Design of Interactive Systems (DIS)

Lecture 2: PACT: a framework for designing interactive systems

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Chapter 3

- **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
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PACT: A framework for Designing Interactive Systems

- An essential part of DIS is that it should put people first (human centered).
- PACT (people, activities, contexts, technologies) as a useful framework for thinking about a design situation.

Activities and Technologies

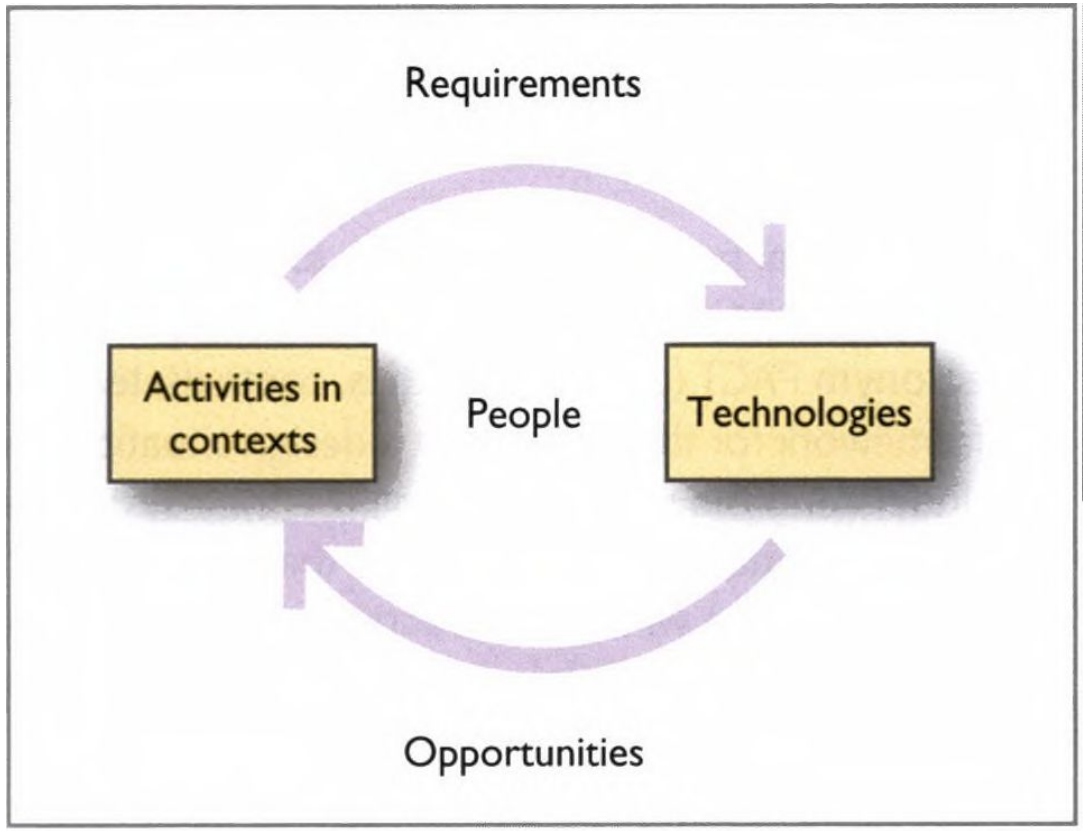


Figure 2.1 Activities and technologies

(Source: Based on Carroll (2002), Figure 3.1, p. 68)

Figure 2.1 shows how activities (and the contexts within which they take place)

People: Physical Difference

- People differ from others in a variety of ways
- Variability in five senses – sight, touch, hearing, smell and taste.

Ergonomics

- Ergonomics: the study of the relationships between people and their environment.
- The environment includes
  - the ambient environment (temperature, humidity, atmospheric pressure, light levels, noise and so on)
  - the working environment too (the design of machines, health and safety issues - e.g. hygiene, exposure to ionizing radiation, microwaves, etc.).

Ergonomics

- Despite Ergonomics is old, it has much to tell us about the design of interactive devices such as a mobile games console, a tablet PC or smartphone.

Fitts's Law

Fitts's law

Fitts's law is a mathematical formula which relates the time required to move to a target as a function of the distance to the target and the size of the target itself, say moving a pointer using a mouse to a particular button. It is expressed mathematically as follows:

$$T_{(\text{time to move})} = k \log_2(D/S + 0.5)$$

where $k \sim 100$ ms, D is the distance between the current (cursor) position and the target, and S is the size of the target.

Thus one can calculate the time to move a distance of 15 cm to a button of size 2 cm as

$$T = 100 \log_2\left(\frac{15}{2} + 0.5\right)$$

$$= 0.207 \text{ seconds}$$

Fitts's law describes motor control. The smaller the target and the greater the distance, the longer it will take to hit the target. Fitts's law can also be used to calculate how long it would take to type this sentence or, more importantly, a number of time-critical operations such as hitting the brake pedal of a motor car, or the likelihood of hitting <OK> rather than <Cancel> or, more worryingly, <Fire> or <Detonate>.

People: Psychological Difference

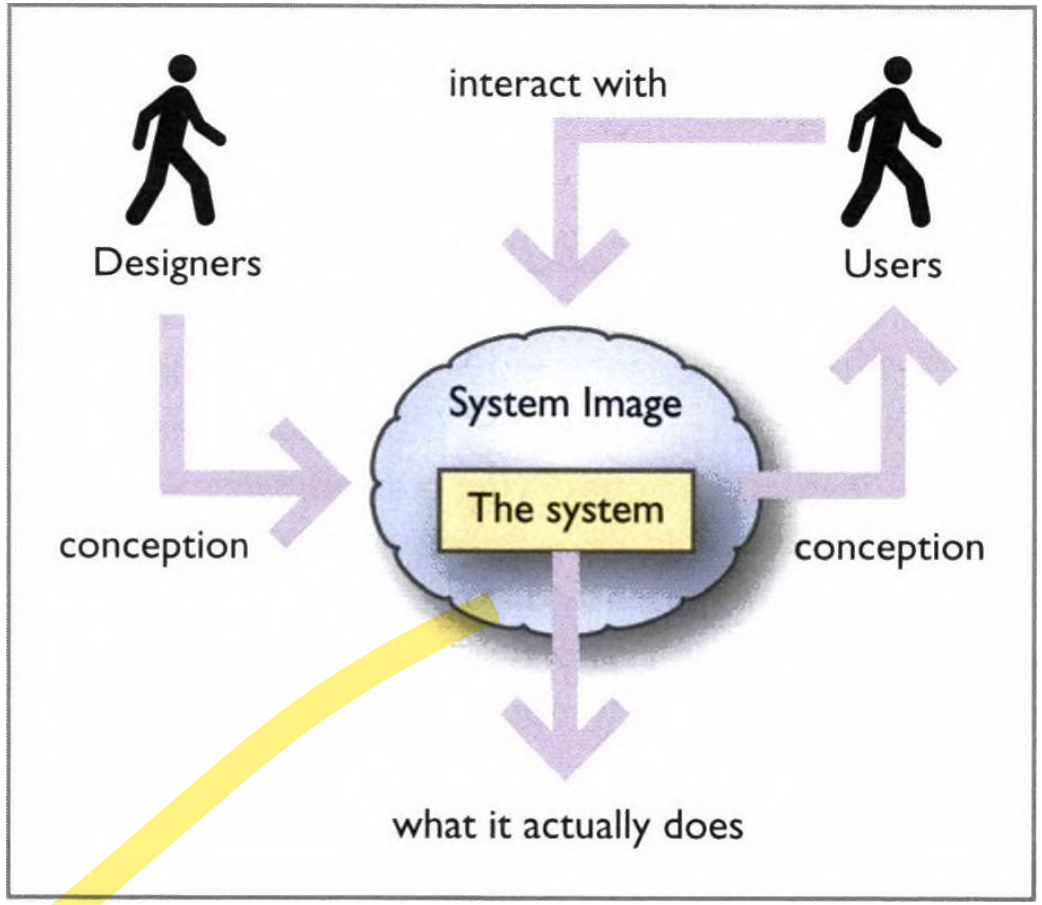
- Designers should **design for people with poor ability** by providing good signage and clear directions
- **Language differences** are of course crucial to understanding, and **cultural differences** affect how people interpret things
- People are good at **recognizing** than remembering
- Some are good at **words**, others are good at **numbers**
- There are differences in personality, emotional make-up and ability to work under stress

Mental Model

- The **understanding** and **knowledge that we possess of something** is often referred to as a ‘mental model’
- If people do not have a good mental model of something they can only perform actions by rote
- A key design principle is to design things so that **people will form correct and useful mental models** of how they work and what they do.
- People develop mental models through interacting with systems, observing the relationship between their actions and the behaviours of the system and reading any manuals or other forms of explanation that come with a system.

Mental Model

As Norman set out in his classic exposition of the issues (Norman, 1986), designers have some conception of the system they have produced.



Nature of Mental Models of Interactive Systems (Norman, 1983).

- Mental models are incomplete. People will understand some parts of a system better than others.
- People can 'run' (or try out) their models when required, but often with limited accuracy.
- Mental models are unstable - people forget details.
- Mental models do not have firm boundaries: similar devices and operations get confused with one another.
- Mental models are unscientific, exhibiting 'superstitious' behaviour.
- Mental models are parsimonious. People are willing to undertake additional physical operations to minimize mental effort, e.g. people will switch off the device and start again rather than trying to recover from an error.

Person: Social Differences

- People make use of systems, products and services for very different reasons.
- They have **different motivations** for using systems.
- These **motivations change** at different times.
- **Experts** use a system regularly and learn all sorts of details, whereas a **beginner** will need to be guided through an interaction.
- There are people who quickly give up **if things are difficult**.
- Designing for **homogenous** and **heterogenous** group of people.

Activities

- There are many characteristics of activities that designers need to consider.
- Used for very simple tasks as well as highly complex, lengthy activities, so designers need to be careful when considering the characteristics of activities.
- 10 important characteristics of activities that designers need to consider.
  - Temporal aspects (items 1-4)
  - Cooperation (5)
  - Complexity (6)
  - Safety-critical (7 and 8)
  - The nature of the content (9 and 10).

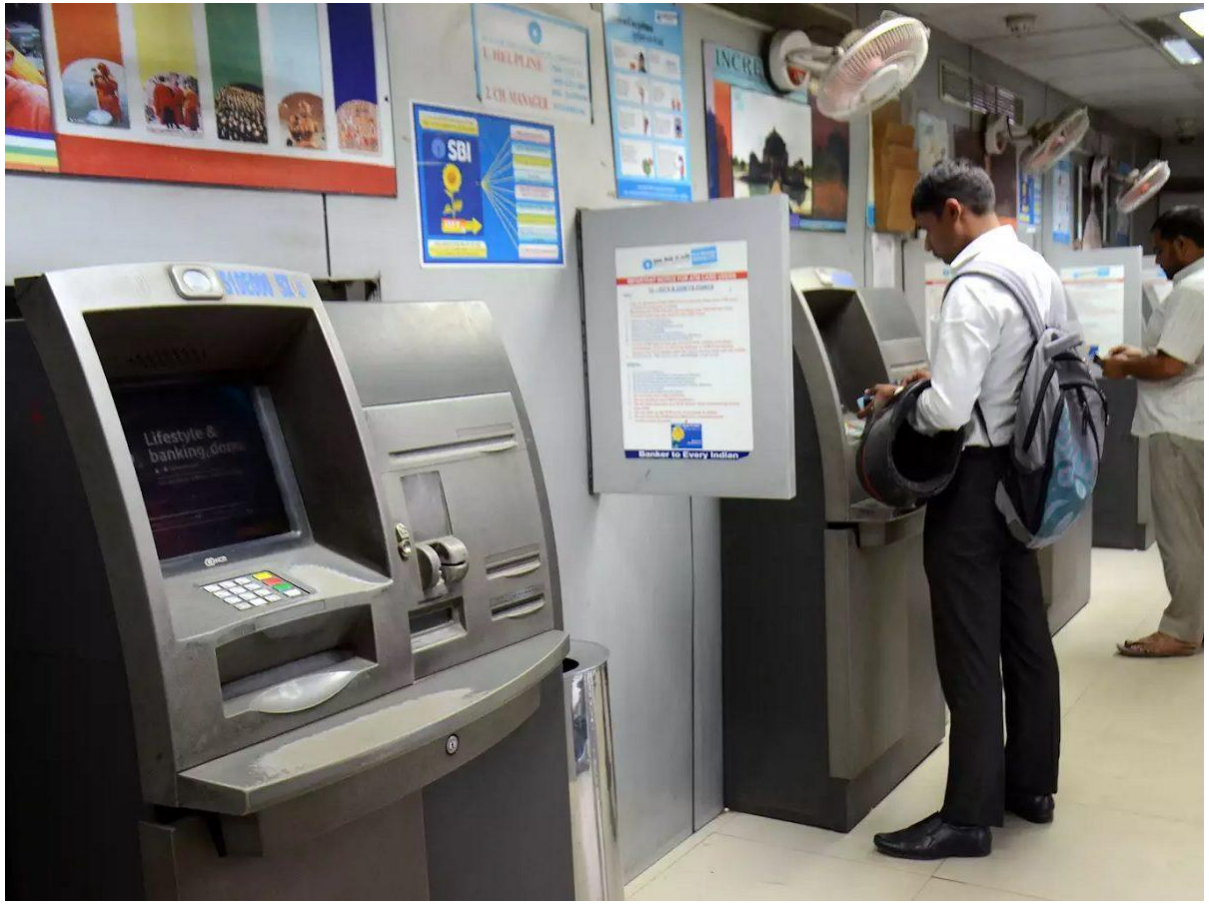
Activities

- **Temporal aspects** (items 1-4)
- **Cooperation** (5)
- **Complexity** (6)
- **Safety-critica**l (7 and 8)
- **The nature of the content** (9 and 10).

2. Frequent or infrequent activity
3. Time pressure – quiet or busy
4. Activities with and without interruption
5. Response time
7. Ensure that mistakes do not have a serious effect
8. Design by thinking what happens when a mistake or error is made
9. Whether data is large requiring alphabetic data entry
10. Which media an activity requires

Context

- Activities always happen in a context, so there is a need to analyse the two together.
- Three useful types of context are distinguishable:
  - the **organizational context**, the **social context** and the **physical circumstances** under which the activity takes place.
- Example, withdrawing cash from ATM



Technologies

- Medium that interactive system designers work with.
- Designers need to be aware of various possibilities for input, output, communication and content.
- Input devices are concerned with how people enter data and instructions into a system securely and safely.
- Technologies for displaying content to people rely primarily on the three perceptual abilities of **vision, hearing** and **touch**

Communication

- Communications between people and between devices is an important part of designing interactive systems.
- Issues such as bandwidth and speed are critical.
- Wireless communication is becoming much more common and often a wireless ‘hub’ is attached to an Ethernet network.
- Short-range communications directly between one device and another (i.e. not using the Internet) can be achieved using a technology called Bluetooth.

Content

- Content concerns the data in the system and the form it takes.
- The content that a technology can support is also critical.
- Good content is accurate, up to date, relevant and well presented.
- ‘Streamy’ outputs such as video, music and speech have different characteristics from ‘chunky’ media such as icons, text or still photographs.
- Animations are also popular ways of presenting content.

Scoping a problem with PACT

- The aim of human-centered interactive systems design is to arrive at the best combination of the PACT elements with respect to a particular domain.
- Designers want to get the right mix of technologies to support the activities being undertaken by people in different contexts.
- A PACT analysis is useful for both **analysis** and **design activities**: understanding the current situation, seeing where possible improvements can be made or envisioning future situations.

Example: PACT Analysis

- Developing a system controlling access to university laboratories:
  - People
    - Students, lecturers and technicians are the main groups.
  - Activities
    - The overall purpose of the activity is to enter some form of security clearance and to open the door.
  - Contexts
    - Physically the activity takes place indoors, but people might be carrying books and other things that makes doing anything complicated quite difficult.
  - Technologies: A small amount of data has to be entered quickly

Class activity

Write down a quick PACT analysis for the development of a VENDING MACHINE.