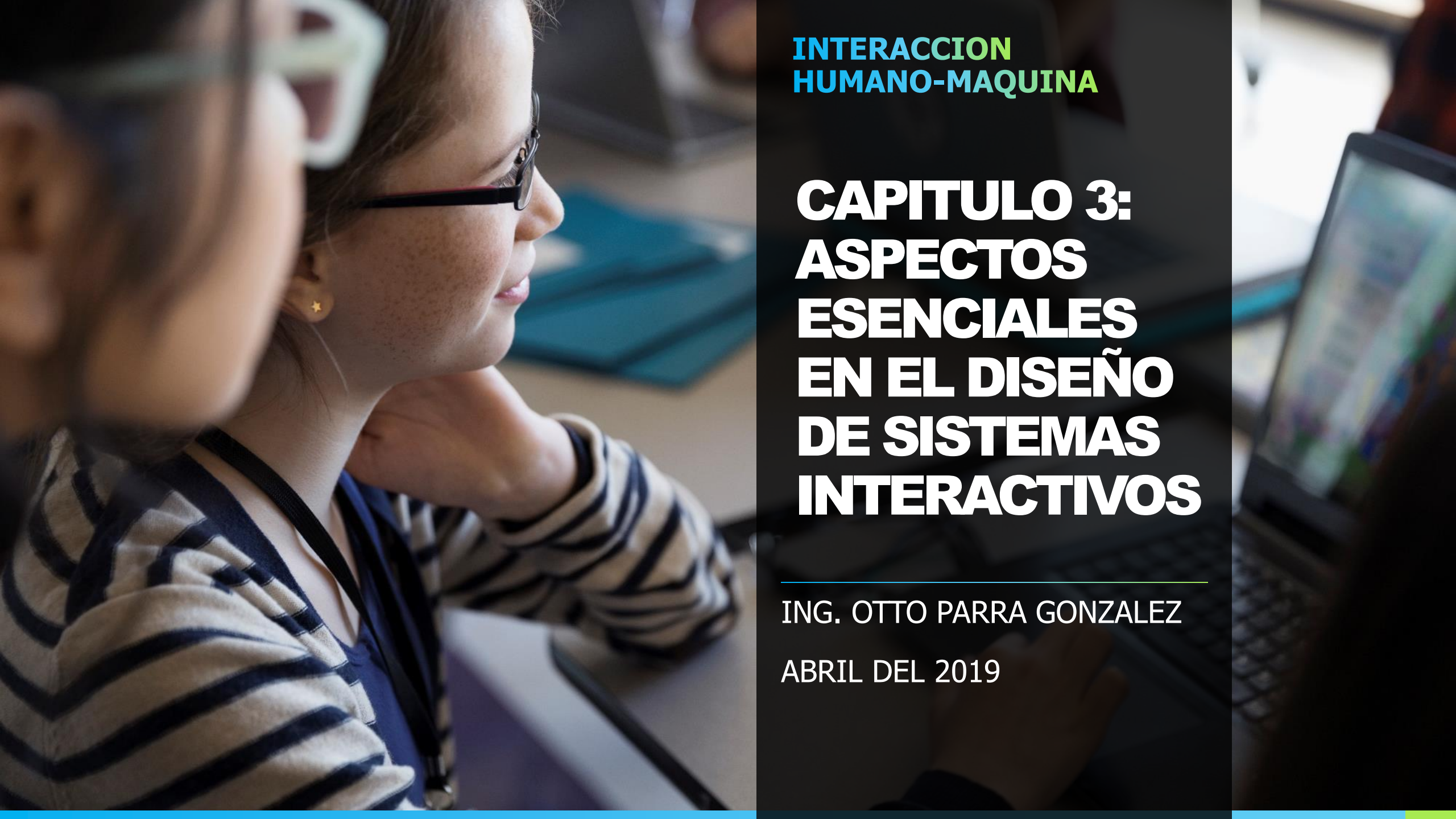

INTERACCION HUMANO-MAQUINA

CAPITULO 3: ASPECTOS ESENCIALES EN EL DISEÑO DE SISTEMAS INTERACTIVOS

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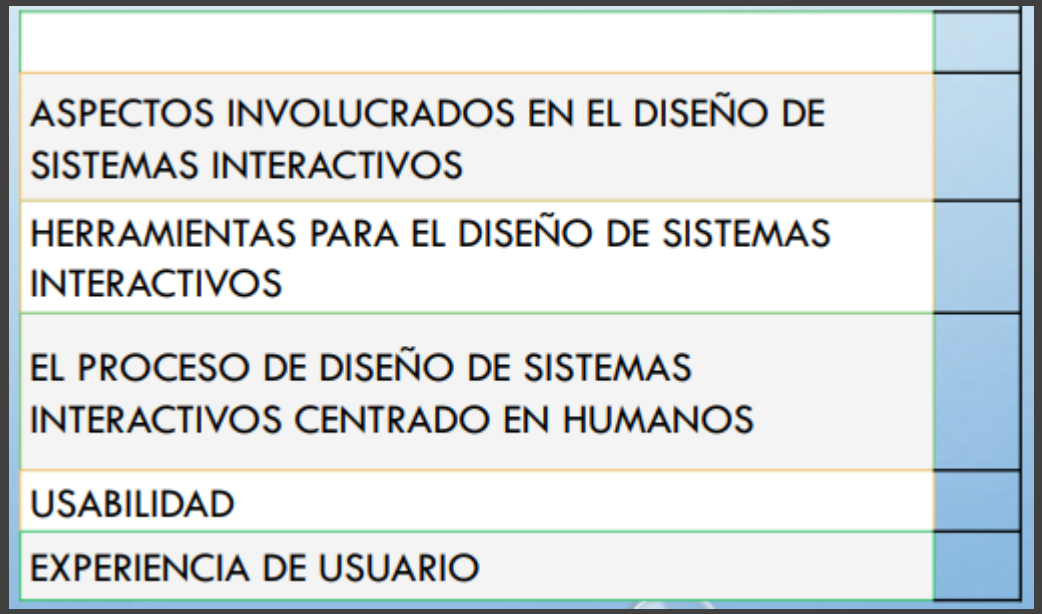
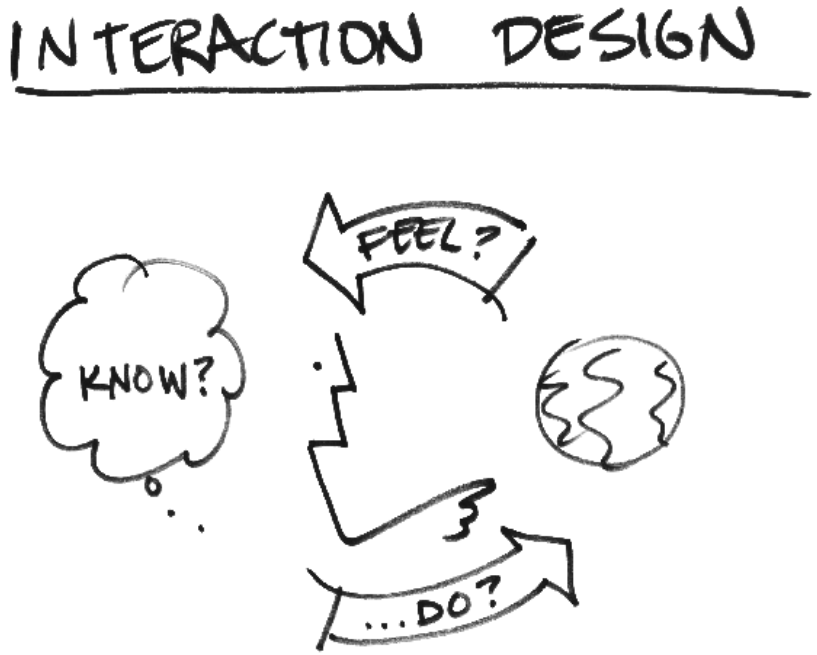
ABRIL DEL 2019

CAPITULO 3

ASPECTOS ESENCIALES EN EL DISEÑO DE SISTEMAS INTERACTIVOS





The interaction design should create great user experience. It requires experience and understanding of basic principles of the interaction design in most of the UI disciplines. It's about designing for the entire interconnected system: the device, the interface, the context, the environment, and the people.

Interaction designers strive to create meaningful relationships between people and the products and services that they use, from computers, to mobile devices, to appliances, and beyond.

INTRODUCTION

The definition for Interaction Design is, "it is the **behavior and structure of the interactive systems**". In other words, it is the relationship between the user and the product, and the service they use.

UX and ID are concerned with the design of websites, desktop applications, smartphone apps, ubiquitous computing systems, mobile systems, wearable systems and systems to support cooperation between people.

UX and ID are concerned with the development of novel apps, visualizations, auditory displays and responsive environments. HCI is about how to design for these experiences in a human-centered way that takes account of human abilities and preferences and ensures that systems are accessible, usable and acceptable.

INTRODUCTION

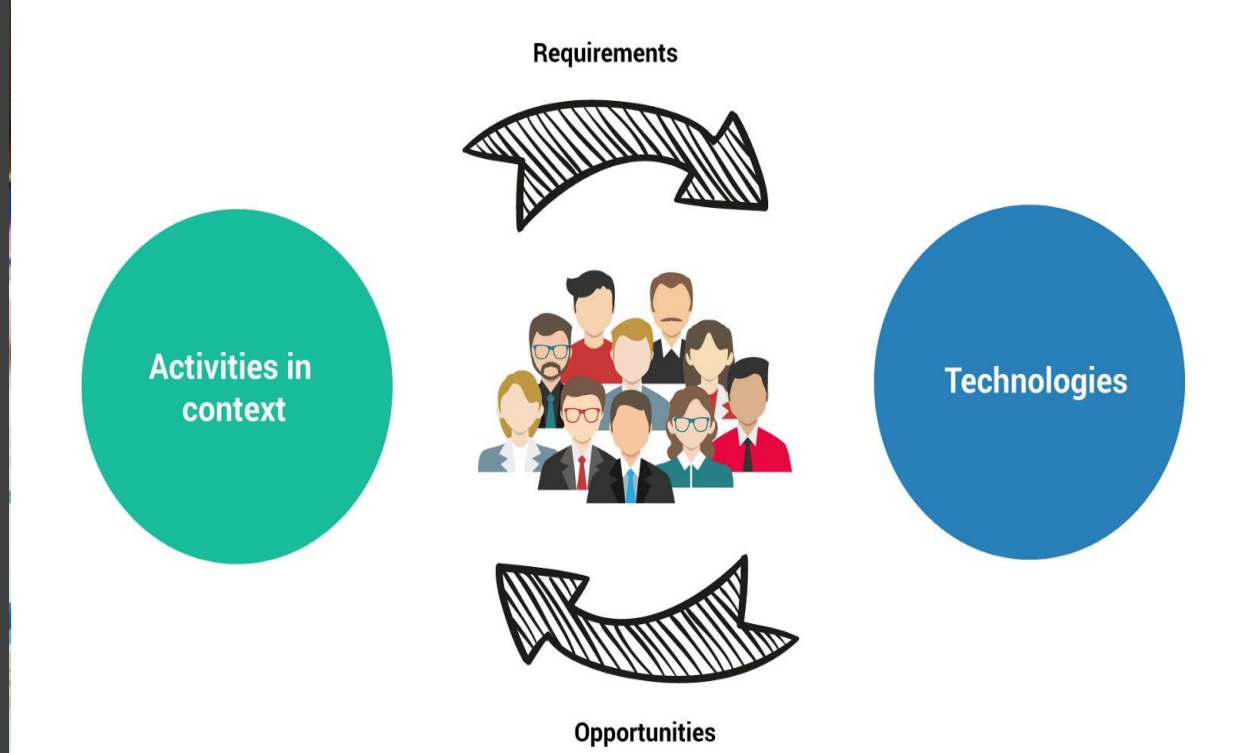
Human- computer interaction (HCI) and Interaction Design (ID) to deal with the demands of twenty-first-century computing and the demands for improved user experience (UX).

The concerns of interactive systems design

The design of interactive systems covers a very wide range of activities. Sometimes designers will be working on both the hardware and the software for a system, in which case the term ‘product design’ seems to be most appropriate to describe what they are doing.

- Sometimes the designer will be producing a piece of software to run on a computer, on a programmable device or over the Internet. In these cases the terms ‘system design’ and ‘service design’ seem more appropriate.

- *Design.* What is design and how should you do it?
- *Technologies.* These are the interactive systems, products, devices and components themselves.
- *People* who will use the systems and whose lives would we like to make better through our designs?
- *Activities and contexts.* What do people want to do? What are the contexts within which those activities take place?.



THE KEY CONCERNS:

Design

Technologies

People

Activities and contexts

- The term ‘design’ refers both to the creative process of specifying something new and to the representations that are produced during the process.
- So, for example, to design a website a designer will produce and evaluate various designs, such as a design of the page layout, a design of the colour scheme, a design for the graphics and a design of the overall structure.
- In a different field of design, an architect produces sketches and outlines and discusses these with the client before formalizing a design in the form of a blueprint.

DESIGN

What is design? It's where you stand with a foot in two worlds - the world of technology and the world of people and human purposes - and you try to bring the two together.

Mitch Kapor in Winograd (1996), p. 1

Design

Design is rarely a straightforward process and typically involves much iteration and exploration of both requirements (what the system is meant to do and the qualities it should have) and design solutions.

There are many definitions of ‘design’. Most definitions recognize that *both* problem and solution need to *evolve* during the design process; rarely can you completely specify something before some design work has been done.

Engineering design

Scientific principles and technical specifications are employed to produce formal models before construction starts

Design as craft

Which draws upon both engineering and creative approaches

Creative or artistic design

Innovation, imagination and conceptual ideas are the key ingredients.

The term “interactive system” is intended to cover components, devices, products and software systems that are primarily concerned with processing information. Interactive systems are things that deal with the transmission, display, storage or transformation of information that people can perceive.

They are devices and systems that respond dynamically to people’s actions.

PEOPLE AND TECHNOLOGY

Interactive system is the term we use to describe the technologies that interactive system designers work with.

People and technology

Increasingly, interactive components are being included in all manner of other products (such as clothes, buildings and cameras).

Mobile phones

Since they transmit, store and transform information

Websites

Since they store and display information and respond to people's actions

Computer game controllers

They provide information of the user's actions

Tables, chairs and doors

They are not considered because they don't process information

People and technology

Machine- and people-centred views

View	People are	Machines are
Machine-centred	Vague Disorganized Distractible Emotional Illogical	Precise Orderly Undistractible Unemotional Logical
People-centred	Creative Compliant Attentive to change Resourceful Able to make flexible decisions based on content	Dumb Rigid Insensitive to change Unimaginative Constrained to make consistent decisions

Source: Adapted from Norman (1993), p. 224

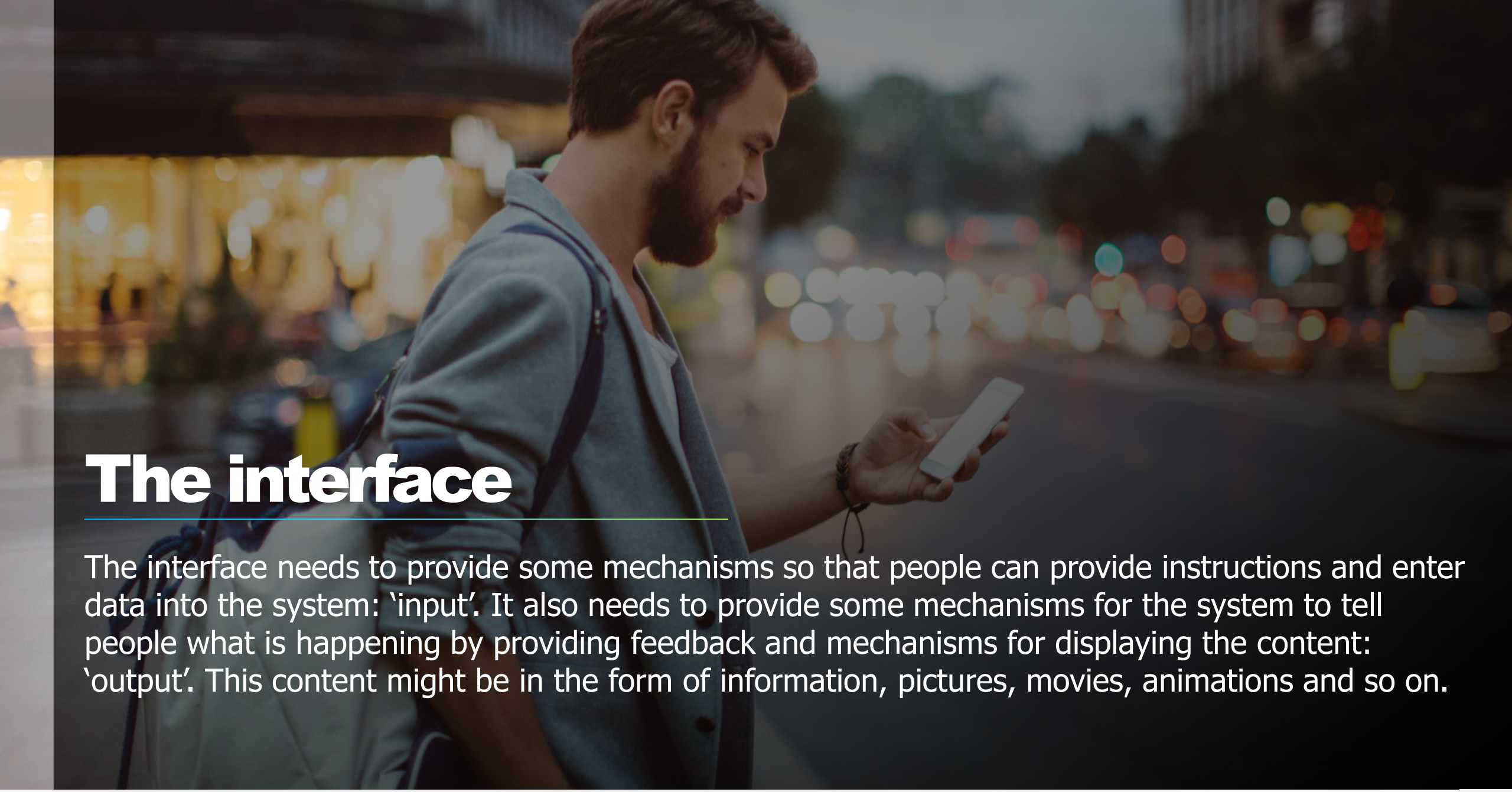
A fundamental challenge for interactive systems designers is to deal with the fact that people and interactive systems are different. Of course we take the people-centered view, but many designers still take the machine-centered view because it is quicker and easier for them, though not for the person who finishes up using the product.

Another difference between people and machines is that we speak different languages. People express their desires and feelings in terms of what they want to do or how they would like things to be (their goals). Machines need to be given strict instructions.

- **Physically** we might interact with a device by pressing buttons or moving levers and the interactive device might respond by providing feedback through the pressure of the button or lever.
- **Perceptually** the device displays things on a screen which we can see, or makes noises which we can hear.
- **Conceptually** we interact with a device by trying to work out what it does and what we should be doing. The device provides messages and other displays which are designed to help us do this.

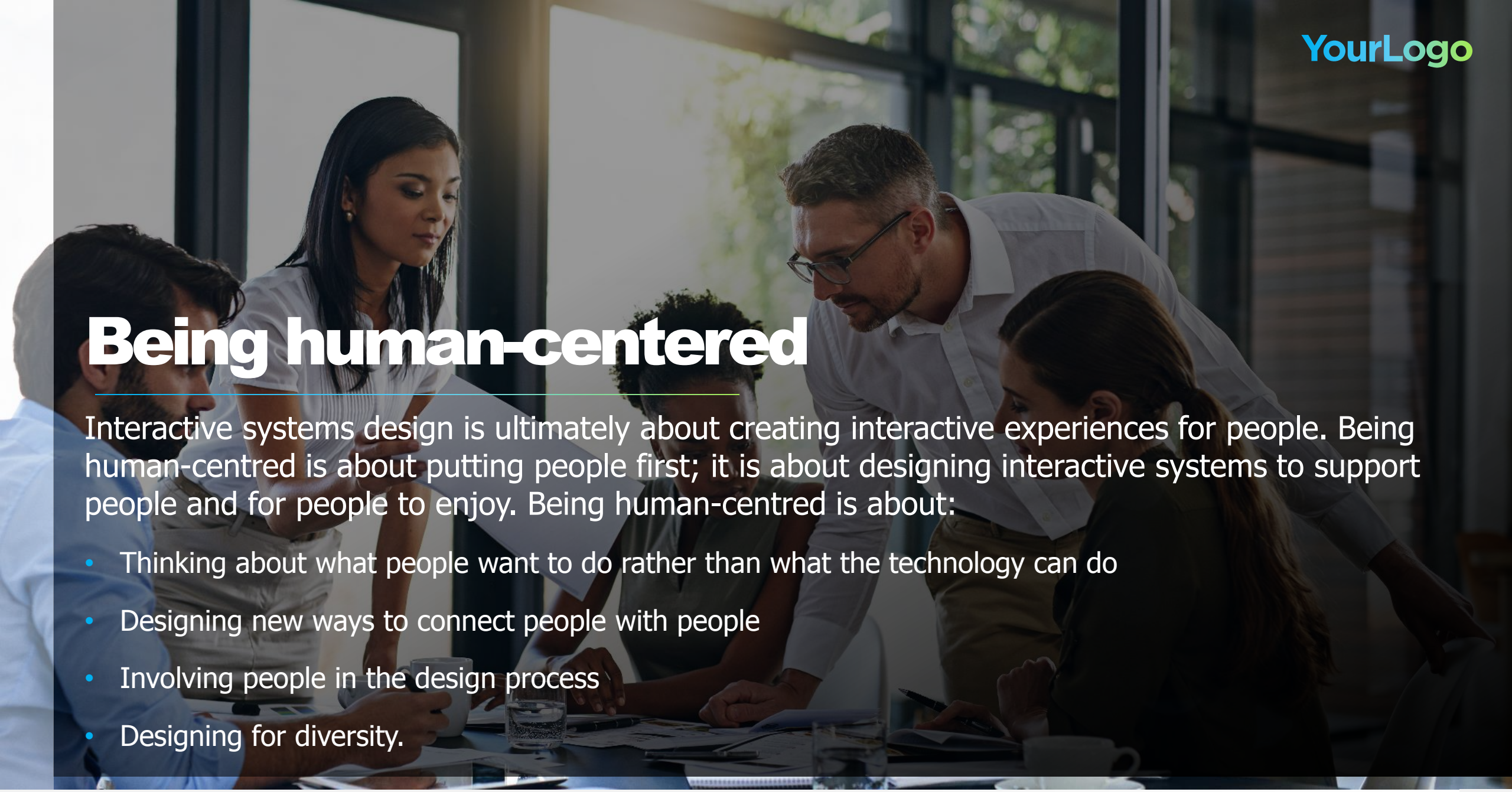
The interface

The interface to an interactive system, also called the user interface (UI), is all those parts of the system with which people come into contact, physically, perceptually and conceptually.



The interface

The interface needs to provide some mechanisms so that people can provide instructions and enter data into the system: ‘input’. It also needs to provide some mechanisms for the system to tell people what is happening by providing feedback and mechanisms for displaying the content: ‘output’. This content might be in the form of information, pictures, movies, animations and so on.



YourLogo

Being human-centered

Interactive systems design is ultimately about creating interactive experiences for people. Being human-centred is about putting people first; it is about designing interactive systems to support people and for people to enjoy. Being human-centred is about:

- Thinking about what people want to do rather than what the technology can do
- Designing new ways to connect people with people
- Involving people in the design process
- Designing for diversity.

Task

Look at the pictures in Figure. What does the interface to (a) the remote control, (b) the microwave, (c) the palmtop computer or (d) the Xbox controller consist of?

The skills of the interactive systems designer

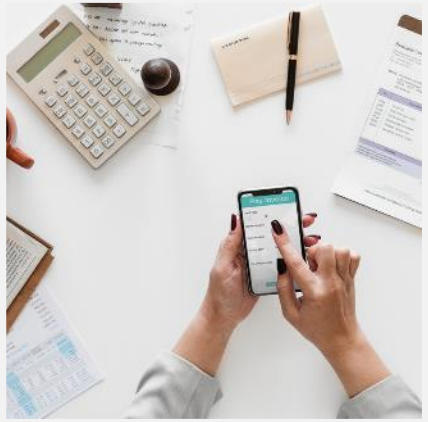
Designers of interactive systems need a variety of skills and need to understand a variety of disciplines if they are to be able to do their jobs well. They need the mixture of skills that allows them to be able to:

Study and understand

the activities and aspirations of people and the contexts within which some technology might prove useful and hence generate requirements for technologies

Know the possibilities

Know the possibilities offered by technologies



Research and design

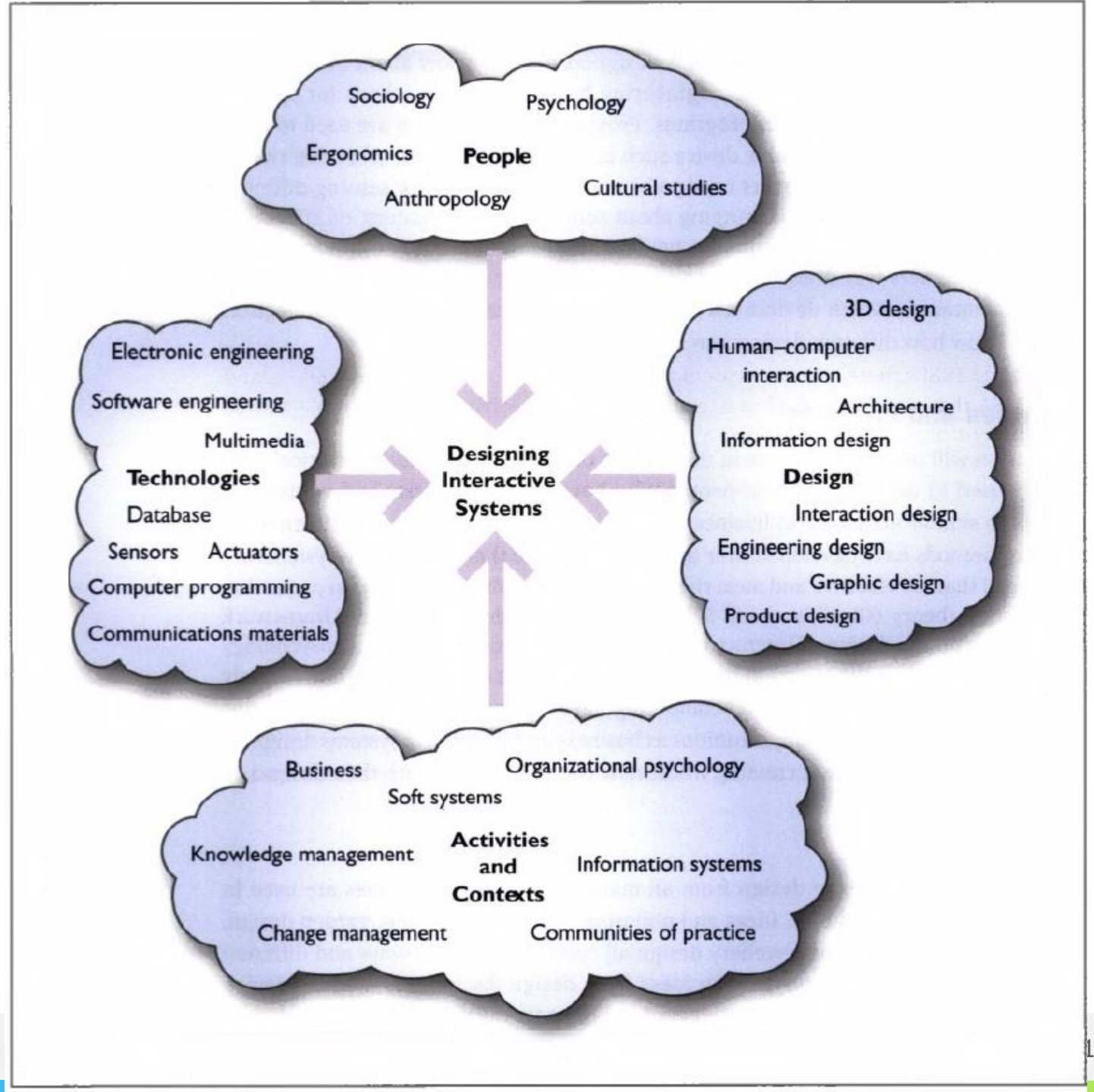
Research and design technological solutions that fit in with people, the activities they want to undertake and the contexts in which those activities occur

Evaluate alternative designs

Evaluate alternative designs and iterate (do more research and more design) until a solution is arrived at

The skills of the interactive systems designer

- An interactive systems designer may be involved in a community information system project on one occasion, a kiosk for processing photographs on another, a database to support a firm of estate agents on another, and a children's educational game on another!
- Designers of interactive systems cannot be expert in all these fields, of course, but they must be aware enough to be able to take techniques from different areas, or access research in different disciplines when appropriate.



Why being human-centered is important

Being human-centred in design is expensive. It involves observing people, talking to people and trying ideas out with people, and all this takes time. Being human-centred is an additional cost to any project, so businesses rightly ask whether taking so much time to talk to people, produce prototype designs and so on is worthwhile. The answer is a fundamental 'yes'. Taking a human-centred approach to the design of interactive systems is advantageous for a number of reasons.

Return on investment

Paying attention to the needs of people, to the usability of the product, results in reduced calls to customer helplines, fewer training materials, increased throughput, increased sales and so on.

Safety

Systems have to be designed for people and for contexts. It is no good claiming 'human error' if the design was so bad in the first place that an accident was waiting to happen.

Ethics

Now that it is so easy to collect data surreptitiously and to use that data for purposes other than what it was intended for, designers need to be ever more vigilant.

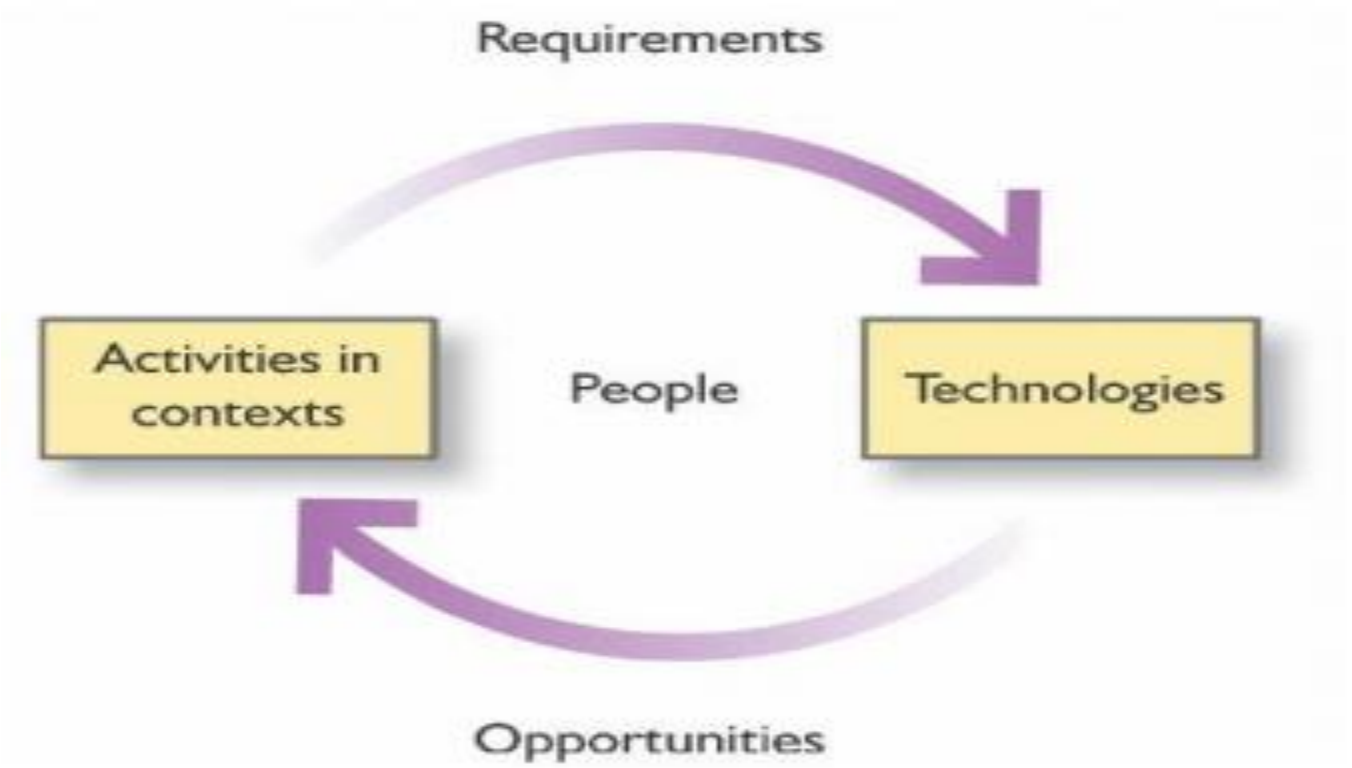
Sustainability

Interactive systems have a big impact on the world, and designers should approach interaction design from the perspective of what is sustainable

PACT: A FRAMEWORK FOR DESIGNING INTERACTIVE SYSTEMS

CHAPTER 3: ASPECTOS ESENCIALES EN EL DISEÑO DE SISTEMAS INTERACTIVOS

- Designers need to understand the people who will use their systems and products. They need to understand the activities that people want to undertake and the contexts in which those activities take place.
- Designers also need to know about the features of interactive technologies and how to approach designing interactive systems.



PACT

PACT (people, activities, contexts, technologies) Is a useful framework for thinking about a design situation. Designers need to understand the people who will use their systems and products.

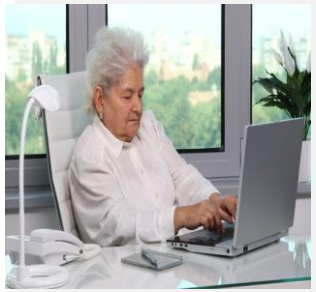
People using technology

If the technology is changed then the nature of the activities will also change.

Teenagers

using mobile phones

They are using social networks to communicate with friends or relatives



Elderly woman

Using computer

To write letters or search some topic on Internet

Air traffic controller

Working to ensure

the smooth operation of an airport.

In all these settings we see people using technologies to undertake activities in contexts and it is the variety of each of these elements that makes designing interactive systems such a difficult and fascinating challenge. Technologies are there to support a wide range of people undertaking various activities in different contexts.

People

Physical differences

- People differ in physical characteristics such as height and weight.
- Variability in the five senses - sight, hearing, touch, smell and taste - has a huge effect on how accessible, how usable and how enjoyable using a technology will be for people in different contexts.

Ergonomics

- The term ‘ergonomics’ was coined in 1948 to describe 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) and the working environment too (the design of machines, health and safety issues - e.g. hygiene, toxicology, exposure to ionizing radiation, microwaves, etc.).

Fitt'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

Physhological differences

- Psychologically, people differ in a variety of ways. 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.

Mental models

- 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. If something goes wrong they will not know why and will not be able to recover.
- 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: mental model

Norman has made the following general observations about the 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

Activities: Ten important characteristics

- First and foremost, the designer should focus on the overall *purpose* of the activity.
- After that the main features are:
  - Temporal aspects
  - Cooperation
  - Complexity
  - Safety-critical

Activities

There are many characteristics of activities that designers need to consider. The term is used for very simple tasks as well as highly complex, lengthy activities, so designers need to be careful when considering the characteristics of activities.

Activities: important characteristics

The 10 important characteristics of activities that designers need to consider are:

Temporal aspects ítems 1-4

1. Temporal aspects cover how regular or infrequent activities are.
2. Other important features of activities include time pressures, peaks and troughs of working. A design that works well when things are quiet can be awful when things are busy.
3. Some activities will take place as a single, continuous set of actions whereas others are more likely to be interrupted.
4. The response time needed from the system must be considered.

Cooperation Item 5

- 5. Another important feature of activities is whether they can be carried out alone or whether they are essentially concerned with working with others. Communication and coordination then become important.

Complexity Item 6

- 6. Well-defined tasks need different designs from more vague tasks. If a task or activity is well defined it can be accomplished with a simple step-by-step design. A vague activity means that people have to be able to browse around, see different types of information, move from one thing to another and so on.

Activities: important characteristics

The 10 important characteristics of activities that designers need to consider are:

Safety-critical
ítems 7 and 8

- 7. Some activities are 'safety-critical', in which case any mistake could result in an injury or a serious accident. Others are less so.
- 8. In general, it is vital for designers to think about what happens when people make mistakes and errors and to design for such circumstances.

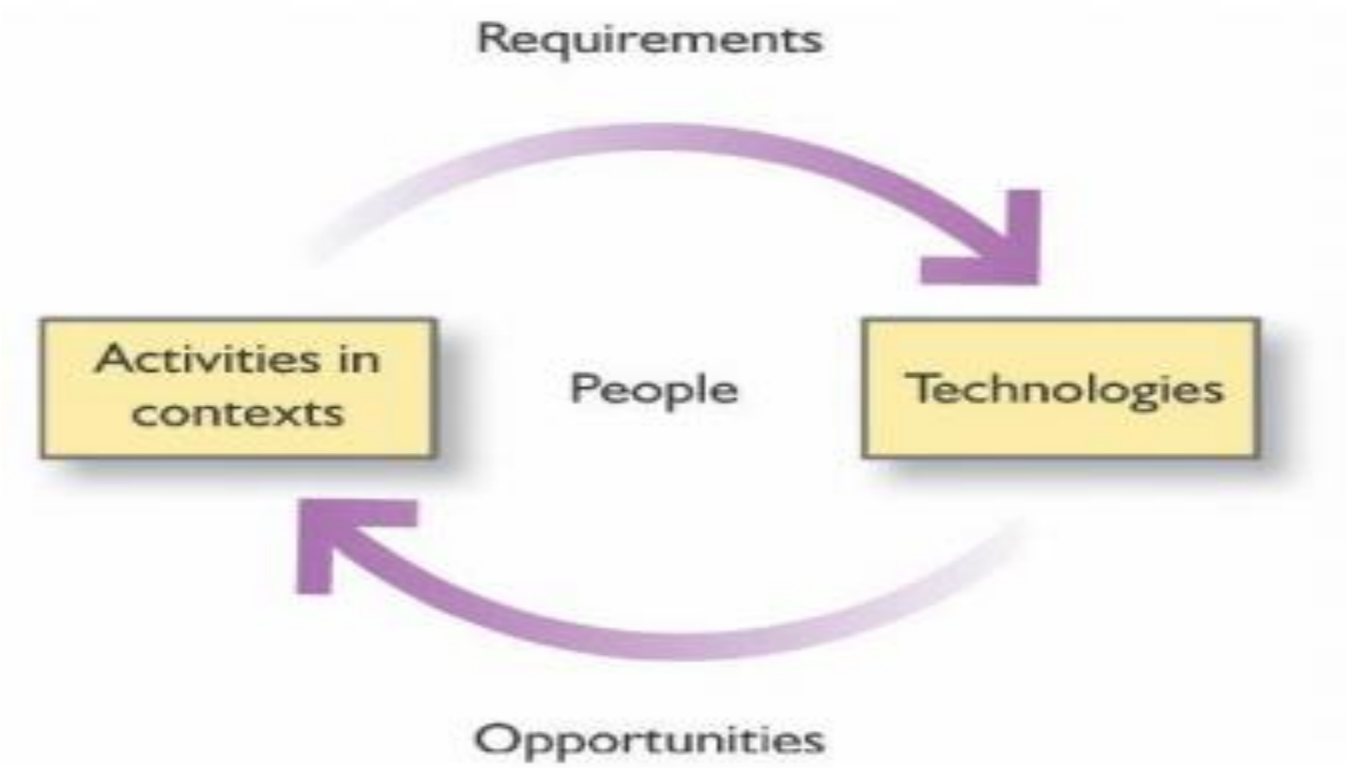
The nature of the content
Items 9 and 10

- 9. It is also important to consider the data requirements of the activity. If large amounts of alphabetic data have to be input as part of the activity, then a keyboard is almost certainly needed. In other activities there may be a need to display video or high- quality colour graphic displays. Some activities, however, require very modest amounts of data, or data that does not change frequently, and can make use of other technologies. A library, for example, just needs to scan in a barcode or two, so the technology can be designed to exploit this feature of the activity.

The nature of the content
Items 9 and 10

- 10. Just as important as data is the media that an activity requires. A simple two-tone display of numeric data demands a very different design from a full-motion multimedia display.

- Sometimes it is useful to see context as surrounding an activity. At other times it can be seen as the features that glue some activities together into a coherent whole.
- For an activity such as 'withdraw cash from an ATM', for example, an analysis of context would include things such as the location of the device (often as a 'hole-in- the-wall'), the effect of sunshine on the readability of the display, and security considerations.
- Social considerations would include the time spent on a transaction or the need to queue.
- The organizational context for this activity would take into consideration the impact on the bank's ways of working and its relationships with its customers.
- It is important to consider the range of contexts and environments in which activities can take place.



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.

Context: types

Three useful types of context are distinguishable:



Physical environment

- The physical environment in which an activity happens is important. For example, the sun shining on an ATM display may make it unreadable.
- The environment may be very noisy, cold, wet or dirty.
- The same activity - for example, logging on to a website - may be carried out in geographically remote environments where Internet access is slow, or with all the facilities of a large city and fast networks.

Social context

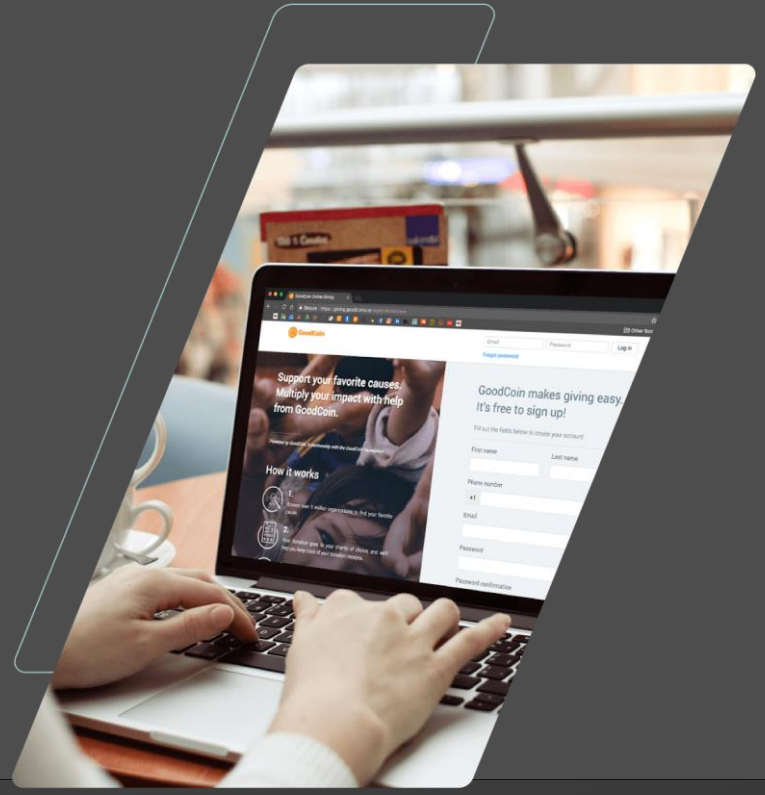
- The social context within which the activity takes place is also important. A supportive environment will offer plenty of help for the activity. There may be training manuals available, tuition or experts to hand if people get into trouble.
- There may be privacy issues to consider, and an interaction can be very different if the person is alone compared to being with others

Organizational context

- The organizational context is important as changes in technology often alter communication and power structures and may have effects on jobs such as deskilling.

Technologies

- Interactive systems can perform various functions and typically contain a good deal of data, or information content. People using such systems engage in interactions and physically devices have various degrees of style and aesthetics.
- Designers of interactive systems need to understand the materials they work with, just as designers in other areas of design such as interior design, jewellery design, etc. have to do.
- Designers need to be aware of various possibilities for input, output, communication and content.



Technologies

The final part of the PACT framework is the technologies: the medium that interactive system designers work with. Interactive systems typically consist of hardware and software components that communicate with one another and transform some input data into some output data.

The input

Input devices are concerned with how people enter data and instructions into a system securely and safely.

Touch-based input

A light pen

Mouse

Joystick

Which input devices would you use for a tourist information 'kiosk' application to be sited in the arrivals area of an airport? The system allows people to book hotel rooms, etc., as well as to find information about the area. Explain your choices.

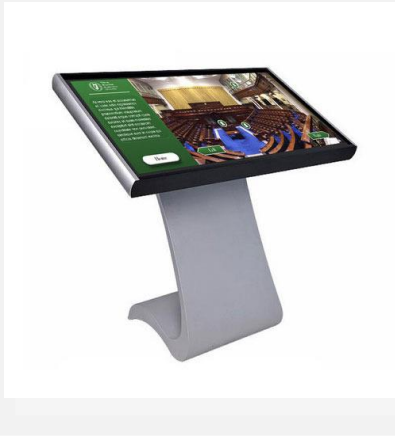
The output

Technologies for displaying content to people rely primarily on the three perceptual abilities of vision, hearing and touch. The most fundamental output device is the screen or monitor.

Screens (monitors)

Data projector

Printers



Kiosks

- 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.
- To do a PACT analysis the designer simply scopes out the variety of Ps, As, Cs and Ts that are possible, or likely, in a domain.
- This can be done using brainstorming and other envisionment techniques and by working with people through observations, interviews and workshops.

Scoping a problem with PACT

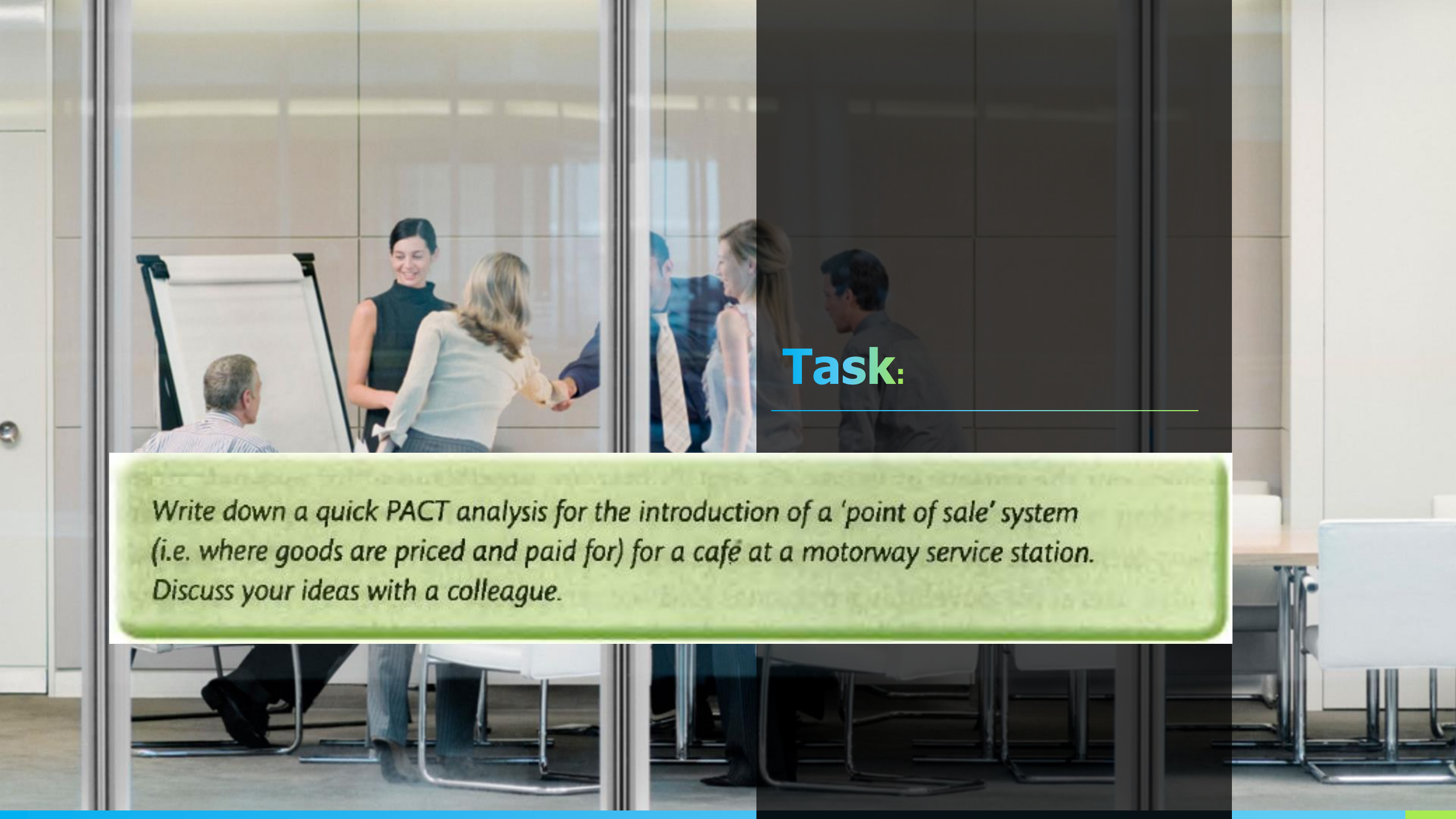
The aim of human-centred interactive systems design is to arrive at the best combination of the PACT elements with respect to a particular domain. Designers want to get the right mix of technologies to support the activities being undertaken by people in different contexts.

PACT analysis: an example

- Let us assume that we have been asked by a university department to consider developing a system controlling access to their laboratories.
- **People**
  - Students, lecturers and technicians are the main groups. These are all well educated and understand things such as swipe cards, passwords and so on. People in wheelchairs need to be considered, as do other design issues such as colour blindness. There may be language differences. Both occasional and frequent visitors need to be considered. However, there are other stakeholders who need access to rooms, such as cleaning staff and security personnel. What are the motivations for management wanting to control access in the first place?
- **Activities**
  - The overall purpose of the activity is to enter some form of security clearance and to open the door. This is a very well-defined activity that takes place in one step. It happens very frequently, with peaks at the start of each laboratory session. The data to be entered is a simple numeric or alphanumeric code. It is an activity that does not require cooperation with others (though it may be done with others, of course). It is not safety- critical, though security is an important aspect.

PACT analysis: an example

- Let us assume that we have been asked by a university department to consider developing a system controlling access to their laboratories.
- **Contexts**
  - Physically the activity takes place indoors, but people might be carrying books and other things that makes doing anything complicated quite difficult. Socially it may happen in a crowd, but also it may happen late at night when no one else is about. Organizationally, the context is primarily about security and who has access to which rooms and when they can gain access. This is likely to be quite a politically charged setting.
- **Technologies**
  - A small amount of data has to be entered quickly. It must be obvious how to do this in order to accommodate visitors and people unfamiliar with the system. It needs to be accessible by people in wheelchairs. The output from the technology needs to be clear: that the security data has been accepted or not and the door has to be opened if the process was successful. Communication with a central database may be necessary to validate any data input, but there is little other content in the application.



Task:

Write down a quick PACT analysis for the introduction of a 'point of sale' system (i.e. where goods are priced and paid for) for a café at a motorway service station. Discuss your ideas with a colleague.