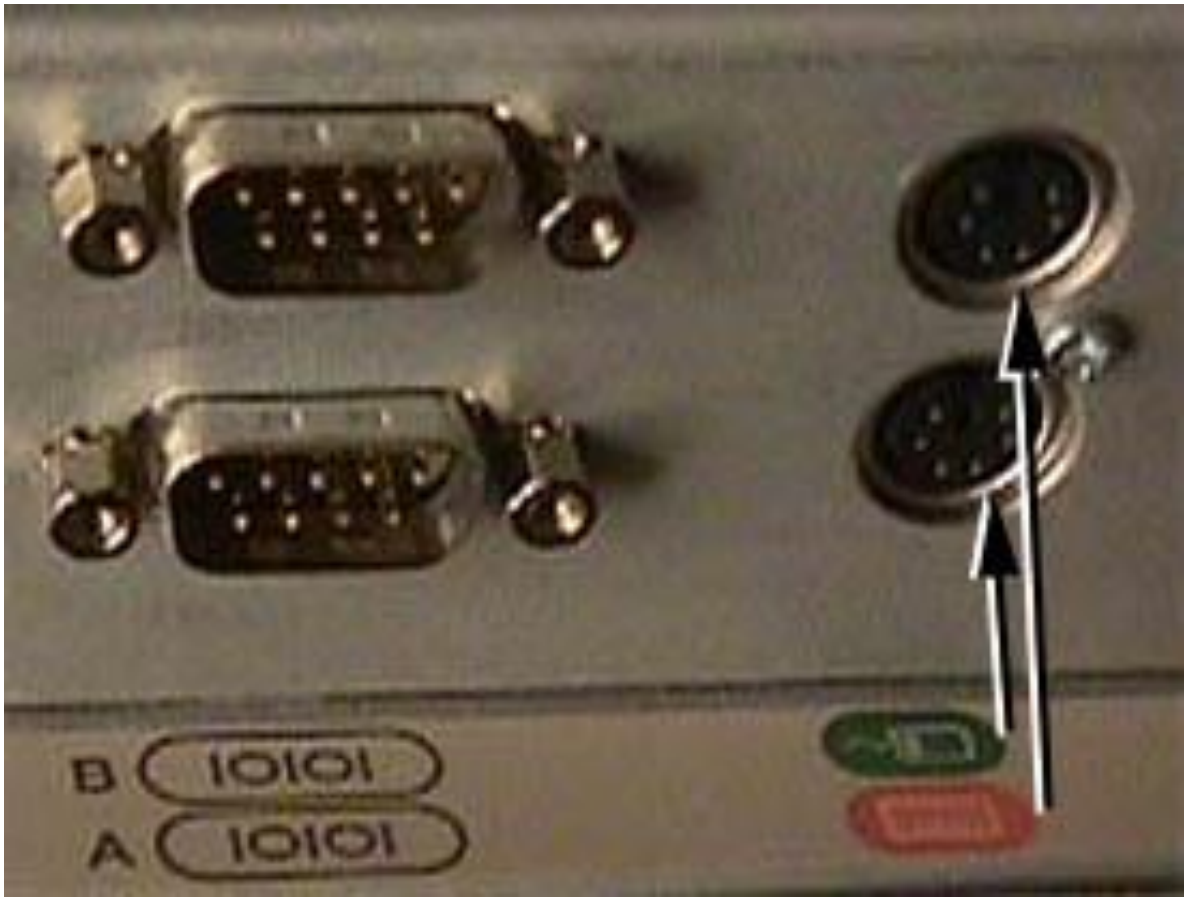
2 possibilities per side
=4 total possibilities

full mapping



Mapping Problems

Where do you plug in the mouse?



Mapping ambiguous

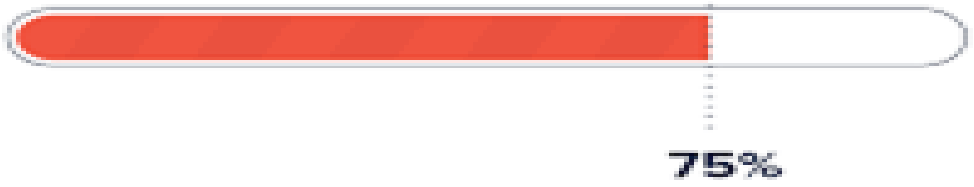
Feedback

- Feedback is sending back to the user information about what action has actually been done
- Visibility of the effects of the operation tell you if something worked correctly
- Systems should be designed to provide adequate feedback to the users to ensure they know what to do next in their tasks
- feedback can be presented **visually** and **aurally**

Tactile feedback should allow users to recognize and distinguish different meanings

Feedback Examples

- Telephone button press tones
  - Telephone clicks
- Rice cooker goes “bing!”
- Clicker on your turn signal
- Animated icon while waiting for a web page to load



Manage complexity

- Today's devices and computer system are commonly developed with many , many, features.

- However , the increase in controls and features makes it more difficult
  - To make all the controls visible

- which make it harder for the user to
  - understand the device
  - Learn how to use it
  - Memorize functions

- keep the number of features, actions and controls **Balanced**

Norman’s Principles in Software

- Visibility
  - Visibility of the tasks the interface supports
  - Communication of system state / mode
- Affordance
  - If it looks like a button it can be pressed, if it is a underlined it can be clicked (web)
- Mapping
  - Clicking on a particular interface element produces expected effect (under File should be open)

Norman’s Principles in Software

- Constraints
  - Constraining search criteria, graying out menu items that don’t apply in a particular context
- Feedback
  - Providing clear and immediate feedback for each user action

Consistency

- Design interfaces to have similar operations and use similar elements for similar tasks. (for example, always use Ctrl key plus first initial of the command for an operation: Ctrl+c, Ctrl+s, Ctrl+o)

- The main benefit is that 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? (for example, save, spelling, select, style)
- You have to find other initials or combinations of keys, thereby breaking the consistency rule (for example, Ctrl+s, Ctrl+Sp, Ctrl+shift+l)
- Increases learning burden on user, making them more prone to errors

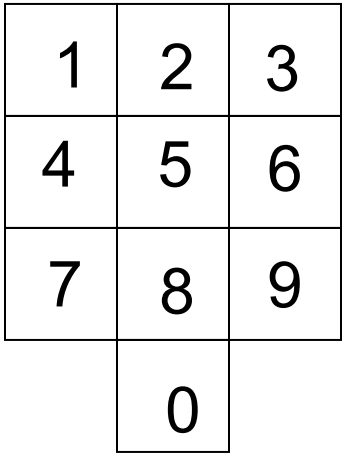
Internal and external consistency

- 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, and so on to be the same across applications and devices
  - Very rarely the case, based on different designer's preference

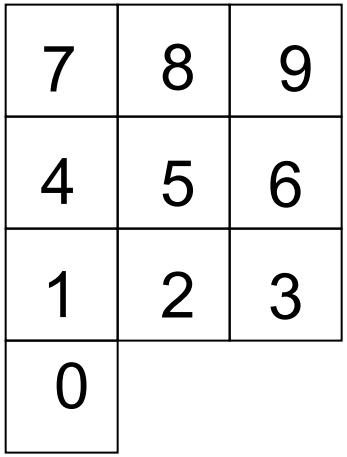
Keypad numbers layout

A case of external inconsistency

(a) phones, remote controls



(b) calculators, computer keypads



Key points

- 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.