- *Recall different approaches to the problem of communication with ICT systems and discuss the resource implications of sophisticated HCI.*

including command / menu structures	*screen design*	*nature of error messages, availability of help*	*user friendliness*	*Ease of learning.*

- *Discuss the implications for customising software to develop a specialist HCI. Chapter 61*

The Human Computer Interface
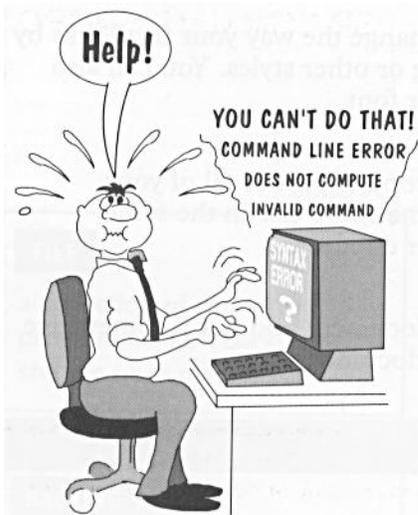
What is it?

The human computer interface (usually shortened to HCI) is the term used to describe the interaction between the user and a computer. Many different things could be regarded as part of the HCI, like the way the screen looks, or whatever the program makes it clear to the user what they have to do next. This is where the term **user friendly** originates from.

It is important **not** to allow the word "computer" to limit your vision to a PC sitting on an office desk. HCI's are also found in the following situations: -

- Cash machines at banks / building societies
- A pilot checking his instrument panel on a jumbo jet
- A musician composing a symphony
- A scientist monitoring a chemical reaction

Organisations tend to use one of three types of HCI

i)   Command Driven

Command Driven Interface
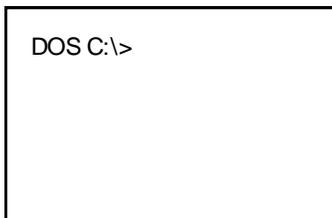
DOS C:\>

a direct method of access for more experience users - requires typing a command to make something happen, but you must already know   what that command is. Dos C:\> e.g. DIR gives directory listing- the fastest way to issue commands and explore the computer system.   Must type in exactly.

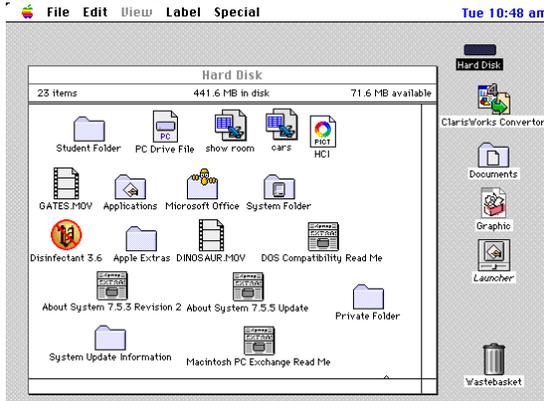|	
1.	New Document
2.	Load document
3.	Save Document
4.	Print Document
5.	Quit

Menu Driven Interface

ii)   Menu Driven

Menu driven systems are slightly more user friendly than command driven systems because you are less likely to make mistakes if you do not remember the commands. The user can choose from the menu

ii)   Graphical User Interface (GUI)   (See ICT2)

GUI's (Gooeys) Graphical User Interface - for novices and less technically minded users. GUI's require far more memory and operate more slowly because of added graphics processing
 (WIMP Windows Icons Mouse Pointer and Pull-down menus)

Benefits	
All possibilities as a list	Minimal typing
Error trapping is simple	Inappropriate choices can be withheld from user
Context sensitive help can be provided	
	Extended hierarchy of menus can be difficult to follow
Drawbacks	
Tedious for experienced users	
Several screens might be required	

Advantages of common user interface between different generic applications include

common commands	Increased speed of learning
ease of use	Confidence building in novice users
reased range of tasks solvable by experienced users	Greater range of software accessible to average users

For users to communicate effectively with IT systems, a good user interface design is essential.

Well-designed systems can improve the output of employees, improve the quality of life and make the world a safer and more enjoyable place to live in.

Designing New Software

Research into Human-Computer Interaction (HCI) involves the study of good software design to see what makes it good. Researchers observe people interacting with computers to see what they find intuitive and what they find confusing.
- Good interfaces provide:
- Help for novice users
- Short-cuts for experienced users
- Metaphors or images (e.g. a picture of a printer on a print   button)
- Consistent behaviour, which makes use of long-term memory   e.g. always using F1 for Help or ESC to stop a process. There are   certain functions that have become de facto standards.
- Clear and helpful error messages.
- Uncluttered screens with effective use of colour.

http://www-2.cs.cmu.edu/afs/cs.cmu.edu/user/bam/www/uicourse/special/	HCI

Properties of a good user interface

The best interfaces are those that are those that are: -

ATTRACTIVE	- Interfaces are more likely to be used if they are attractive. - Screen arrangement i.e. colours, typefaces (font & sizes), graphics elements, all impact on the look of the interface
FORGIVING	- Users should be able to recover easily from mistakes users should be able to get on line help easily - Easily cancel wrong selections - Should be intuitive when things go wrong
CUSTOMISABLE	The user should be able to tweak the interface to his or her own habits e.g. - Ability to size or move windows - Design icons and tool bars - Design desktop patterns
TRANSPARENT	This implies predictability; that is the interface should provide choices that are logical and reflect how users are likely to react to situations
UNBURDENSOME	Implies that the software rather than the user should be the most accommodating - e.g. menu systems that require users to simply recall what a command does rather than remember a specific language syntax - Several ways to execute a command, thereby making it easier for the user to work in the way they find most comfortable
SAFE	e.g. the pilot of a jumbo jet
EFFICIENT	Users do not spend five minutes trying to find the correct way to insert their card and type in their PIN and the amount of cash they want, and then leave without remembering to take their card
ENJOYABLE	- a primary school pupil performing a certain task within a program - a new user finding his/her way around the system
USER FRIENDLY	e.g. screen which leaves error message on screen can be

	confusing
	• Repeated rejection of data without explanation can be frustrating
	• Should be concise but intuitive/easy enough to allow the user to correct the error
AVAILABILITY	• Users still complain that programs are hard to use. What these programs need are **of help** better built in training and troubleshooting features e.g. on line help screens that the user can pull up on the screen for assistance when they are stuck
	• indexed alphabetically
	• Context sensitive - refers to an on line feature that provides assistance relating to the type of operation the user is currently trying to perform

USABLE should be a product of collaboration between the designer and the users

User, not designer, convenience should be paramount	Interface is consistent throughout the system
Built in help and advice accessible at different levels	Spacing is important
Techniques of highlighting such as blinking and colour should be used sparingly	Desktop
Filing cabinets for disc drives	Documents for files
Folders for directories	Waste paper baskets for deletion of files
Control Panel	Buttons for initiating action e.g. print
Switches for setting options on and off e.g. a grid on a spreadsheet	Radio buttons for choosing sizes of paper
Lights to indicate active events e.g. printing	Sub-panel menu to select system defaults

Resource implications of a sophisticated HCI

- Processing power is required (processing power is needed to draw the interface, leaving less for the application itself)

- The overhead of increased processing time due to complex use of graphics and dynamic objects/windows, etc.

- need for increased memory resource Backing Store (a GUI takes up more disk space than a command line interface)
- Immediate Access Store (a GUI will hog RAM)+ hard disk as virtual memory.
- sound Card
- colour monitor

Examples of specialist HCI's include:-

Automatic pilot systems in an aircraft	Embedded computers- washing machines, microwaves
Navigation systems (land, sea and air)	Machines for developing photographs
Touch screens in tourist information centres	Flight simulators
Speech input (voice recognition)	Automated teller machines

Implications include: -

- Security - ATMs - navigation systems
- Safety - pilot of jumbo jet
- Who is HCI for?   blind person, disabled person
- Accuracy (voice recognition)

When Paperclips Attack: http://news.bbc.co.uk/hi/english/sci/tech/newsid_753000/753922.stm
Good link on interface design: http://www.open2.net/ictportal/app/hci/hci.htm

EXAMINATION QUESTIONS

Q1 Name some other tasks for which computers are used, and for which special purpose interfaces are required.

- *Navigation systems (land, sea and air), washing machines, machines for developing photographs,   touch screens in tourist information centres, flight simulators.*

Q2 In the early days of cash machines, it was found that users sometimes forgot to remove their cards after withdrawing their cash. What simple change was made to eliminate this fault?

- *Cards have to be removed before the cash appears. Change HCI design by prompting user to remove card before cash is given out.*

Q3 Identify TWO situations in which a command driven interface would be appropriate.

- *A command-driven interface is appropriate for a technical user or a user who will undergo training and use the same software all the time.*

Q4 Name some other situations where voice recognition would be appropriate.

- *Data entry for people affected by RSI (Repetitive strain injury); military aircraft, lifts (elevators)*

Q5   Give other examples of sophisticated HCIs

- *Digital watch, video recorder, touch screen on sophisticated photocopying machine.*

Q6   A different HCI would be needed for each of the following users:

   i)   a young child in a primary school
   ii) a blind person
   iii) a graphic artist

For each user describe and justify an appropriate HCI.   **(9 marks)**

i)WIMP interface: Touch sensitive screen or concept keyboard or mouse (accept keyboard), because easy to use or appropriate reason e.g. child cannot read.
(ii) Command driven interface: Keyboard (Braille) or voice I/O, Braille printer, because cannot see screen
(iii)WIMP; graphics pad, high resolution screen, digitiser, plotter. Must respond to sensitivity of touch/resolution (or any reasoned alternative)

1997 User interfaces have gradually become more and more oriented to the needs of users over recent years.

   a) Briefly describe three features of user interfaces which have been developed and explain how each has benefited the user (3 marks)

   b) Describe two ways in which user interfaces need to be developed further to make computers more accessible and friendly to untrained users.   (2 marks)

(a)   We would like to see a 3-3 split here but accept up to 4-2 in either direction.

- ***Physical factors****: Max. 4 @ 1 each from : position of screen, lighting conditions, seating conditions, choice of colour schemes, etc., ergonomics/design of mouse/keyboard ventilation/room temperature*
- *Psychological factors**: Max. 4 @ 1 each from: user friendly interface (qualified), help available for novice users, short cuts for expert users, make use of human long term memory to maximise efficiency, functionality, technophobia*

(b)   Three points. In each case:

for the factor (1) for a clear explanation of its impact on systems resources (1)

- *NB: More than one of the resource implications: a greater demand for memory/IAS/backing store and processor functionality and time/speed, might apply to the same factor of the H.C.I. However, candidates can only gain 1 mark for the resource implications of each factor.*
- *on-line help availability- increased need for backing store (2,1,0)*
- *complexity of interface/ multiplicity of menu routes adds to size of resultant code thus increased IAS demands (2,1,0)*
- *use of GUI- increased IAS demands (2,1,0)*
- *need for multi-tasking/ability to switch between applications/tasks - processor functionality overhead (2,1,0)*
- *Faster searching of help file -processor speed overhead. (2,1,0)*

Q8   Many machines now offer graphical user interfaces such as Windows and the Mac OS.

i)   Describe **two** features of such interfaces, which are likely to be helpful to a non-technically minded user.   **(2 marks)**

ii) Describe **three** advantages of this type of interface.   (3 marks)

a) Features include:	
icons which indicate their meaning	*pointer controlled by mouse*
easy selection from a menu	*choose by clicking on icon, or*
use of hot keys	*cancel/undo commands*

(b) Able to respond to speech input	
point and touch screens	*more help facilities*
better error messages	*commonality*

Q9   A school runs two versions of the same word processing package on its network. Both versions allow users to type in text, but Version A accepts only keyed commands whereas with Version B the user may use a mouse as well as the keyboard.

- a)   Describe how the use of a mouse can be helpful during Word Processing operations. Give a range of examples to justify your answer. **(6 marks)**
   b) At some point in the future it seems likely that computers will be able to receive input in spoken form. Discuss, with examples, how this development could affect the design and use of word processing packages**. (6 marks)**

a) A mouse is helpful because it is faster to perform tasks and easier to see what you are operating on (selected text highlighted). e.g. moving round text is faster with point and click, selecting text is faster using point and drag. Option selection is easier using dialogue boxes, or pop up menus using right mouse button.
b)   At the simplest level text could be entered in spoken form rather than being typed in. or punctuation, could use icons on a tool bar which could be selected and placed where
*   required or there could be a punctuation button to accept the next word as punctuation e.g. "full stop" in a similar way there could be a command button which when selected would take the next word as a command.*
e.g. speak the text to be highlighted, press command button then say "Centre"

or could have the three mouse buttons mapped to text Punctuation   Command
Other commands such as page set-up could be spoken, and the dialogue box could appear on the screen and the required settings spoken.

Q10   Considerable efforts have been made to provide powerful yet intuitive user interfaces to a wide range of application packages, operating systems and programming languages.
a) Identify a range of facilities that could be provided and discuss the perceived need for such facilities.   **(4 marks)**
b) Describe how you might assess the effectiveness of such interfaces.   **(1 mark)**

*a) An operating system could provide **icons** representing software packages and **mouse support** so that the user can load software by clicking on the icon. It could provide easier ways of copying files, by using a mouse to move a file from one directory list to another.*
***Editing facilities** in all types of software could be provide to so that the mouse is used, for example, to highlight text, and a **menu** of options allows the user to select, cut and paste. These facilities are need because it is hard to remember the correct syntax for performing infrequently used commands. Computers are no longer the province if the trained expert; people from many different skill areas want to use, for example word processors, spreadsheets and databases and do not want to learn complex operating system commands.*
b)The effectiveness of such interfaces could be assessed by the number of copies of a package
*   like Microsoft Windows, which uses these techniques, which are sold worldwide.*

1995.7 (8 marks)

A particular institution uses a range of software packages from different suppliers, each with a different user interface. You are asked to advise the institution on the advantages of using software packages with a common user interface.

Give FOUR advantages of having a common user interface   (**4 marks**)
Describe ONE specific aspect of a user interface that would benefit from being common between software packages   **(2 marks)**
A user interface which has already been configured by an IT expert may not have been customised to the exact needs of the user. This can result in poor use of the package by the user who may not know how to reconfigure the interface.

Describe a feature that is subject to this kind of configuration   **(2 marks)**

(a) *common commands* *ease of use - ease of navigation* *nsistency between packages*	*increased speed of learning - training not needed* *confidence building of users - particularly novices* *Reduces support overheads*
(b) *buttons are same type* *colour of screen* *style/colour of error messages* *sition of menus*	*consistency (1) qualified (1)* *mouse buttons* *position of error messages* *same use of hot keys* *nsistency of defaults*
(c) *page view or layout set incorrectly* *wrong toolbar selected*	*on-line spell checking rather than at end* *wrong colour, reconfiguration of colour*

1991.10 (12 marks)

The choice of a user interface has been described as 'one of the most critical areas of software consideration'. Many machines now offer a front end GUI (Graphical User Interface) or WIMP environment.

(a) Describe the advantages of this type of interface to an average user **(2 Marks)**

Describe the potential disadvantages of this type of interface to an experienced user **(2 marks**
Describe the advantages and disadvantages in the use of this type of interface to the system.
 (4 marks)
(b) A particular user installs a word processing package, a spreadsheet package and a DTP package on a machine; all operate under such a front end environment. Describe TWO examples of the types of data exchanged between the packages and explain why this process may be easier than on a system which does not use a front end. **(4 marks)**

(a)user friendly point and click, providing easy access to a range of facilities e.g. filing, fonts, device   management
gets in the way', more time consuming/greater number of operations to do a simple task, may be several levels of menu before the one required, direct example contrasts to command line,
provides consistent environment, easier to data exchange using 'clipboard', device management
        globally set, multi-tasking, DDE (dynamic data exchange)
(b)   data exchanged wp-dtp... raw text for formatting/page layout
        sp-dtp or wp sheets for inclusion
        easier environment takes care of formatting changes of file transfer between the packages
automatically.

1997.5 (12 marks)

a)   Give **six** of the physical and psychological factors which govern how people interact with computer systems.   **(6 marks)**

 b) Give **three** factors which should be considered when providing a sophisticated human
 computer interface, explaining the impact of each one on the system's resources **(6 Marks)**

1998.6 (10 Marks)

A university uses a complex CAD (computer aided design) package. The package has a sophisticated human-computer interface which also places considerable demands on the system's resources.

(a) Give **two** examples of a system's resources that would be affected by such a package and explain the demands placed upon them (4)

(b) Describe **three** features you would expect to find in the human-computer interface which would merit the description 'sophisticated'. (6)

(a) In each of 2 examples: 1 for the resource and 1 for the demand on it.
 Backing storage (1) - requires sufficient capacity to cope with large graphics files / large help-files/ size of application code (1)
IAS (1) requires sufficient capacity to cope with multiple graphical user windows (1)
Processor (1) : needs sufficient clock speed to cope with additional processing involved in smooth presentation of Graphics display (1)
etc. Avoid repetition any 2 x (1+1)=4
(b)   In each case give 1 for naming the feature and then 1 for describing it. Descriptions must make it clear that some level of sophistication exists.
on-line help (1) with context sensitive searching of different topics (1)
effective use of colour (1) to highlight on screen message e.g. warning messages in red, suggestions in a different colour (1)
well designed command/menu structures taking into account skills of CAD designer (1) with shot cut keys for experienced users (1)
use of a range of input/ output devices appropriate to CAD design work (1) e.g. graphics tablet, plotter, etc. (1) – 2 examples gets 2 marks
user friendliness (1) takes account of design skills and terminology used by designers (1)
GUI (1) – presents complex information in graphical/icon format (1)
– features must be appropriate to CAD e.g. not voice recognition.

Max. 3x (1+1)=6

2000 6(12)
The workstations on a particular company network are set up to allow each user to change software, menus, icons and colour schemes to suit his or her own preferences. These variations make support for users difficult to manage.
The network manager wants to change to a standard user interface, so that all the users will be given the same set of menus, icons and colour schemes.
(a) (i) Describe two benefits for the users of this standardised approach, other than improved support.(4
(ii) Describe two of the disadvantages for the users of this standardised approach. (4)
(b) What are the resource implications for planning this standardised interface?   (4)

(a) (i) Benefits for users:
- *ease of learning - training material can he written to match workstation I-ICI ,(2,1,0)*
- *easier transfer of skills to new packages if interface is maintained, (2, 1,0)*
- *consistency of interface maintained when users move between workstations, (2,1,0)*
- *better self support between users, (2, 1, 0)*
- *'standard settings for defaults' e.g. Word starting each sentence with a capital letter. (2,1,0)*
- *Easier distribution/use of standardized items such as templates/logos etc*

(ii) Disadvantages for users:
- *Level of skills for different users - standard may suit less able but not highly skilled, (2,1,0)*
- *Have to wait for changes in software configuration rather than do it themselves, (2,1,0)*
- *May not be able to use favourite specialised software unless is included in standard (2,1,0)*
- *Standard colour sets may not be appropriate for colour blind or other disabilities (2,1,0)*
- *User no longer has control over their own desktop environment plus expansion (2,1,0)*
- *Either need for additional training/support OR user may be confused plus expansion (2,1,0)*

6 (b) Resource implications:
- *Need to upgrade some workstations if they cannot support standard (1)*
- *Upgrades may include hard-drive, screen (1)*
- *May involve moving software from local workstations to a server (1) May involve increased network traffic (1)*
- *Need to upgrade server storage capacity to accommodate move of apps from workstations to a server (1)*
- *Need to upgrade networking infrastructure from ring to star (1)*
- *Time consideration for restructuring (1)*
- *Use of staff for restructure (1)*
- *Time lost during changeover (1)*
- *Network management software enables this change to occur (1)*

Spring 2003.8

A mail order music company has decided to expand and has established a retail outlet in a busy shopping centre.

a.   An important feature of the mail order system is the interface for the staff who use it. State three features you would expect the human/computer interface to have in such a system and give a different reason for each one. (6 marks)

b.

i.   Name an appropriate device for capturing data on each item that is sold via the retail outlet. (1 mark)

ii.   Describe one advantage for the company of using this device. (2 marks)

a.
- *Consistency with other systems (1) so that users are less likely to make errors (1)*
- *Automated data entry (1) to reduce errors (1)*
- *Cater for different levels of user expertise (1) workers may not be very ICT literate (1)*
- *Cater for different end user's physical abilities (1) e.g. for partially sighted (1)*
- *Consistent at both sites (1) so staff do not have to learn two systems (1)*
- *Sensible use of colour (1) as the system will be used fairly intensively (1)*
- *Help features accessible (1) so that users are able to assist themselves when they need to (1)*
- *Menu based system (1) so that input choices are restricted to items sold (1)*

- *Graphical user interface (1) to build on users previous experience/ to avoid language issues/ etc (1)*

Credit any feature related to interface that fits within the given context.
Second mark is given for expansions that can be justified within context.
3 x (2,1,0) marks
b.
i.
- *Bar Code Scanner (1)*
- *Key Board (1)*

1 mark
ii.   This description must relate to the answer to (i) in order to get the marks
e.g. Bar Code Scanner
- *simple method (1) needs minimal training so staff can be working quickly (1)*
- *stock is already provided with bar code from supplier (1) so little extra work required in preparation (1)*
- *Speed of data capture c/w other methods (1) so that store increases productivity (1)*
- *Etc.*

e.g. Key Board
- *cheap method c/w bar code scanner (1)*
- *simple method (1) needs minimal training so staff can be working quickly (1)*
- *Etc.*

June 2003.*3*
A school has approached you for advice as it plans to develop a computer-based learning environment for its pupils aged from 6 to 10.
(a) Describe **two** factors the school should consider whilst designing the interface for the
    computer system.   *(4 marks)*
(b) State, with a reason:
(i) **one** example of a suitable input device that could be used by the pupils;   *(2 marks)*
 (ii) **one** example of a suitable output device that could he used by the pupils.   *(2 marks)*

June 2003.6
There are several types of human/computer interface.
(a)   (i) Describe one feature of a command line interface.   *(2 marks)*
(ii) Name, giving **one** reason, one application where this interface would be appropriate. *(2 marks)*
(b)   (i) Describe one feature of a menu driven interface.   **(2 marks)**
        (ii) Name, giving **one** reason, **one** application where this interface would he
appropriate.*(2 marks)*
    a.   (i) Describe **one** feature of a graphical user interface. .*(2 marks)*
(ii) Name, giving **one** reason, **one** application where this interface would be appropriate. *(2 marks)*