Design of Interactive Systems (DIS)

Lecture 4: Usability

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Overview

- **Chapter 1**: Designing interactive systems: a fusion of skills
- **Chapter 2**: PACT: a framework for designing interactive systems
- **Chapter 3**: The process of human-centred interactive system design
- **Chapter 4**: Usability
- **Chapter 5**: Experience Design
- **Chapter 6**: The Home Information Centre (HIC): a case study in designing interactive systems

Usability

- Usability has always been the central pursuit of HCI
- Definition: “usability is that systems should be easy to use, easy to learn, flexible and should engender a good attitude in people (Shackel, 1990)”.
- Aim:
  - Understand the key issues and concepts of access
  - Understand the principles underlying usability
  - Understand the key issues of acceptability
  - Understand the general principles of good interactive systems design.

Different views of Good Design

The interactive systems designer aims to

- **View-1:** produce systems and products that are ***accessible, usable, socially*** and ***economically acceptable*****.**
- **View-2:** produce systems that are ***learnable, effective*** and ***accommodating***.
- **View-3:** balance the **PACT elements** with respect to a domain.

Good Design

- **Accessibility** concerns removing the barriers that would otherwise exclude some people from using the system at all.
- **Usability** refers to the quality of the interaction in terms of parameters such as ***time taken to perform tasks***, ***number of errors made*** and ***the time to become a competent user***.
- A system must be *accessible* before it is *usable*.
- Acceptability refers to fitness for purpose in the context of use.

Accessibility

- Legislation such as the UK's Equality Act 2010 and Section 508 in the USA now requires software to be accessible.
- People will be excluded from accessing interactive systems for several reasons

Accessibility

- **Physically** people can be excluded (devices making excessive demands on their ability)
- **Conceptually** people may be excluded because they cannot form a clear mental model of the system.
- **Economically** people are excluded if they cannot afford some essential technology.
- **Cultural exclusion** results from designers making inappropriate assumptions about how people work and organize their lives
- **Social exclusion** can occur if equipment is unavailable at an appropriate time and place

Overcome Barriers of Accessibility

- Two main approaches
  - design for all/ universal design
    - goes beyond the design of interactive systems and applies to all design endeavours
  - inclusive design
    - **Varying ability** is not a special condition of the few but a common characteristic of being human and **we change physically** and **intellectually** throughout our lives.
    - If a design works well for people with disabilities, it works better for everyone.
    - At any point in our lives, personal self-esteem, identity and well-being are deeply affected by our ability to function in our physical surroundings with a sense of comfort, independence and control.
    - Usability and aesthetics are mutually compatible

Principles of universal design*

Equitable use. The design does not disadvantage or stigmatize any group of users.

Flexibility in use. The design accommodates a wide range of individual preferences and abilities.

Simple, intuitive use. Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

Perceptible information. The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

Tolerance for error. The design minimizes hazards and the adverse consequences of accidental or unintended actions.

Low physical effort. The design can be used efficiently and comfortably, and with a minimum of fatigue.

Size and space for approach and use. Appropriate size and space are provided for approach, reach, manipulation, and use, regardless of the user's body size, posture, or mobility.

* Compiled by advocates of universal design, listed in alphabetical order: Bettye Rose Connell, Mike Jones, Ron Mace, Jim Mueller, Abir Mullick, Elaine Ostroff, Jon Sanford, Ed Steinfeld, Molly Story, Gregg Vanderheiden.

Inclusive Design

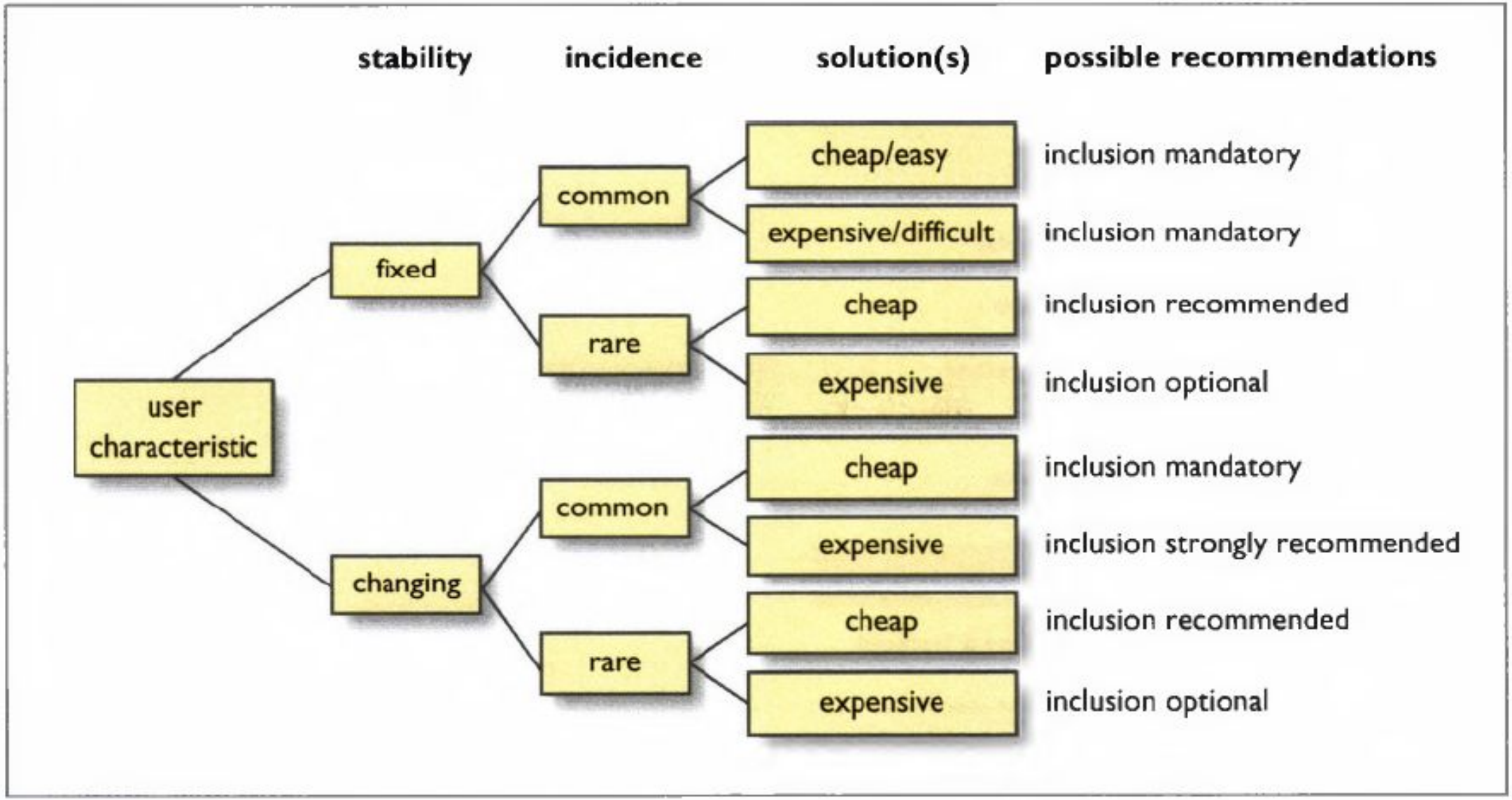


Figure 4.1 Decision tree for inclusivity analysis

Accessibility

- As a way of ensuring an accessible system, designers should:
  - include people with **special needs** in requirements analysis and testing of existing systems;
  - consider whether **new features affect users** with special needs (positively or negatively) and note this in the specification;
  - take account of guidelines - include evaluation against guidelines;
  - Include special needs users in usability testing and beta tests.

Usability

- A system with a **high degree of usability** will have the following characteristics:
  - It will be efficient in that people will be able to do things using an **appropriate amount of effort**.
  - It will be effective in that it contains the **appropriate functions** and **information content**, organized in an **appropriate manner**.
  - It will be **easy to learn** how to do things and remember how to do them after a while.
  - It will be **safe to operate** in the variety of contexts in which it will be used.
  - It will have **high utility** in that it does the things that people want to get done.

Key Principles of Usability

- *Early focus on users and tasks*
- *Empirical measurement*
- *Iterative design*
- *Integrated usability*

Key Principles of Usability

- ***Early focus on users and tasks***
  - Designers must first understand **who the users** will be, in part by studying the **nature of the expected work** to be accomplished, and in part by making users part of the design team through participative design or as consultants.

Key Principles of Usability

- ***Empirical measurement***
  - Early in the development process, intended users' reactions to printed scenarios and user manuals should be observed and measured.
  - Later on they should actually use **simulations** and **prototypes** to carry out real work, and their **performance** and **reactions** should be observed, recorded and analysed.

Key Principles of Usability

- ***Iterative design***
  - When problems are found in user testing, as they will be, they must be fixed. This means design must be iterative: there must be a cycle of design, test and measure, and redesign, repeated as often as necessary.
  - Empirical measurement and iterative design are necessary because designers**, no matter how good they are, cannot get it right the first few times** (Gould et *al.,* 1987, p. 758).

Key Principles of Usability

- *Integrated usability*
  - All usability factors must evolve together, and responsibility for all aspects of usability should be under one control

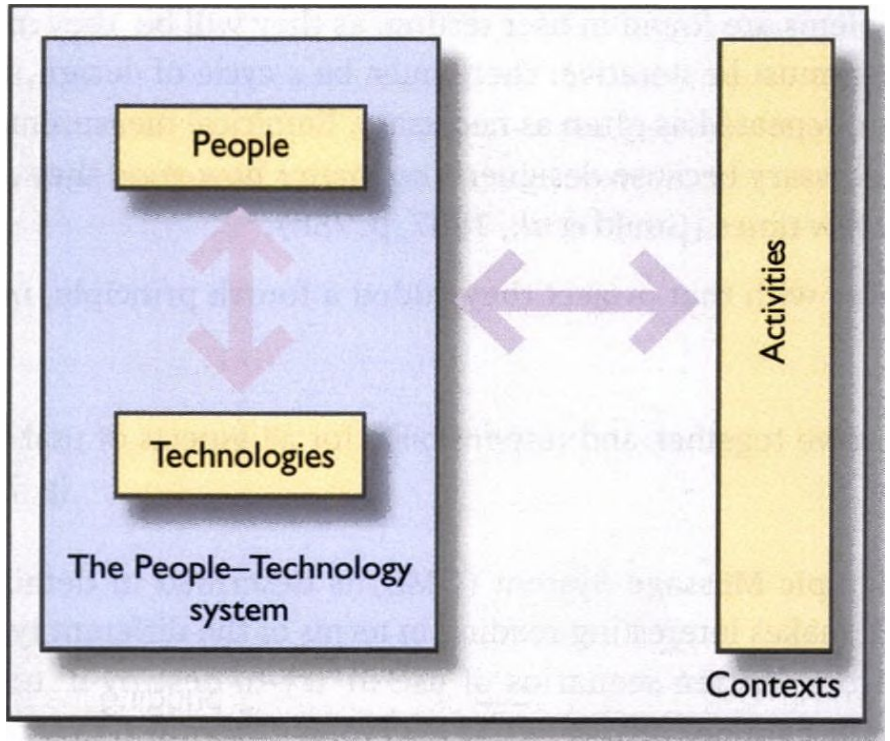
Value Sensitive Design

- Value Sensitive Design is a design approach that aims to account for **human values** in a principled and comprehensive manner emphasizing the **moral perspective**, **usability** and **personal preferences**.

Usability Aim

- One way to look at usability is to see it as concerned with achieving a balance between the four principal factors of human-centred interactive systems design, PACT:
  - People
  - Activities people want to undertake
  - Contexts in which the interaction takes place
  - Technologies (hardware and software)

  Two relationships need to be optimized.



Norman's Characterization

- Don Norman (Norman, 1988) focuses on the **interface** between **a person** and the **technology** and **on the difficulty of people having to translate their goals into the specific actions required by a user interface**.

  - People have goals - things they are trying to achieve in the world. But devices typically only deal with simple actions. This means that two 'gulfs' have to be bridged.

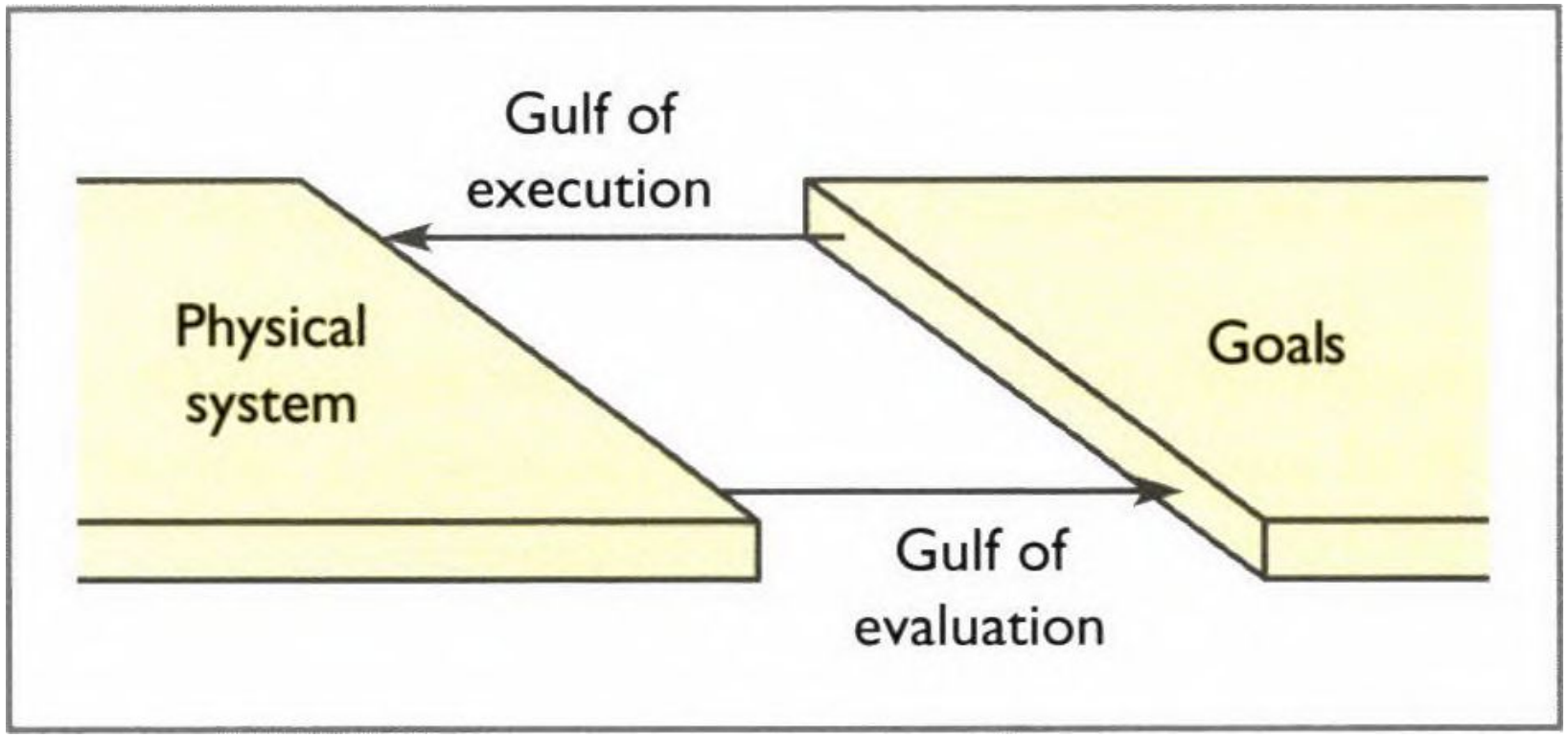
Norman's Characterization

- The **gulf of execution** is concerned with translating goals into actions, and the **gulf of evaluation** is concerned with deciding whether the actions were successful in moving the person towards his or her goal.

- These gulfs have to be bridged both semantically (does the person understand what to do and what has happened?) and physically (can the person physically or perceptually find out what to do or what has happened?).

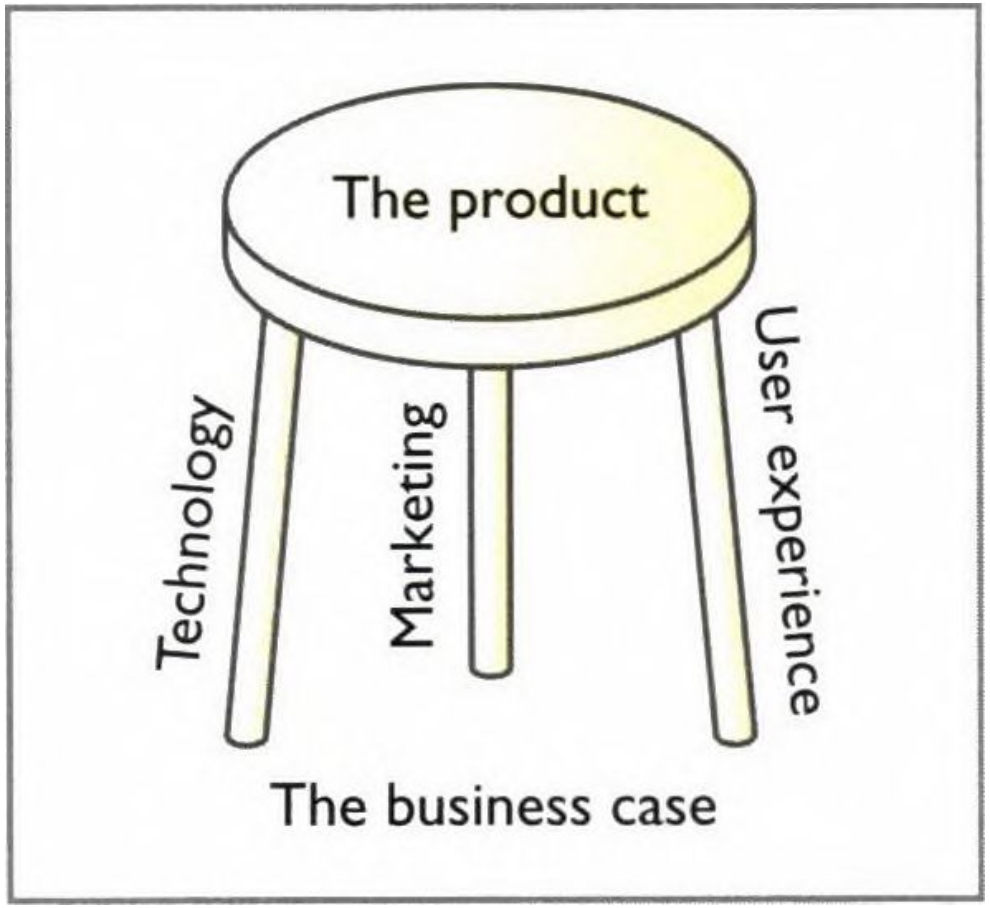
Norman's Characterization

- A key issue for usability is that very often the **technology gets in the way** of people and the activities they want to do.
- *E.g.,* Using remote control, using a hammer or driving a car.
- Bridging the gulfs
- Technological breakdown



Acceptability

- Acceptability is about fitting technologies into people's lives.
- The key features of acceptability
  - *Political*
  - *Convenience*
  - *Cultural and social habits*
  - *Usefulness*
  - *Economic*



Design principles

- Design principles can be very broad or they can be more specific. There are also good design principles that derive from psychology, such as '**minimize memory load**',
- Apple, Microsoft and Google all provide user interface design guidelines for the development of products that run on their platforms.
- Design principles can guide the designer during the design process and can be used to evaluate and critique prototype design ideas.
- All the principles interact in complex ways, affecting each other, sometimes conflicting with each other and sometimes enhancing each other.

Design principles

- Design principles are grouped into three main categories - learnability, effectiveness and accommodation
- Principles 1-4 are concerned with access, ease of learning and remembering (**learnability**).
- Principles 5-7 are concerned with ease of use, and principles 8 and 9 with safety (**effectiveness**).
- Principles 10-12 are concerned with accommodating differences between people and respecting those differences (**accommodation**).

Design principles

Helping people access, learn and remember the system

1. ***Visibility***. Try to ensure that things are visible so that people can see what functions are available and what the system is currently doing.
2. ***Consistency***. Be consistent in the use of design features and be consistent with similar systems and standard ways of working.
3. ***Familiarity.*** Use language and symbols that the intended audience will be familiar with.
4. ***Affordance.*** Design things so it is clear what they are for; for example, make buttons look like push buttons so people will press them.

Design principles

Giving them the seme of being in control, knowing what to do and how to do it

5. ***Navigation.*** Provide support to enable people to move around the parts of the system: maps, directional signs and information signs.
6. ***Control.*** Make it clear who or what is in control and allow people to take control. Also make clear the relationship between what the system does and what will happen in the world outside the system.
7. ***Feedback.*** Rapidly feed back information from the system to people so that they know what effect their actions have had. Constant and consistent feedback will enhance the feeling of control.

Design principles

Safely and securely

8. ***Recovery.*** Enable recovery from actions, particularly mistakes and errors, quickly and effectively.
9. ***Constraints.*** Provide constraints so that people do not try to do things that are inappropriate.

In a way that suits them

10. ***Flexibility.*** Allow multiple ways of doing things so as to accommodate people with different levels of experience and interest in the system.
11. ***Style.*** Designs should be stylish and attractive.
12. ***Conviviality.*** Interactive systems should be polite, friendly and generally pleasant. Nothing ruins the experience of using an interactive system more than an aggressive message or an abrupt interruption.

Summary

- Paying attention to design principles can help sensitize the designer to key aspects of good design.
  - Access to interactive systems for all people is an important right.
  - Usability is concerned with balancing the PACT elements in a domain.
  - Acceptability is concerned with ensuring that designs are appropriate to contexts of use.
  - Twelve design principles are particularly important. They can be grouped into three main design issues of learnability, effectiveness and accommodation.

Class activity

Write down the examples of interactive systems you use in your daily life for each design principle from 1 to 12.