Course - DT249/1

Subject - Information Systems in Organisations

Semester 1, Week 12

INTERACTING WITH COMPUTERS
Module Content Title

From the course document, this week’s lecture refers to:

Interacting with computers
Textbooks?

- The Laudon and Laudon book, ‘Management Information Systems’ (Seventh Edition) – Chapters 6 (6.2) and 10 (10.4)
Interacting with Computers

- The topic of ‘interacting with computers’ is concerned, largely, with the principles of Human-Computer Interaction (HCI) or, in a narrower field, Graphical User Interfaces (GUls).
Interacting with Computers (2)

There is a huge range of types of computers and types of applications - HCI is a concern for all of them.

- Pocket PCs
- Desktop PCs
- Wireless Devices
- Nuclear systems
- Mobile phones
- MP3 players
- Airport control systems
- Laptops
- Medical systems
- Mainframes
- Web applications
- GPS devices
- Smart TVs
- etc etc
Human-Computer Interaction (HCI) is concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.

i.e HCI involves the study, planning, design and uses of the interaction between people (users) and computers.
Human-Computer Interaction (2)

- HCI emphasises the significance of good interfaces and the relationship of interface design to successful human interaction with computer systems.

- It is often regarded as the intersection of computer science, behavioral sciences, design, media studies, and several other fields of study.
Human-Computer Interaction (3)

- Interacting with computers is improved by ‘good usability’.

- What is that?

- A computer system has usability. (Whether it is easily usable, or difficult to use, is measurable.)

- Usability, like many features of systems, can be ‘designed in’…
Overview: Map of Human Computer Interaction

Use and Context

Social Organization and Work

Human-Machine Fit and Adaptation

Application Areas

Human

- Human Information Processing
- Language, Communication and Interaction
- Ergonomics

Computer

- Dialogue Techniques
- Dialogue Genre
- Input and Output Devices
- Computer Graphics
- Dialogue Architecture

Evaluation Techniques

Example Systems and Case Studies

Design Approaches

Implementation Techniques and Tools

Development Process

Example Systems and Case Studies

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Development Process
Why Study Human Use of Computer Systems?

- When considering why to study Human Computer Interaction, there are several perspectives or views:
  - The human factors view
  - The personal view
  - The systems view
  - The marketplace view
  - The business view
  - The social view
The Human Factors View

Humans have cognitive and physiological limitations.

Errors are costly in terms of

- loss of time
- loss of money
- loss of morale
- loss of lives in critical systems

Design can cope with such limitations.
The Personal View

People view computers as appliances (like phones and televisions), and want it to perform as one.
Humans are complex.

Computers are complex.

There is a complex interface between the two.
The Marketplace View

Everyday people who use computers:

- now expect an “easy to use system”
- are not tolerant of poorly designed systems
- have little control of training programmes
- are often a heterogeneous group

If a product is hard to use, people will often seek other products – EG Mac vs Personal Computer (iOS vs Microsoft Windows).
Business organisations want to use their employees more productively and effectively.

The personnel costs now far outweigh hardware and software costs in many business plans.
Computers contribute to critical parts of our society, and cannot be ignored. EG:

- to the education of children
- to take medical histories and provide expert advice
- to keep track of our credit worthiness
- to help form government policies
- to control air and ground traffic flow
- to book travel
The Social View (2)

- to control chemical/oil/nuclear plants
- to control space missions
- to assist humans with their everyday tasks (office automation)
- to control complex machines internally (aircraft, space shuttles, super tankers)
- to help control consumer equipment (cars, washing machines, televisions)
- to entertainment (games, Kindles, Netflix)
Views – so what?

In all these views, human best interests and economics are aligned.

(How people use systems (and, to some extent, the way they use them), and the cost of using systems can be combined.)
The End User

- A ‘user’ is an individual – a person who uses a computer. This includes expert programmers as well as novices. An *end user* is any individual who runs an application program.

- The end user is the person who uses the hardware or software or system after it has been fully developed and installed.
The End User (2)

- There are often two types of users; users who require a finished product (end users), and users who may use the same product for development purposes (as in ‘end user computing’ or ‘end user development’).
- The term *end user* usually implies an individual with a relatively low level of computer expertise.
The User Group

- A user group is a group of individuals with common interests in some aspect of computers.

- Some user groups cover nearly everything with subgroups (called SIGs – Special Interest Groups), while others concentrate on a particular area, such as computer graphics, or a particular application (such as Sage Accounts).
Usability

Usability is generally regarded as the principle of ensuring that interactive products are easy to learn, effective to use and enjoyable from the user’s perspective.

Designing for maximum usability is the goal of Human-Computer Interaction design.
“User experience”
- Encompasses more than usability
- Also, note the ‘elements of usability’
Usability Measures

Measurement is possible in relation to usability in systems design.

Designers might define the target user community and the type of tasks associated with the interface being designed.

‘System communities’ might evolve and change. 
   EG The interface to information services for a Customer Support System might be modified over time.
Usability Measures (2)

Five human factors (usability measures) central to evaluation:

1. Time to learn
2. Speed of performance
3. Rate of errors by users
4. Retention over time
5. Subjective satisfaction
Five Usability Measures

1. **Time to learn**  
   ◦ How long does it take for typical members of the community (users) to learn relevant task?

2. **Speed of performance**  
   ◦ How long does it take to perform relevant benchmark tasks? (Tasks with known measures to compare with.)

3. **Rate of errors by users**  
   ◦ How many, and what kinds of errors are made during benchmark tasks?
   ◦ …/ continued
Five Usability Measures (2)

4. **Retention over time**
   - Frequency of use, and ease of learning, help make for better user retention (memorising tasks).

5. **Subjective satisfaction**
   - Do the users like the designed interface?
   - Allow for user feedback via interviews, free-form comments and satisfaction scales.
User Interface Analysis

- Interface analysis means understanding:
  - the people (end-users) who will interact with the system through the interface,
  - the tasks that end-users must perform to do their work,
  - the content that is presented as part of the interface,
  - the environment in which these tasks will be conducted.
User Interface Design

- Is the user’s new application/system:
  - Easy to learn?
  - Easy to use?
  - Easy to understand?

- Golden rules:
  - Place the user in control
  - Reduce the user’s memory load
  - Make the interface consistent
User Interface Design (2)

- Typical design errors:
  - Lack of consistency
  - Too much memorisation
  - No guidance/help
  - No context sensitivity
  - Poor response (e.g., to users via pop-up messages)
  - Arcane/unfriendly
User Interface Design Process

- Interface validation
- Interface analysis and modeling
- Interface construction
- Interface design
HCI Design

- Rather than the traditional design models adopted within software engineering which are characterised by their linearity, Human-Computer Interaction (HCI) has adopted a design model which aspires to incorporate the following premises. It is, generally:
  - user centred
  - multi disciplinary
  - highly iterative (repeated)
User Centred System Design

- User centred system design is based upon a user’s:
  - abilities and real needs
  - context
  - work
  - tasks
Design Principles for Usability

- Obviously, when designing a system it is worth taking the USER into account! Principles for good design of this sort include:
  - Early focus on the users
  - Empirical measurement
  - Iterative design
  - Integrative design ( - help for users, training, documentation, etc., in parallel to the technical design)
Usability

Early focus on users

• Bring the design team into direct contact with the users right from the start.

• Get the user involved in the design (as much as possible) so they can instill their knowledge into the design process.
Usability (2)

Empirical measurement

• Actual behavioral measures of
  • learnability
  • usability

• Testing of appropriate tasks or concepts - access speeds, time to learn procedures - remembering that novices are different from experts.

• Collect the users’ thoughts (interviews, questionnaires…)

• Collect the users’ mistakes,

• Collect the users’ attitudes.
Usability (3)

Iterative design

• Incorporate the results from the tests into the next prototype
• Set goals for the system
• Get feedback on evaluation

(Evaluation criteria next)
Usability (4)

- Evaluation criteria

The designed system should be:
- easy to use
- user friendly
- easy to operate
- simple
- responsive
- flexible
Usability (5)

Integrated design

It might be best practice to:

• build online help into the system, prepare training, documentation AND process modules (coded programs) at the same time.
Usability Definitions

- Usability is task related, people related and function related. It has cognitive, behavioral, and communicative components.

- To be truly usable a system must be compatible not only with the characteristics of human perception and action but, and most critically, with user's cognitive skills in communication, understanding, memory and problem solving.
Usability Definitions (2)

- Designing a usable system requires:
  - understanding of the intended users.
  - the amount of time they expect to use the system.
  - how their needs change as they gain experience.
Usability Design

(Back to: )

Early focus on the user

• What: understand the users’ cognition, behaviour and attitude in relation to the goals of the organisation.

• How: interviews, observations, discussions, working with the users.

Empirical Measurement

• What: tasks and dependent measures.

• How: testing – protocol (procedural rules) analysis, observation, interviews, etc.
Usability Design (2)

Interactive design

• What: the problems encountered are to be corrected and measure again.
• How: an evolving system – prototyping.

Integrated Design

• What: a parallel development of interface, help, documentation, training and measurement.
• How: a bespoke system – integrating designed features.
Goals for usability

- Time needed to learn - how long does it take for typical users to learn to use the commands relevant to a set of tasks?

- Speed of performance - how long does it take to carry out the benchmark set of tasks?

- Rate of errors by users - how many and what kinds of errors are made in carrying out the benchmark set of tasks?

…/continued
Measurable Human Factors (2)

- Subjective satisfaction - how much did the users like using aspects of the system?
- Retention over time - how well do users maintain their knowledge?
Cognitive Engineering

Learning is a relatively permanent change in behaviour resulting from:

- Elaboration, association, practice, rehearsal.

Metaphor - a mental model, structure, or framework which help bridge any gap between what a person knows and what is being attempted to be learned.
Cognitive Engineering (2)

In relation to learning to use icons and menus (metaphors) presented on a screen:

- Learning is a relatively permanent change in behaviour resulting from conditions of practice.
- Human learning then is the association of one item with another item (Associated learning).
- Pairs of stimuli are introduced, a mental association is made for them, and the stimuli then become interrelated.
- Future learning can then depend upon past learning (Constructivism).
People develop new cognitive structures by using metaphors to cognitive structures they have already learned.

The metaphor is a model or structure/conceptual framework which helps bridge any gap between what the user knows and what is to be learned.

Metaphors spontaneously generated by users will predict the ease with which they can master a computer system.

If this is indeed the case then systems designers must understand and employ the use of metaphors in system designs.
Eight recommendations to aid both the user and designer in build effective systems

1. Find and use appropriate metaphors in teaching the naive user a computer system. A metaphor must have a suitable domain for a given system and given user population.

2. Given a choice between two metaphors choose the one which is most congruent with the way the system works.

3. Assure that the correct attitude is presented. Costs of ignoring this recommendation range from user dissatisfaction and reduced productivity to sabotage.
4. When more than one metaphor is needed to represent a system, choose metaphors that are similar enough, but not so similar that confusion results.

5. Consider the probable consequences to users and system designers of each metaphor used. This is the evolving state from novice to user. Two paths are possible: one leading directly to the system, the other to a new metaphor.

6. The limits of the metaphor should be pointed out to the user.
7. The intent of the metaphor in the beginning is to aid understanding and usability; for the continual user it is no longer necessary. The metaphor is used also as a motivator, at first to get the user to use the system, then to make him productive and keep his interest.

8. Provide the user with an exciting metaphor for routine work and eventually present the user with advanced scenarios requiring different action.
Cognitive Engineering (7)

Goals of cognitive engineering:
- to understand the fundamental principles of human action and performance relevant to the principles of system design.
- to devise physical systems that are pleasant to use.

Psychological variables - goals, intentions and attitudes

Physical variables - pertain to the ergonomics of the system (the WAY the systems is used physically).
As mentioned before in several versions of the same point, computer based systems should be easy to learn and remember, effective and pleasant to use.

These ideas can have testable usability behavioral measures applied to them.
Nine basic categories of usability problems:

1. Simple and natural dialogue: the dialogue should be simple and clearly stated. It should not contain any irrelevant information. The information should appear in a natural and logical order.

2. Speak the user's language: the dialogue should be expressed in the terminology familiar to the user rather than in system oriented terms.

3. Minimise the user's memory load: instructions should be visible, easily retrievable, and simplified. Presentation load should be reduced when ever possible (i.e. users should not have to remember file names when they are retrievable).

4. Be consistent: the terminology and concepts should always be used in the same manner.
Cognitive Engineering (9)

5. Provide feedback: the system should provide feedback as to what is transpiring within a reasonable time.

6. Provide clearly marked exits: clearly marked exits should be provided to the user in case of mistakes.

7. Provide shortcuts: system flexibility for the novice and expert. Menus for the novice and commands for the experts.

8. Provide good error messages: the error messages should be constructive and provide meaningful suggestions to the user of what to do next.

9. Error prevention: a careful design that prevents error messages from occurring in the first place.
Cognitive Engineering (10)

Conclusion:

- The identification of specific, and potential usability problems in a human computer dialogue design is difficult.
- Usability goals should be defined and incorporated into the design.
- Designers may have difficulties in applying design principles unless they have simple basic requirements for the design product.
What Next?

- Next week:
  Revision of notes – with a review of a past paper.