BELL College

BSc Applied Computing

1. Introduction to HCI

Contents

JP 11/11/2004

Introduction

HCI (human-computer interaction) is the study of how people interact with computers and to what extent computers are or are not developed for successful interaction with human beings. A significant number of major corporations and academic institutions now study HCI.

As its name implies, HCI consists of three parts: the **user**, the **computer** itself, and the ways they work together.

User
By "user", we may mean an individual user, a group of users working together. An appreciation of the way people's sensory systems (sight, hearing, touch) relay information is vital Also, different users form different conceptions or mental models about their interactions and have different ways of learning and keeping knowledge and. In addition, cultural and national differences play a part.

Computer
When we talk about the computer, we're referring to any technology ranging from desktop computers, to large scale computer systems. For example, if we were discussing the design of a Website, then the Website itself would be referred to as "the computer". Devices such as mobile phones or VCRs can also be considered to be "computers".

Interaction
There are obvious differences between humans and machines. In spite of these, HCI attempts to ensure that they both get on with each other and interact successfully. In order to achieve a usable system, you need to apply what you know about humans and computers, and consult with likely users throughout the design process. In real systems, the schedule and the budget are important, and it is vital to find a balance between what would be ideal for the users and what is feasible in reality.

The Goals of HCI

The goals of HCI are to produce usable and safe systems, as well as functional systems. In order to produce computer systems with good usability, developers must attempt to:

- **understand** the factors that determine how people use technology

- **develop** tools and techniques to enable building suitable systems

- **achieve** efficient, effective, and safe interaction

- **put people first**

Underlying the whole theme of HCI is the belief that people using a computer system should come first. Their needs, capabilities and preferences for conducting various tasks should direct developers in the way that they design systems. People should *not* have to change the way that they use a system in order to fit in with it. Instead, the system should be designed to match their requirements.

BELL College

Usability

Usability is one of the key concepts in HCI. It is concerned with making systems easy to learn and use. A usable system is:

- easy to learn
- easy to remember how to use
- effective to use
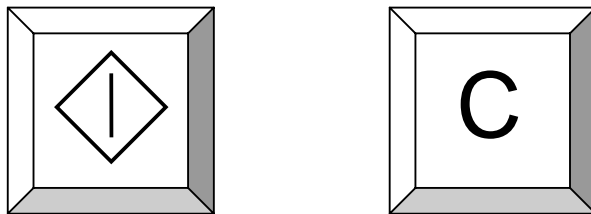- efficient to use
- safe to use
- enjoyable to use

Why is usability important?

Many everyday systems and products seem to be designed with little regard to usability. This leads to frustration, wasted time and errors. This list contains examples of interactive products:

mobile phone, computer, personal organizer, remote control, soft drink machine, coffee machine, ATM, ticket machine, library information system, the web, photocopier, watch, printer, stereo, calculator, videogame etc….

How many are actually easy, effortless, and enjoyable to use?

For example, a photocopier might have buttons like these on its control panel.

Imagine that you just put your document into the photocopier and set the photocopier to make 15 copies, sorted and stapled. Then you push the big button with the "C" to start making your copies. What do you think will happen?

    (a) The photocopier makes the copies correctly.
    (b) The photocopier settings are cleared and no copies are made.

If you selected (b) you are right! The "C" stands for clear, not copy. The copy button is actually the button on the left with the "line in a diamond" symbol. This symbol is widely used on photocopiers, but is of little help to someone who is unfamiliar with this.

Factors affecting usability

The main factors affecting usability are:

- Format of input
- Feedback
- Visibility
- Affordance

The principles of **visibility** and **affordance** were identified by HCI pioneer Donald Norman.

- **Visibility** is the mapping between a control and its effect. For example, controls in cars are generally visible – the steering wheel has just one function, there is good feedback and it is easy to understand what it does. Mobile phones and VCRs often have poor visibility – there is little visual mapping between controls and the users' goals, and controls can have multiple functions.

- The **affordance** of an object is the sort of operations and manipulations that can be done to it. A door affords opening, a chair affords support. The important factor for design is **perceived affordance** – what a person thinks can be done with an object. For example, does the design of a door suggest that it should be pushed or pulled open?

HCI and its evolution

This section lists some of the key developments and people in the evolution of HCI. You will look at some of these in more detail during this course.

- **Human factors engineering** (Frank Gilbreth, post World War 1) – study of operator's muscular capabilities and limitations.
- Aircraft cockpits (World War 2) – emphasis switched to perceptual and decision making capabilities
- **Symbiosis** (J.C.R. Licklider, 1960's) - human operator and computer form two distinct but interdependent systems, augment each other's capabilities
- **Cognitive psychology** (Donald Norman and many others, late 1970's, early 1980's) - adapting findings to design of user interfaces
- Development of **GUI interface** (Xerox, Apple, early 1980's)
- Field of **HCI** came into being (mid 1980's) – key principles of User Centred Design and Direct Manipulation emerged.
- Development of software design tools (e.g. Visual Basic, late 1980's, early 1990's)
- **Usability engineering** (Jakob Neilsen, 1990's) - mainly in industry rather than academic research.
- **Web usability** (late 1990's) – the main focus of HCI research today.

Factors in HCI

There are a large number of factors which should be considered in the analysis and design of a system using HCI principles. Many of these factors interact with each other, making the analysis even more complex. The main factors are listed in the table below:

Organisation Factors Training, job design, politics, roles, work organisation		Environmental Factors Noise, heating, lighting, ventilation	
Health and Safety Factors	The User Cognitive processes and capabilities Motivation, enjoyment, satisfaction, personality, experience		Comfort Factors Seating, equipment, layout.
User Interface Input devices, output devices, dialogue structures, use of colour, icons, commands, navigation, graphics, natural language, user support, multimedia,			
Task Factors Easy, complex, novel, task allocation, monitoring, skills			
Constraints Cost, timescales, budgets, staff, equipment, buildings			
System Functionality Hardware, software, application			
Productivity Factors Increase output, increase quality, decrease costs, decrease errors, increase innovation			

Disciplines contributing to HCI

The field of HCI covers a wide range of topics, and its development has relied on contributions from many disciplines. Some of the main disciplines which have contributed to HCI are:

- **Computer Science**
    o technology
    o software design, development & maintenance
    o User Interface Management Systems (UIMS) & User Interface Development Environments (UIDE)
    o prototyping tools
    o graphics
- **Cognitive Psychology**
    o information processing
    o capabilities
    o limitations
    o cooperative working
    o performance prediction
- **Social Psychology**
    o social & organizational structures
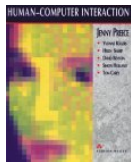
BELL College

- **Ergonomics/Human Factors**
  - hardware design
  - display readability
- **Linguistics**
  - natural language interfaces
- **Artificial Intelligence**
  - intelligent software
- **Philosophy, Sociology & Anthropology**
  - Computer supported cooperative work (CSCW)
- **Engineering & Design**
  - graphic design
  - engineering principles

EXERCISE

1. Suggest some ways in which the design of the copier buttons on page 3 could be improved.

2. For the following scenarios, map out what you do (USER INPUT) with the way the system seems to operate (SYSTEM FEEDBACK)

   - Buying the books "Human Computer Interaction (J. Preece)" and "Shaping Web Usability (A. Badre)" on the internet

   - Sending a text message on a mobile phone

3. Consider factors involved in the design of a new library catalogue system using HCI principles..

4. Use the internet to find information on the work of Donald Norman and Jakob Neilsen

Further Reading

The notes for this course are partly based on the following book, which is recommended as supplementary reading. Other useful books will be listed on your course web site.

Human Computer Interaction by Jenny Preece (Addison Wesley 1994)