Designing interactive systems: A fusion of skills

Aims
Designing interactive systems is concerned with developing high quality interactive systems, products and services that fit with people and their ways of living. Computing and communication devices are embedded in all sorts of everyday devices such as washing machines and televisions, ticket machines and jewellery. No self-respecting exhibition, museum or library is without its interactive component. We carry and wear technologies that are far more powerful than the computers of just a few years ago. There are websites, on-line communities, cellphone applications and all manner of other interactive devices and services that need developing. Interactive systems design is about all this.

In this chapter we explore the width and breadth of designing interactive systems. After studying this chapter you should be able to:

■ Understand the concepts underlying the design of interactive systems
■ Understand why being human-centred is important in design
■ Understand the historical background to the subject
■ Understand the skills and knowledge that the designer of interactive systems needs to draw upon.
THE VARIETY OF INTERACTIVE SYSTEMS

Designing interactive systems is concerned with many different types of product. It is about designing software systems that will run on a computer at work. It is about designing websites, games, interactive products such as MP3 players, digital cameras and applications for personal digital assistants (PDAs). It is about designing whole environments in which phones, PDAs, laptop computers, digital projectors and other devices communicate with one another and through which people interact with one another. It is about designing interactive systems, products and services for the home, for work or to support communities.

Here are some examples of recent interactive products and systems.

Example 1: iPhone

In 2007 Apple Inc. changed the face of mobile technologies when they introduced the iPhone (Figure 1.1). The iPhone had a carefully crafted, purpose-designed interface to make use of the finger as the input device. It had a revolutionary touch-sensitive screen that allowed for multi-touch input. This facilitated new interaction techniques such as pinching an image and drawing it in to make it smaller, or pinching and moving the fingers out to make a image larger. Many mobile devices and larger screen systems have now adopted this technology, but the iPhone started it. The iPhone also included sensors that could register how the phone was being held and whether it was vertical, horizontal or sloping. This allows for other novel interaction methods. For example, the display would automatically adjust from portrait style to landscape. In 2008 the ‘app store’ was launched, turning the iPhone into an open platform for developers to design and produce their own software. Combined with the iTunes delivery service, this turned the iPhone into a versatile, multimedia device with literally thousands of applications, from sophisticated games to trivial pieces of entertainment to useful information applications. This created new experiences and new services for a new set of customers.

Figure 1.1 iPhone
(Source: Hannah Gal/Science Photo Library)
Example 2: Wii

Also in 2007 Nintendo introduced the Wii (Figure 1.2). The Wii was a revolutionary new games concept that used infra-red sensors attached to a TV or other display device to track a wand that transmitted infra-red signals. The new system could, therefore, register different gestures such as a ‘bowling’ action, a ‘tennis shot’ action or a host of other movements. The notion of computer games changed radically, from a young person shooting at imaginary monsters, or driving imaginary cars, to a family-wide entertainment. When the ‘Wii fit’ was introduced it appealed to a new audience of people wanting to keep fit at home.

Figure 1.2  Wii Fit
(Source: Keith Morris/Alamy)

Example 3: Second Life

Second Life (Figure 1.3) is a huge on-line community populated by animated virtual people (called avatars). It consists of thousands of simulated buildings, parks, seasides, factories, universities and everything else one could find in the real world (and much else besides). People create avatars to represent themselves in this virtual world. They can determine their size, shape, gender and what they want to wear. They are controlled by their creators using the Internet, interacting with other avatars, and visiting virtual places.

Artificial life

Artificial life (often abbreviated to ‘Alife’) is a branch of artificial intelligence (AI), the discipline that looks at whether intelligent software systems can be built and at the nature of intelligence itself. The tradition in AI has been to represent knowledge and behaviours through rules and rigid structures. Alife tries instead to represent higher-level features of the things in an environment, such as the goals that a creature has and the needs that it must satisfy. The actual behaviour of the artificial creatures is then more unpredictable and evolves in the environment. Increasingly, characters in computer games are using Alife techniques.
**Example 4: i Robo-Q domestic toy robot**

The i Robo-Q domestic toy robot is an example of the new children’s toys that are increasingly available (Figure 1.4). Toys are using all manner of new technologies to enhance the experiences of children at play. They use robotics, voice input and output, and a variety of sensors to provide novel and engaging interactions.

**Example 5: Facebook**

Facebook (Figure 1.5) is a highly popular website that allows people to keep in contact with their friends. Known as social networking sites, there are many similar systems around. Facebook is the most popular. It allows people to add applications in a similar way to the iPhone. People can store and share digital photos, write notes to each other and get regular updates about what their friends are doing.
Summary

These five examples of interactive systems capture many of the features that the interactive systems designer has to work with. The designer of interactive systems needs to understand the possibilities that exist for new forms of interaction, with fixed devices or mobiles, for people on their own or for connecting people to each other through text messages or through animation and video. It is a fascinating area to work in.

Challenge 1.1

Find five interactive products or systems that you use – perhaps a coffee machine, a cellular phone, a fairground ride, a TV remote control, a computer game and a website. Write down what it is that you like about each of them and what it is that you do not like. Think about the whole experience and not just the functions. Think about the content that each provides: is it what you want? Is it fun to use? If possible, find a friend or colleague to discuss the issues. Criticism and design are social activities that are best done with others. What do you agree on? What do you disagree on? Why?

1.2 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 term ‘system design’ or ‘service design’ seems more appropriate. We switch between these expressions as appropriate. However, the key concerns of the designer of interactive systems are:

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

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

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 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.

One thing that is useful is to distinguish the amount of formality associated with a design:

- At one end of a spectrum is engineering design (such as the design of a bridge, a car or a building) where scientific principles and technical specifications are employed to produce formal models before construction starts.
- At the other end of this spectrum is creative or artistic design where innovation, imagination and conceptual ideas are the key ingredients.
- Somewhere in the middle lies ‘design as craft’ that draws upon both engineering and creative approaches.

Most design involves aspects of all of these. A fashion designer needs to know about people and fabrics, an interior designer also needs to know about paints, lighting and so on, and a jewellery designer needs to know about precious stones and the properties of metals such as gold and silver. The famous design commentator Donald Schön has described design as a ‘conversation with materials’, by which he means that in any type of design, designers must understand the nature of the materials that they are working with. Design works with, and shapes, a medium; in our case this medium consists of interactive systems. Others emphasize that design is a conscious, social activity and that much design is often undertaken in a design team.

**People and technologies**

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

This definition is intended to exclude things such as tables, chairs and doors (since they do not process information) but to include things such as:

- 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.

Increasingly, interactive components are being included in all manner of other products (such as clothes, buildings and cameras).
A fundamental challenge for interactive systems designers is to deal with the fact that people and interactive systems are different (see Box 1.1). Of course we take the people-centred view, but many designers still take the machine-centred 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.

### BOX 1.1 Machine- and people-centred views

<table>
<thead>
<tr>
<th>View</th>
<th>People are</th>
<th>Machines are</th>
</tr>
</thead>
</table>
| **Machine-centred** | Vague  
Dissorganised  
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

### The interface

The interface to an interactive system is all those parts of the system with which people come into contact, physically, perceptually and conceptually:

- 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 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. Figure 1.6 shows a variety of interfaces.
Chapter 2 discusses input and output devices in more detail.

Designing interactive systems is not just a question of designing interfaces, however. The whole human–computer interaction needs to be considered, as does the human–human interaction that is often enabled through the systems. Increasingly, interactive systems consist of many interconnected devices, some worn by people, some embedded in the fabric of buildings, some carried. Interactive systems designers are concerned with connecting people through devices and systems; they need to consider the whole environment they are creating.

![Figure 1.6 Various user interfaces: remote control; microwave; PDA; and xbox controller](Source: Fujitsu; © D. Hurst/Alamy; POD/Gareth Boden; Microsoft Corporation)

**Challenge 1.2**

*Look at the pictures in Figure 1.6. What does the interface to (a) the remote control, (b) the microwave, (c) the PDA or (d) the xbox controller consist of?*
Being human-centred

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.

The evolving nature of interactive systems design

The primary discipline contributing to being human-centred in design is human–computer interaction (HCI). HCI arose during the early 1980s, evolving into a subject ‘concerned with the design, evaluation, and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them’ (ACM SIGCHI, 1992, p. 6).

HCI drew on cognitive psychology for its theoretical base and on software engineering for its design approach. During the 1990s the closely related area of computer supported cooperative work (CSCW) focused on technology support for cooperative activities and brought with it another theoretical base that included sociology and anthropological methods. At the same time designers in many different fields found that they had to deal with interactive products and components, and in 1989 the first computer-related design course was established at the Royal College of Art in London. In America the designers at Apple were putting their ideas together in a book called The Art of Human–Computer Interface Design (Laurel, 1990a) and a meeting at Stanford University in 1992 resulted in the book Bringing Design to Software (Winograd, 1996). All this – coupled with the phenomenal changes in computing and communication technologies during the same period – has brought us to where we are today: a dynamic mix of ideas, approaches and philosophies applied to the design of interactive systems and products.

This book is about human-centred interactive systems design. It is about human–computer interaction (HCI) and interaction design in the twenty-first century.

BEING DIGITAL

In 1995 Nicholas Negroponte, head of the Massachusetts Institute of Technology’s ‘Media Lab’, wrote a book called Being Digital in which he explored the significance of an era in which we change atoms for bits. We live in a digital age, when all manner of devices represent things using binary digits (bits). The significance of being digital is that bits are transformable, transmittable and storable using digital technologies. Consider the following scenario.
In the morning you get woken up by a digital alarm clock which automatically turns on the radio. To change the radio channel you might press a button that searches for a strong signal. You pick up your mobile, cellular phone and check for messages. You might go to your computer and download a personalized newspaper into a personal digital assistant (PDA). As you leave the house you set the security alarm. In the car you adjust the heating, use the radio and attend to the various warning and information symbols that detect whether doors are open, or seat belts are buckled. Arriving at the station, you scan your season ticket through the car parking machine, get a train ticket from the ticket machine and get money from an automated teller machine (ATM). On the train you read the newspaper on your PDA, scrolling through text using a stylus. Arriving at your office, you log on to the computer network, check e-mail, use various computer packages, browse the Web and perhaps listen to an Internet radio station broadcasting from another country. You have a video link with colleagues in other cities and perhaps work together on a shared document. During the day you use a coffee machine, make calls on the cell-phone, check names and numbers in the address book, download a new ringing tone, photograph a beautiful plant that you see at lunchtime and video the swans on the river. You upload these to your social networking website. Arriving home, you open the garage doors automatically by keying a number on your phone and in the evening you spend an hour or so on the games machine, watch TV and program the set top box to record a late-night show.

This is the world we are living in and the world that designers of interactive systems are designing for. The huge range of interactions that we engage in and the interfaces that we use offer an exciting if daunting challenge. Moreover, increasingly designers are having to deal with the issue of people engaged in multiple interactions with different devices in parallel. One important commentator, Bruce ‘Tog’ Tognazinni, prefers the term ‘interaction architect’ to describe this emerging profession.

How we got here

The revolution that has brought us to where we are today started towards the end of the Second World War, in 1945, with the development of the first digital computers. These were huge machines housed in specially built, air-conditioned rooms. They were operated by scientists and specialist computer programmers and operators, who physically pressed switches and altered circuits so that the electronics could complete their calculations.

During the 1960s computer technology was still dominated by scientific and accounting applications. Data was stored on paper tape or cards with holes punched in them, on magnetic tapes and large magnetic disks, and there was little direct interaction with the computer. Cards were sent to the computer centre, data was processed and the results were returned a few days later. Under the guidance of ‘Lick’ Licklider, however, things were beginning to change. The first screens and cathode ray tubes (CRTs) were being used as interactive devices and the first vision of a computer network – an internet – was formulated by Licklider. He worked at the Advanced Research Projects Agency (ARPA) at the US Department of Defense. His work also led to the establishment of computer science at four US universities (Licklider, 2003). Licklider was followed by the pioneering work of Ivan Sutherland at MIT, Doug Englebart who is credited with inventing the computer mouse, and...
Ted Nelson who developed the concept of hypertext, the idea of linking objects and being able to jump directly from one object to the next. In the UK pioneering work on computers was based at Manchester University and in 1959 Brian Shackel had published the paper ‘Ergonomics for a computer’.

During the 1970s computing technology spread into businesses and screens linked to a central computer began to emerge. Computers were becoming networked together and indeed the first e-mail was sent over the ARPANET in 1972. The method of interaction for most people in the 1970s was still primarily ‘batch’; transactions were collected together and submitted as a batch of work and computing power was shared between different people. Interest in HCI began to grow, with publications in the *International Journal of Man–Machine Studies*. As the decade ended so keyboards and screens became more common, but it was not until 1982 that the first real graphically based interfaces appeared in the form of the Xerox Star, Apple Lisa and Apple Macintosh computers. These used a bit-mapped display, allowing a graphical user interface (GUI) and interaction through pointing at icons and with commands grouped into menus. This style became ubiquitous when, in 1985, the Windows operating system appeared on (what were then usually IBM) personal computers (PCs). The personal computer and Windows-like operating system are attributed to another important pioneer, Alan Kay. Kay obtained his PhD, studying under Ivan Sutherland, in 1969 before moving to Xerox Palo Alto Research Center (PARC). It was here that the object-oriented computer programming language Smalltalk was developed. Many argue that it was the development of the VisiCalc spreadsheet program on the Apple II computer (the ‘killer app’) in 1979 that really fired the personal computer market (Pew, 2003).

The 1980s was the decade of the micro computer, with the BBC micro home computer selling over 1 million units and a whole plethora of home computers being adopted worldwide. Games consoles were also gaining in popularity in the home entertainment market. In business, people were getting networked and the Internet began to grow based around e-mail. It was during the 1980s that human–computer interaction (HCI) came of age as a subject. In both the USA and Europe the first big conferences on HCI were held: the CHI ’83 conference on Human Factors in Computing Systems in Boston, MA, and INTERACT ’84 in London. Don Norman published his famous paper ‘The trouble with UNIX: the user interface is horrid’ (Norman, 1981a) and Ben Shneiderman published *Software Psychology* (Shneiderman, 1980).

In the 1990s colour and multimedia arrived on the PC, which had begun to dominate the computer market. In 1993 a new interface was produced that took advantage of a simple mark-up or specification ‘language’ (called hypertext mark-up language, HTML). Thus the ‘World Wide Web’ came about and revolutionized the whole process of transmitting and sharing files. Pictures, movies, music, text and even live video links were suddenly available to everyone at work and at home. The growth of personal, community and corporate websites was phenomenal and the vision of a wholly connected ‘global village’ community began to become a reality. Of course, this growth was primarily in the West and in the USA in particular, where ‘broadband’ communications enabled a much more satisfying experience of the Web than the slow connections in Europe. Many parts of the world were not connected, but in the twenty-first century connections to the Web are global.
By the turn of the century the convergence of communications and computing technologies was just about complete. Anything could potentially be connected to anything, anywhere. Since all the data was digital, it could all be transmitted over the airwaves or over wired networks, and it could easily be transformed from one form into another. The proliferation of mobile devices, coupled with the wide availability of the Internet, brings us to the age of ‘ubiquitous computing’, a term first coined by the late Mark Weiser in 1993. Computing devices are now pervasive across people and across the world, providing all manner of services and experiences. Computing power continues to double every 18 months or so (according to Moore’s law), producing mobile devices that are more powerful now than the largest computers were even just a few years ago. The interconnectivity provided by the Web and wireless communications makes this a fascinating time to be an interactive systems designer.

Where are we heading?

It is a brave person who makes any strong prediction about where new technologies are headed as there are so many confounding factors. It is never just a technology that wins, but technology linked with a good business model linked with timing. Don Norman delivers an interesting insight into both the past and future of technologies in his book *The Invisible Computer* (1999). Discussing such things as why the VHF video format succeeded over Betamax and why Edison’s phonograph was not as successful as Emile Berliner’s, he takes us forward to something he calls ‘information appliances’. This notion has been taken up by others (Sharpe and Stenton, 2003), providing the following set of characteristics of information appliances:

- Appliances should be everyday things requiring only everyday skills to use.
- Appliances have a clear, focused function that can be used in a variety of circumstances.
- Peer-to-peer interaction. A key idea of appliances is that they work together without the need for central control or uploading and downloading.
- Direct user interface. Appliances need to be simple and intuitive to use.
- Successful appliances are those which support the notion of the swift and simple completion of a task.
- Appliances represent the ability to do something on impulse without having to think hard about how to do it.
- Appliances are personal and portable.

In 2010 this vision has been achieved to some extent with the range of smart phones such as the iPhone. But rather than the appliance concept being reflected in hardware, it is provided through the thousands of focused applications (‘apps’) that are available to download on to the iPhone, the Google Android or one of the other mobile platforms. Indeed Google along with Amazon are pioneering the idea of cloud computing where you don’t need to carry any applications or data with you, just keep them in the ‘cloud’ and download them when you need them.
Whom do you trust?

Wireless connectivity between devices is now common both through the ‘wifi’ standard called IEEE 802.11 and through Bluetooth. For example, your mobile phone will connect to your laptop computer via Bluetooth, and the laptop may be connected to an internal company network via a wireless network and hence to the Internet through the company’s wired connection and hence to any other device in the world. How will you know where any piece of data that you look at actually is? If you look at the address book ‘in your phone’, you might in reality be accessing an address book on your laptop, or on any computer on the company’s network or indeed anywhere on the World Wide Web. If data is duplicated, how will it be kept consistent? Across which devices will the consistency be reliable?

What we do know is that new products, business models, services and a range of other features will rapidly come into the world, and the interactive systems designer has to be ready to cope. Whether information appliances are just one of many directions that the future takes, we will have to see. In Microsoft’s vision of HCI in 2020 (Microsoft, 2008) they argue that ‘HCI needs to move forward from concerns about the production and processing of information toward the design and evaluation of systems that enable human values to be achieved’ (p. 77) – something also emphasized by Cockton (2009) and his call for worth-centred design.

Figure 1.7 illustrates some design concepts that have come from IDEO in their project looking at identity and how the business card might be developed in the future. The purpose of the project is to explore different concepts and ideas of identity rather than to simply produce new products.

Figure 1.7 Concepts for future business cards and ideas of identity
(Source: IDEO, 2003. Courtesy of IDEO)
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 offered by technologies
- 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 and iterate (do more research and more design) until a solution is arrived at.

The range of skills and academic disciplines that will contribute to such a person is significant. Indeed, it is often the case that no single person possesses all the skills needed for some design activity, which is why the design of interactive systems is often an affair for a design team. 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. We group the subjects that contribute to the design of interactive systems under the headings of knowledge of People, Technologies, Activities and contexts, and Design, and illustrate the relationships in Figure 1.8 (p. 21).

People

People are social beings, so it is important that the approaches and techniques adopted in the social sciences are used to understand people and technologies. Sociology is the study of the relationships between people in society, the social, political and other groups that they participate in, and the settings in which such relationships take place. Anthropology is similar but focuses also on the study of culture, biology and language and on how these have evolved and changed over time. Both use techniques such as interviews and observation to arrive at their conclusions. A key approach, particularly in anthropology, is ‘ethnography’, which uses qualitative methods such as observations and unstructured interviews to produce a description of a particular culture or social group and its setting. Also related is cultural studies, which looks at people and their relationship with cultural issues such as identity, but also much more prosaic cultural activities such as shopping, playing computer games or watching TV. Descriptions tend to be from a more literary criticism background, informed by experience and reflection. Psychology is the study of how
people think, feel and act. In particular, cognitive psychology seeks to understand and describe how the brain functions, how language works and how we solve problems. Ergonomics is the study of the fit between people and machines. In designing interactive systems, the designer will borrow much from each of these disciplines, including methods to help understand and design for people.

Technologies

The technologies that interactive systems designers need to know about include both software and hardware. Software engineering has developed methods for specifying and implementing computer programs. Programming languages are used to issue instructions to any programmable device such as a phone, computer, robot dog or earrings, shirts and chairs. Designers need to be aware of hardware for sensing different types of data (sensors) and for bringing about some change (actuators, or effectors). There are many different components available that produce many different effects and here designers will draw upon engineering knowledge, principles and methods. Communication between devices uses various communication ‘protocols’. Designers need to know how different devices can communicate.

Activities and contexts

Interaction will usually take place in the context of some ‘community of practice’. This term is used to denote groups of people who have shared interests and values and engage in similar activities. In business communities and organizations, information systems methods have developed over the years to ensure that information systems are developed that are effective and meet the needs of people who work there. In particular, soft systems theory (Checkland and Scholes, 1999) provides a very useful framework for focusing on the design of interactive systems. Social and organizational psychology are needed to look at the effects of technological change on organizations, and recently knowledge management and social computing have become important areas. Finally, new technologies offer new opportunities as business and interactive systems designers find that they are sometimes creating whole new ways of working with their designs.

Design

Principles and practices of design from all manner of design disciplines are used in designing interactive systems. Ideas and philosophy from architecture, garden design, interior design, fashion and jewellery design all crop up in various ways and different forms. It is not easy to simply pick up ideas from design disciplines, as much design knowledge is specific to a genre. Designers need to know the materials they work with and it is likely that more specialist design disciplines will emerge. One such discipline is product design, which is itself changing as it takes on board the nature of interactivity. Product design is an important contributing discipline to the skills of the designer of interactive systems. Graphic design and information design are particularly important for issues of information layout and the understandability and aesthetic experience of products. Human–computer interaction has itself evolved many techniques to ensure that designs are people-focused.
Challenge 1.4

Imagine that you are put in charge of a design team that is to work on a project investigating the possibility of a new set of Web services for a large supermarket. These services will allow connection from any fixed or mobile device from any location, allowing food items to be ordered and delivered. The client even wants to investigate the idea of a ‘smart refrigerator’ that could automatically order items when it ran out. What range of skills might you need and which subject areas would you expect to draw upon?
WHY BEING HUMAN-CENTRED 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 worth while. 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

Williams, Bias and Mayhew (2007) provide details of a number of case studies looking at the costs of taking a human-centred approach to interactive systems design and at the benefits that arise. Paying attention to the needs of people, to the usability of the product, results in reduced calls to customer help lines, fewer training materials, increased throughput, increased sales and so on.

Involving people closely in the design of their systems will help to ensure acceptability. Systems will be more effective if they are designed from a human-centred perspective and people will be more productive. Nowhere is the economic argument more pertinent than in Web design and e-commerce sites. Jared Spool and his company User Interface Engineering have a number of reports demonstrating the importance of good design to e-commerce and claim that sales can be increased by 225 per cent by turning ‘browsers’ into ‘buyers’.

Safety

In the early 1980s there was an accident at a nuclear power plant at Three Mile Island in the USA that almost resulted in a ‘meltdown’. Reportedly one of the problems was that the control panel indicated that a valve was closed when it was in fact open, and another indicator was obscured by a tag attached to another control: two fundamental design errors – one technical and one organizational – that human-centred design techniques would help to avoid. Other classic horror tales include a number of plane and train disasters that have been attributed to faulty displays or to operators not understanding or interpreting displays correctly. 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

Being human-centred also ensures that designers are truthful and open in their design practice. 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. As systems are increasingly able to connect autonomously with one another and share data it is vital that people know where the data that they give is going and how it might be used. People need to trust systems and be in a position to make choices about privacy and how they are represented.

The issue of intellectual property is another important aspect of ethical design; it is very easy to take an image from a website and use it without giving proper acknowledgement for its source. There are many issues associated with plagiarism
or other dishonest uses of written materials. Privacy, security, control and honesty are all significant features of the interactive systems designer’s life. Equality and attention to access are two of the ‘political’ issues that designers must address.

As technology changes so do traditional views and approaches to big moral and ethical questions. There are standards and legal requirements that need to be met by designs. Fundamentally, ethical design is needed because the systems that are produced should be easy and enjoyable to use, as they affect the quality of people’s lives. Designers have power over other people and must exercise that power in an ethical fashion. The ACM code of ethics gives good advice on ethical design.

**Sustainability**

Interactive systems have a big impact on the world, and designers should approach interaction design from the perspective of what is sustainable. Millions of mobile phones and other devices are thrown away each year and they contain metals that are potentially dangerous to the environment. Large displays and projectors gobble up power. Cultures get swamped by the views and values of the dominant suppliers of hardware and software and local languages die out when all information is in English, Chinese or Hindi. Human-centred design needs to recognize diversity and design to enhance human values.

**SUMMARY AND KEY POINTS**

Designing interactive systems is a challenging and fascinating discipline because it draws upon and affects so many features of people’s lives. There is a huge variety of interactive systems and products, from business applications of computers to websites to dedicated information appliances to whole information spaces. Designing interactive systems is concerned with designing for people using technologies to undertake activities in contexts. Designing interactive systems needs to be human-centred.

- It draws upon many different subject areas, including both engineering design and artistic design.
- It is needed because we live in a digital age when bits are easily transformed and transmitted.
- It is necessary if we are to have safe, effective, ethical and sustainable design.

**FURTHER READING**

Laurel, B. (ed.) (1990) *The Art of Human–Computer Interface Design*. Addison-Wesley, Reading, MA. *Although this book is quite old, many of the articles in it are still relevant and many of the authors of those articles are still at the forefront of interaction design today.*

**Getting Ahead**


Norman, D. (1998) *The Design of Everyday Things*. Addison-Wesley, Reading, MA. *These two easy-to-read books provide a wealth of examples of good and bad design.*


**WEB LINKS**

The Usability Professionals Association is at [http://www.upassoc.org/](http://www.upassoc.org/)

The Interaction Design Association is at [http://www.ixda.org/](http://www.ixda.org/)

The on-line material that goes with this chapter is at [www.pearsoned.co.uk/benyon/chapter1](http://www.pearsoned.co.uk/benyon/chapter1)

**COMMENTS ON CHALLENGES**

**Challenge 1.1**

Of course, what you say will be dependent on the product or systems chosen. The important thing is to think in broad terms about the nature of the interaction with the device and at the activities that the device enables, and how good it is at doing them!

I could talk about the coffee machine at work, which is a simple, functional device. A single button press produces a reasonable cup of coffee. It is limited, however, in the variety of coffees that I can get (four types only) so I would ideally prefer a person mixing coffee for me rather than getting it from a machine. If I stay late at work and have to use the other coffee machine, it is a nightmare. The money slots don’t work properly, the cups are too thin so the drink burns your hands, and the default is coffee with sugar (which I hate) so I have to remember to press the ‘no sugar’ button. Which I frequently forget to do!

This simple device can be contrasted with a website. Take [www.ideo.com](http://www.ideo.com), for example: a site for the IDEO design company. Here the opening page is nice and clean, but there is no site map or other help to get the visitor oriented. Clicking on any of the three images or on the ‘enter IDEO’ button takes you to the same location. Once again the screen is dominated by some nice images but this means that there is not much room for the information! A very small scrolling window on the right-hand side is difficult to read and difficult to control.

**Challenge 1.2**

The interface to the microwave consists of the various switches on the front that allow programming the time and temperature. There is also an audio part – the ‘ping’ when the timing is finished. The remote control just uses buttons as the interface and the xbox controller has various buttons and a 4-way joystick. The PDA uses a pen (pointer) and a touch-sensitive screen. Icons are used on the screen and there are a few buttons on the casing. The PDA accepts ‘graffiti’ handwriting recognition.
Challenge 1.3

The aim of this challenge is to get you to think beyond user interfaces and beyond human–computer interaction to the changes that new technologies are bringing or could bring. As we create new information appliances and new products such as business cards, we, you, interactive systems designers, change the world. We change what is possible and change how people interact with other people. Reflect on (and discuss with someone else, if possible) the political, moral and ethical issues of these concepts.

Challenge 1.4

This project will demand a wide range of skills. On the technology side there are networking and software engineering issues concerned with how devices can be programmed to do this and how the information about products and orders can be stored. There will be issues of authorization and authentication of payments. Product design may come in if there are to be purpose-built devices created to access the services (e.g. an in-store smart scanner that could be used to record items bought). There will be a lot of information design expertise required and some graphic design to help in the layout of information. On the people side of things, general psychological knowledge will help to inform the design, and sociology may help to understand the social setting and impact that such services would have. Business models may need to be developed and certainly the skills of information systems designers will be needed.

EXERCISES

1. Spend some time browsing the websites of corporations such as IDEO, Sony and Apple. Do not just look at the design of the site (though that can be useful); look at the products they are talking about and the philosophy of their design approach. Collect together your favourites and be prepared to spend time discussing them with your colleagues. Think of the whole range of issues about the site: what it looks like, how easy it is to use, how relevant the content of the site is, how clearly the content is organized, what the overall ‘feel’ of the site is.

2. 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.

Write down how you might approach the design of the supermarket shopping service discussed in Challenge 1.4. Don’t do the design; think about how to approach the design. Are there any issues of effectiveness, safety, ethics and sustainability that need to be considered?