Legislative Trends

Many countries are concerned with privacy or data protection. In Europe 17 countries have enacted forms of data protection legislation.

It was recently reported that the Law Reform Commission in Hong Kong has spend three years drafting new legislation covering the area of data protection. This has been accelerated by developments in this area by the European community which seek to limit data transfers to countries that do not have data protection and privacy laws as stringent as those in force in the EEC. Hong Kong has recognised that any restrictions on information flow could adversely affect trade. The practical effects of the bill are to create an Office of the Privacy Commissioner to which all registered companies would have to submit returns covering "the main features of the data that they hold".

The commissioner would have the power of inspection, in the event of a complain relating to the unfair use of information or invasion of privacy, or on his own recognisances if there is a suspicion of "wrong doing". The Hong Kong definition of data incorporates paper, as well as computer files.

It should be noted that what is viewed as the extremism of the Hong Kong and European draft data protection directives have attracted criticism from various quarters.

In Hong Kong there were concerns that the proposed legislation was "so wide they might be open to abuse in some cases, too restrictive in others and could be too costly for many companies to implement".

In Europe the criticism has centred on the proposals being "too extreme", getting the balance wrong between privacy and public policy objectives such as "freedom of information", putting too much emphasis on the "holding of data" rather than the "abuses arising from the use to which the data is put" and being too bureaucratic, onerous and costly. Other issues raised related to what "the status of intra-company data exchanges" might be, the concern that the directives could "have serious implications for data exchange with parties in third countries" and that "increasingly important economic activities within the EEC such as broad-casting, direct mailing, market research, credit assessment might be seriously affected.

In the UK there is now legislation to control access to personal data through the UK Data Protection Act 1984. Whilst there is yet no definition of what constitutes "appropriate security measures" under Principle 8 of the Act, these will be forthcoming. Much has been written by security consultants on what constitutes acceptable access controls in operating systcms. Their views will no doubt be highlyrelevant to the definition of appropriate security measures. Users have different access control requirements and are subject to varying financial limits. However, by building in the facility to enable implementation of security processing, the degree of control can be varied to accommodate both individual users and future requirements.

India does not seem to have ma& any move yet towards a data protection act, but in keeping with the international trends, it will possibly be having one in the future. Also in view of the tradition of English law, it is likely to be closest to the corresponding UK Data Protection Act 1984.

1.5 SUMMARY

In this unit, a number of concerns have been addressed, which are not readily apparent but are likely to become more important in the future. The unit begins with an exhortation that a systcms analyst's training is never finished. Since an analyst does not work in isolation, some features of teams and organisation characteristics have been discussed. Systems have to be reliable but if the systems fail, anticipation of needs incase of disastrous failures have been drawn attention to. Issues related to law such as arising in software piracy, computer crimes and privacy, data protection have also been drawn attention to, so that the analyst is aware of these considerations while working on the development of appropriate systems.

UNIT 2 HUMAN COMPUTER INTERACTION

Structure

2.0 INTRODUCTION

In designing computer systems, it must be borne in mind that they are meant for use eventually by humans, and therefore, the way in which the system interacts with humans is of great importance in the design of such systems. In the initial stages, when the users were few, this was not important but as information technology is becoming ubiquitous, the need for more "humane" interface is gaining attention in the industry. Till sometime back the interface was thought as going beyond data entry to direct data capture using OMR, OCR, etc. and in terms of pen-based input, speech and gesture recognition, possibly a variety of languages such as English, Hindi, Japanese, Chinese, etc. and other input/output technologies. However, in recent times, a realisation has come that the top layer of the software programs has also a major component. Since this is the layer experienced by the user, it is very important. The success of Apple Macintosh and Windows have demonstrated this and most software designers are giving utmost attention to it.

This unit is of course a brief overview of some of the issues involved and by no means exhaustive.

2.1 OBJECTIVES

After completing this unit, you will be able to :

- appreciate that computers are meant for use by humans;
- realise that there cannot be a single user-friendly interface;
- appreciate the relevant factors in designing the human- machine interface;
- appreciate the human problems in an organisation moving towards information technology; and
- give adequate importance to ergonomics in the design of computer-based systems.

2.2 THE WHAT, WHY, WHEN AND WHERE OF HUMAN COMPUTER INTERACTION

Human Computer Interfaces (HCI) are tools for helping human beings and machines to work together more effectively. Every tool used by human being has a human interface. When one rides about in a Bicycle, the pedal and the handle are the interfaces through which riding the bicycle is possible. In the case of a car, this may change to the steering wheel, the brake,

the clutch, the accelerator and the speedometer as constituting the human interface. Even when one enters in a building by opening a door, the door knob is a human interface. For automatically opening doors, the light sensing mechanism would be the human interface.

In the case of computers, the evolution of the technology has taken place at a really fast pace, and in the enthusiasm and excitement of the new emerging frontiers, not much attention was paid to its king easily usable. The inner workings of most computers were initially accessible only to the experts who were well-versed in programming languages. A question was raised by some people in the 1950s itself as to whether instead of training people in low, medium and high level programming languages, is it not possible to design computers that would be able to communicate more directly.

It was only with the dramatic increase in numbers that was brought about during the P.C. revolution that it was possible to seriously address the question. The effect of the PC revolution was the emergence of a whole new set of tools for tasks ranging from Word-processing, personal banking, management, decision support and onwards upto robotic control. The other emerging dimension was that, instead of just a handful of specifically trained programmers being the only users, personal computers began to be used by people from all walks of life. Such as farming, retailing, manufacturing, commerce, entertainment, medicine, politics etc.

HCI, therefore, is about understanding the task, user and environmental factors in order to design systems that can be used effectively by humans. This can be done by understanding the factors including psychological, ergonomics and social factors that determine how people operate and make use of the technology. Having acquired this understanding, the designers have a role in seeing that the computer systems meet the task in user needs. The net result would, therefore, be to achieve efficient and effective interaction.

It is not always transparent and obvious as to how the information should pass between the human and the machine. In complex systems such as computers which comprise both hardware and software, the design of the interface become even more complicated. Many of us have had experience in using gadgets which were not easy to operate and gave problems because the user was not prevented from taking action which was damaging for the equipment It is not only in the use of gadgets that the human interface may be perceived as difficult. Even in administrative systems such as doing the work in offices, in using forms, in following procedures and in trying to get information or decisions which pertain to one's problem, there are numerous instances of the interface being extremely hostile to the prospective user.

While using computers, when a beginner tries to work through an operating system like UNIX or DOS, he is often intimidated by an unclear and cryptic error message or a system response.

In the context of computer systems, the challenge to the system designer from the point of view of HCI is at several levels. At one level it relates to selecting the most appropriate input devices such as the Keyboard, Mouse, Light Pen, etc. for the task and likewise the most appropriate output display devices, such as video, printed text, printed graphics bearing in mind both aspects of colour and speed. Apart from the physical object used for input, the means of transfer of information, for example, by use of forms, query and answer based languages, natural languages, comments or graphic based structures such as spreadsheets, Icons, Menus etc.

Whenever one tries to see the advantages and limitations of the alternatives of the device methodology that can be used, the approach has to be somewhat qualitative in nature, Of course, HCI is also emerging to be a field in which quantitative techniques are now being used in order to have a better confidence in the decisions that have been taken. In this brief discussion such approaches relying on statistical and mathematical techniques will not be referred to but it is still worthwhile enumerating some considerations that the designers would like to bear in mind when selecting the most appropriate input device.

2.2.1 The Task Features

If the task is one where large amounts of the text are to be read from some other document and essentially typed, then the Keyboard is the most useful advice. If a more graphical approach is to be used and a cursor on the screen is required to be moved around and positioned for an operation to take place then the Mouse is a better device rather than using

the arrows on the keyboard. If several objects have to be drawn on the screen of the user then the Mouse too would be somewhat clumsy device.

2.2.2 User Characteristics

In the same context one would find that young children are more excited and happier hying to use a Mouse. But users who have been using typewriters for quite sometime and are comfortable with the keyboard may still prefer to be typing rather than trying to master a new experience on a pointing device and fumble with the device while learning to use it.

2.2.3 Contextual and Environmental Factors

The lighting, the noise, the ventilation and the general comfort in the working place is also an important factor to be borne in mind. Ergonomics is referred to a little later in this unit and is also a major consideration.

The benefits that accrue out of a good WCI implementation is an improvement in the quality of work and often the benefits are largely hidden, intangible and unquantifiable.

But Management all over is now becoming more sensitive to the issue of quality as recent success stories in other cornmcrcial and engineering products have proved beyond doubt that eventually the customers perception of the quality of the product is what leads to it becoming a success in the market.

In the preceding unit, it has been pointed out that team activity is an essential part of the designing and developing computer systems. As it is clear from what has been said about HCI expertise, it is actually encapsulation of knowledge obtained from a variety of different disciplines. Somewhat in the manner of what had been said earlier in terms of what constitutes the Knowledge and Skills Repertory of a good System Analyst, human computer interaction also requires an appreciation of computer science, cognitive psychology, ergonomics and human factors, engineering, designing, anthropology, sociology, philosophy and in many cases now artificial intelligence.

As an example, let us consider the use of ATMs (Automated Teller Machines) which are used universally (and now have begun to make their presence in India) also as a device through which transactions can be made by way of a valid card such as credit card. Humans interact with the machines and the machines deliver the cash against crcdit cards. It was found that quite often the user receiving the cash left the machine immediately after picking up the cash and forgot lo take back the credit card. Designers responded to this problem by introducing a change that required users to retrieve their bank cards before receiving cash. This was an enhanced feature to overcome the problem of users who inadvertently left behind the crcdit cards in the machines. The concept on the basis of which the device was improved was from the principle that a "task" (such as retrieving the crcdit card) becomes more important to a person if that task is "instrumental" to achieving the desired goal (such as receiving money).

The purpose of the section was to draw attention to the fact that while the computer programrner would tend to look upon a computer based system primarily from the point of view of the functionality of the system, the actual design should bear in mind that it is user centered, user participative, experimental, interactive and user supportive.

2.3 COMMUNICATING WITH COMPUTERS

We have experienced on several occasions, that information or instructions given by one person to another person have sometimes been misunderstood and tasks incorrectly carried out. When we use natural language for communicating between human beings, there is scope for ambiguity, lack of precision and possible variation depending upon the context. Natural languages have situations where the same word could have carried different meanings depending upon the context and different words carry similar meaning. Words which sound more or less the same to the human car can have entirely different meanings. However, because the humans communicate with each other constantly paying attention *to* the tone of voice, the facial expression, gesture, posture and even the attire adds lo the messages being communicated. Even silence can carry messages. This is so because a person at the other end of the communication activity is also capable of human reasoning and interpretation and carries a lot of contextual information and experience,

Communication between humans and computer in contrast is primarily for the purpose of making the system carry out specific tasks. The purpose of the communication is to convey suitable instructions to the machines and observe the machines response to those instructions.

The systems designer, therefore, has to make special effort for making this communication between unequal partners effective and fruitful.

Computers have now pervaded many walks of life and, therefore, the tasks for which computers could be used may include-office procedural tasks, engineering tasks, information retrieval tasks, updating of information tasks, controlling of operation tasks etc. The amount of human interaction of course, varies with the nature of task and some of the considerations that have to be borne in mind while carrying out a task analysis would be :

- to what extent the task is repetitive

  the variation caused by the environment in which the task is performed

  variation between different occasions for performing the task
- the frequency at which the task is carried out
- the knowledge expected of the user who is carrying out the task
- the skills in which the user carrying out the task is efficient
- the criticality in time of the task
- possibility of the safety hazards
- whether the task is done alone or in a group

  whether the task is carried out for a long duration or there is switching between several tasks.

Once these considerations have been deliberated upon and their bearing to the particular system has been analyzed, they must be classified into those tasks which ought to be done by the computer and those that ought to be done by human. Of course, a technology oriented designer would be inclined to automate more and more all the tasks. But an over-riding genera! principle should be borne in mind that humans should do those tasks that require a high degree of intelligence or dexterity which they can carry out better and the computers should be made to do those tasks which they can perform better than humans.

There is of course, a great variety in human characteristics and attitudes. Individual differences such as gender, age, socio-cultural background, end up in creating a wide range of human participative. It is, therefore, obvious that one design may not suit all. For example, the design of devices which are to be manipulated by hand, must bear in mind the left-handedness or right handedness of the user,

It is an interesting aside to know that although the first impacts of mass technology methods was to force a standard degree of products and a consequent reduction on personal choice, information technology based products have the possibility of greater degree of possible customization and personalization because software can be made quite flexible. Many of today's software has have the possibilities of setting up parameters to suit one circumstances and to that extent customize it and make it more specific to an individual user's needs.

It has been seen earlier that communication of messages from the user to the computer is done by means of input devices, which can broadly be categorized as those which are activated by limb movement and touch, and those activated by speech and those activated by eye or head movement. Apart from the traditional QWERTY keyboard, there are alternative design keyboards and also Mice, Light pen, Digital, Joy slicks, Track ball and data gloves which are used as Data Entry Devices,

The choice of particular dcvicc is intimatedly linked to the conclusion of the task analysis carried out earlier. For example, where large amounts of text entry are to be done primarily in a typing move, but traditional keyboard on which large number of trained staff are available would be useful. If more adhoc queries and short elements of text are to be entered may be a keyboard in a dictionary style could be more useful. If the task involved primarily pointing and selecting from specified items than the Mouses are very appropriate.

The traditional approach to writing of computer programmes was one of creation of data files, results being obtained in form of certain output files as a result of processing. These output files could then be appropriately formatted and possibly either on screens or as hard copies on a DOT matrix, Line Printer, Ink- jet or Laser Printer. The movement towards more user friendly communication styles have created a de-facto standard of a dialogue style of conversation between the human being and the computer. A dialogue with the computer, therefore, consists of some instructions which are given in a specified form to the computer which may be by typing a command, pointing with the help of a mouse or for that matter as is likely to be in the future, by simply speaking. These instructions are processed by the computer and the result of the processing is displayed again for the benefit of the user. The dialogues can be carried out in different formats. It may either be small dialogue boxes or it may require the filling of a form by indicating values for different variables.

There is a constant movement towards making this dialogue easier for the user. The traditional command language oriented style, which displayed cryptic and intimidating error messages being replaced by more visually appealing mcnu driven approaches.

A menu is a set of options displayed on the screen from which the selection on execution of one or more of the options can be carried out, and having made the choice results in a change in the set of the interface. Unlike command driven systems, the user of the computer, therefore, does not have lo memorise names or even the first four letters of the various commands. He should bc able to understand the functioning of each of the options or these should be listed in the mcnu. Of course, for such systems to be really effective. the names over Icons used in the display of the menu should bc self-explanatory to a typical user with the requisite knowledge and skills for the software. Typically, there is a permanently visible fixed matrix mcnu. Sometimes pull-down or pop up menus also arc used by using the series of them one as what is called as a cascading mcnu. Although menus may appear at first sight to be extremely atuactivc and visually appealing, the experienced users may find it easier without taking up lot of steps on the screen unnecessarily. Also being forced to navigate through a menu to arrive at an operation may be not exciting to a uscr who would later prefer directly typing the specific command. These observations havc been made primarily to draw the attention to the fact that, as has been said earlier, different kind of users would prefer differcnt approaches and, therefore, there can not be just one single model or a user friendly interface for all.

Spreadsheets with which you may already havc become familiar can also be thought of as an interface which is especially useful in instantly recalculating through a table of numbers to carry out a "what-if" analysis of different situations. Query languages such as SQL which is discussed at greater length on course on 'Database Management System'. Also useful to non-programmers and for making adhoc queries with a rudimentery understanding of the database and the text of the language.

Communication by human takes place through the five senses, anti with the availability of digitised pictures and speech and animated images, multi-media provides a very versatile way of displaying and interacting with information.

The student may have heard of virtual reality in which almost a higher level of communication takes place and a uscr can interact with the system using a data glove. A data glove is a wired glove which enables the wearer to touch objects in three dimensional space. It also conveys a certain feel for the hardness, softness and smoothness of the object that seems to be held by using the glove in this virtual space. The glove can also be used for gesturing. Device like the data glove and computer systems depicting virtual reality are very expensive as of now and they arc basically being used for exploratory research programmes. However, like the past experience in other aspect of computer and information technology, the availability of these systems is also likely to undergo an important tremendous change in terms of greater availability at lower costs in the future.

2.4 ERGONOMICS

Even before the usage of computers, various other kinds of automation devices havc been used in the office and work environment. The typewriter, the telephone, the office furniture, the filing cabinets are all part of a normal work place, It was realised early enough that these must be so devised as to be conducive to long hours of work. The discipline which concerned itself with such aspects of work simplification came to be known as **Ergonomics.** The system analyst must realise that the basic ideas carry through into the developmenl and use of computer information system as well.

2.4.1 What is Ergonomics?

Ergonomics is the name given to a new discipline related to work and work simplification and derives from the Greek words (Ergon (work) and Nomos (law)).

The aims of ergonomics are primarily twofold :

(a) to improve the efficiency of the interaction between the human and machine through enhancing the effectiveness and efficiency of human activities at work or at home.

(b) to maintain the individuality of the worker by considerations of human welfare and human well-being in the design procedure, namely in areas of health, safety, satisfaction and comfort of the worker.

The study of human factors is a multi-disciplinary subject and its approach lies in the systematic application of available data such as human characteristics in the design of human machine systems, work procedures and design guidelines. The human characteristics include the physical and psychological capabilities as well as limitations. A typical set of ergonomics properties relevant to the design and functioning of human machine systems are listed at Table 1. The ergonomic properties in an integrated form determine the overall efficiency, reliability and degree of human involvement in the operations.

Ergonomics essentially is the study of the relationship between the human being and the environmental factors affecting the physiological, psychological or anatomical state. For example, the effect of the lighting of an office on the efficiency of its workers fall in this category. Similarly, the height of the computer operator's chair or the colour of the screen may also be considered as part of ergonomics. Ergonomics considerations play a very important role for designing devices involving physical involvement of human being. The design of the driver's seat, the cockpit of an aeroplane. the location of the kick starter on a motor byke-all are supposed to be guided by the ergonomics factors like comfort, safety, efficiency etc. In recent times, with the proliferation of mechanical/electrical/ electronic gadgets-ergonomics has emerged as a major branch of study. Design of any human operated device invariably takes the ergonomics factors into consideration.

Ergonomics, as stated earlier, also involves psychological factors. The impact of any efficiency enhancing device on factors such as morale, motivation, emotional stability has to be analysed very carefully. A device, as such, may increase efficiency. But, if these factors are overlooked, then it may be difficult to sustain it and in the long run it becomes even counter-productive. Efforts should be made to ensure that the device and the human beings operate in a harmonious environment.

Controllability	Serviceability	Assimilation	Habitability
Distribution of functions between operator(s) and the human operator playing dominant role	Design for optimal operations, maintenance and reports	Ease of skills for operations and maintenance of standards for functions under normal conditions	Machine operational factors congenial to human health and work capacity

Table 1: Ergonomic Properties of Human-Machine Systems

2.4.2 Ergonomics in System Design

The fundamental approach and emphasis of ergonomics in system design is to consider the human operator as an integral part of the system to be designed. The task components are allocated to the human and machine, in such a way as to utilise strengths and virtues of each and to complement them efficiently through good user interface design. A chart showing the Human-Computer strength and weaknesses related to office information activities is at Table 2. A synergistic combination of the human/computer capabilities is also shown.

Office Information Functions	Human Weaknesses	Computer Strength	Human Machine Synergy	Human Strength	Computer Weaknesses
INPUT	Slow limited attention Inaccurate Biased	Fast Voluminous Data Accurate Objective	Computer helps higher volumes of data, Human inputs non-computer readable data	Able to capture in original form, can shift control as needed	Unable to Capture data, not computer readable, all actions, prespecified.
PROCESSING	Slow Inaccurate Limited Capacity	Fast Accurate Large Capacity	Human creates alternative options, Computer calculate and analyse	Creative	Prespecified
STORAGE	Retrieval Inaccurate	Retrieval accurate Restricted cues but quick retrieval	Computer reduces human memory tasks to a few simple cues, Human provides sophisticated links to cues to enable speedy retrieval	Can create sophisticated retrieval cues	Pre-specified actions, simple Inflexible retrieval cues
OUTPUT	Slow Limited Capacity, inaccurate, inconsistent	Fast, High Capacity accurate consistent	Machine enables Human to produce many high quality outputs, Human communicates subtle aspects of computer outputs	Many communication modes	Limited variety of output

Table 2 : Human Computer Synergy

Check Your Progress

1. Define the term ergonomics.

.....

.....

2. Mention three safeguards you would recommend during system design to ensure the ergonomic property of service ability of computer hardware and software.

.....

.....

(No model answer is given.)

2.5 HUMAN PROBLEMS IN THE AUTOMATED OFFICE

The complex structure of information technology changes the way people work. It affects organisational structure, worker's job content, decision making, the interaction patterns, and the physical environment with far-reachin'gconsequences. The assessment of the impact of . these changes should encompass the complete operating environment of the system. It should include not only the workers and operating personnel, but also the people like clients, customer and the socio-technical environment which are external to the system. While introducing new technology, due regard to organisational needs and user requirements will ensure smooth transition as well as acceptance and assimilation by the personnel. The projected benefits and productivity gains through automation would not be realised if insufficient attention is paid to human issues.

One critical variable affecting the success or the lack of success in office automation is user acceptance. No matter how technologicallysuperior the equipment is, it is a failure if users reject it. It is noted by systems analysts that the rate of changes due to introduction of technology depends significantly on the degree to which tcchnology will be adopted within the organisation by the different users. The impetus for automation should be focused more on the user requirement and reaction than purely on the technological capability. Therefore, it is essential that the role of office automation should aim at functional integration of the three components of the systcm i.e. the people (the office worker and user) the organisation and the technology.

We will, however, confine our study to the human aspects i.e. people and the organisation.

You will see that all the office structures are closely interrelated to the objectives of the organisation which the officc supports. Therefore, the systcms and procedures in the office will necessarily have to suit the organisational requirements. More importantly, since workers constitute the primary resource in the office environment, human aspects need to be considered with great seriousness. It should be noted that the worker in the office is both an individual and yet a part of the organization and has lo be recognised from both these angles. First, let us consider the individual worker.

(a) **Individual Worker** : The first consideration is whether the technology change involves any physically harmful effecton the individual worker. For example, prolonged exposure to VDU (Video Display Unit) terminal has been known to generate mental and physical hazard for the user. Visual fatigue and deterioration of eyesight are also common problem usually caused by improper office lighting and poorly designed VDUs. Many operators surfer from muscular injuries and strains related to poor postural positions due to poor workstation design. Whilst poor working conditions and environment may present immediate hazards some problems may not immediately take effect but only over a long period of time.

The psychological problems of mental health and job satisfaction of workcrs may also be affected by new technology in the office. Some people who work with computers find that the difficulty to learn and use the machine as being restrictive and intolerable. They may also find that the software tools they use do not satisfy their task requirements. At times, hostility towards using computers may be generated by early traumatic and embarrassing experiences. While starting to use a computer, a user may make some errors that causes situations like wrong billing or incorrect printing of payroll, causing public ridicule. This may very well leave a lasting negative attitude towards the machine.

Changing work patterns as a result of implementing new technology docs not necessarily lead to productivity optimization. While the workers try to adapt to new ways of working, changes in procedures may be necessary to formulate efficient working pattern. Work study techniques may be used for such re-structuring. Now let us consider the other human aspects i.e. the organisation.

(b) **Organisational** Aspects : On the organisational side, some workers may perceive the new tcchnology as an adjunct to their jobs, whilst many others may resist possible changes to their ways of working. This is caused due to changes in the nature of job and responsibilities which need additional training and skill. This in turn affects work procedures and the structure of career and reward systems, There may be changes in power, influence and status of personnel depending on the level of access to information. Security and privacy issues have also become important especially when sensitive information is stored in a computer.

In an automated system, work may appear to become depersonalised, fragmented and restrictive. Workers may miss the personal contact with their work and its associated challenges. The boring and repetitive nature of an automated system thus, may cause stress. strain and resentment. Problems, such as these may result in many organisations suffering from —

(i) Increased labour turnover, absenteeism and low motivation

(ii) Increased probability of first errors and accidents

(iii) Increased lethargy and higher medical costs as a result of work related illnesses and injuries.

Many organisations have learnt that improvement in office ergonomics is not just a means of preventing work place from health-hazards but it also makes sound business sense. What is now better recognized is that through adjusting to organisational work environment and improved work stations design, can boost productivity. Office automation need not necessarily have a negative impact if properly introduced and implemented and the primary lacuna of lack of attention towards human issues is overcome.

2.6 DESIGNING HUMAN-MACHINE SYSTEMS

An integrated approach is essential to overcome the design complexities of human-machine systems. Different environmental factors affecting the performance of individuals as well as the organisation must be analysed carefully. Apart from this, a strategy must be formulated to test the system before it is adopted for practical applications. Let us consider the environmental factors first.

2.6.1 Environmental Factors

The environment of the entire system can be broken down into smaller,sub-systems. We will consider these sub-systems one by one.

a) Human-Machine Environment : The statement of objectives for a human-machine system design should define the acceptable range of inputs and outputs of the systems together with their temporal relationships and response times. The system has to be separated or broken down into Sunctional components which again are allocated to the human or to the machine. The approach to job allotment for human beings involve a series of activities. These include drawing up job specifications, deciding on the level of skill and the requirement of training as well as the selection process. The next step is to design the human-machine interlace. The human and the machine have to be matched to form an integral working unit and close attention must be paid to the area of contact or interface between them. The design of interfaces should combine the strengths and counter the weaknesses of both man and machine in a complementary way to get the best out of the combination.

For example, the information output of the machine must be adapted to the ways in which the human can receive information outputs through visual, auditory or through other means in most efficient ways. Similarly the control input devices of the machine should be adapted to the physical output of the human. The system should undergo through trials and pilot studies for proper evaluation and feedback should be conducted before introducing for practical applications.

b) The Organisational Environment : While designing system, apart from human-machine environment, the design must take into account, the organisational environment. An organisation is characterised by personnel who form the user community of the system. During System design phase an early interaction with the user should be brought about and the user should be involved in the design process. Simulations and prototype designs should be tested by users and system performances correlated through tests specifically designed. User involvement is a key element of the design process. The effectiveness of the user involvement depends on the degree and depth of participation and influence the users have on the design process. The traditional approach to design was to carry out the design and implementation through specialist,,, The dominant theme in that approach is to put together a working technological system. The result is that often user needs are not even taken into account. Other design approaches suggest user participation and specially definition of

needs by users in drawing up requirements specifications. User participation and user involvement in the design process does not always guarantee improved user acceptance. It is important that the users are properly represented and the representatives are encouraged to participate in design decisions in an objective way without fears or peer pressures. Users should also be helped to understand the design alternatives, limitations and constraints.

(c) The Physical Environment: The preferred approach should be for system design not only to involve practical applications of economic principles but also consideration of the physical environment. The three broad areas which are covered in the physical environment are —

(a) the workstation environment,

(b) the human machine interface, and

(c) the office environment.

The workstation environment covers three important areas of design consideration which are the workspace dimensions, the arm's reach and movements, height and the distances. Work surfaces may have to take into account the nature of the work carried out so as to promote proper working postures. One of the objectives in the application of anthroprometric data in equipment design is to enhance the possibility of maintaining postures.

(d) **Office Environment**: This includes noise, lighting and thermal conditions, office layout and design. Noise has high attention drawing properties. It can affect tasks that require vigilance, speed, accuracy, concentration and memory. Although some noise in office environment is tolerable it should not exceed 60 decibels. If required, noise may be regularised and minimised by using sound absorbing insulating materials such as stands, supports, panels etc. and through physical isolation using sound masking systems and so on. Good lighting increases normal efficiency and reduces visual fatigue. In the video workstation environment, lights should not be directly visible nor in the direct line of vision when viewing the videos, neither should light be reflected off the video screen. The reflecting levels of walls ceilings, and floors are affected by the type of surface. These should be considered while designing office lighting. The environment should be regulated to provide a suitable temperature 21 to 25 degree centigrade and humidity of 50 to 70 percent. A good office layout and design may help to promote a pleasing and comfortable working environment using both special layout and design of open plan offices etc. A chart stipulating some guidelines for ergonomic design is at Table 3. These are broad-based guidelines and only indicate desirable characteristics. These can be adopted suitably in relation to your environment, objectives, weather and the function of your organisations.

Work Space Considerations

Work space for operations and maintenance

Optimal space organisation

Levels of natural and artificial illumination for operations and maintenance.

Permissible levels of acoustic noise

Safety devices

Placement of Terminal, detachable Keyboards, Tiltable screens, Working position and adjustable chairs, back rests, movable seats, wrist rests.

Reach

Anthroprometric data

Visual Information (spatial characteristics)

Optimal angles	30 - 40	degrees for perspective images
Horizontal plane	50 - 60	degrees for plane images
	90	degrees head and cyc movement
	180	(slow) head and eye movement
Vertical plane	15	degree horizontal
	70	degrees maximum for eyes only
	+90	head and eyes measurement

Screen-observer distances 2125 x width of screen (small screen) 8 x width of screen (large screen) orange phospor characters on light brown (amber) background more readable.

Environment

VDU's Lighting should be shielded to prevent reflection on the screen. **Use** of antiglare shields.

A clear, stable image should be provided on the screen. Luminescence contrast 3:1 with office lighting.

Lighting Office work typing, lighting 500 lux (× 1.5 for persons over 50 years)

Static Electricity (or Electrostatic discharge)
- -- Printers, terminals and video display may be affected.
- -- Use antistatic spray

Temperature : 20°C

Health Hazard : Viewing of CRT: 15 minutes break after 2 hours of moderate work. 15 minutes break after 1 hour high demand work

e) Job **Environment :** If human issues are not considered in the design, the impact of new technologies may lead to routinisation in implementation and fragmentation of jobs, Job design is basically meant to promote greater job satisfaction, higher work motivation and better performance. Changes in skill requirements mean that current staff may need to undergo training. User support should help users to adjust, adapt and learn changes in their job responsibility. Rewards, career development and incentive schemes should be devised to accommodate this. The computerisation of manual tasks should not leave the workers with tasks that are dull, boring and insignificant. If new jobs are redefined the job content should continue to be meaningful and result in some significant output. These are usually achieved through mechanism such as job rotation, job enlargement and job enrichment.

2.6.2 Human-Machine Interface Design

After the study and analysis of the components of the total environment, lee us consider the factors for designing a human- machine interaction.

The design of the human machine interface is one of the most important aspects of system design. A good interface design should take into account the following factors:

a) **User characteristics :** It includes consideration of the kinds of users who will use the equipment, their diverse backgrounds and skills, the user expectations as well as their physical characteristics. The users who posses high degree of skill often prefer more powerful functions which usually means greater complexity. Unskilled operators, on the other hand, would prefer simple functions which are easier to learn and use. Stereo-lype expectations also affects the users perception as to how one thinks the system will behave.

b) **Task characteristics :** The nature of users tasks differ and therefore the need for specific kinds of services from the system. For example unstructured tasks usually require a more flexible mode of interaction to meet the varying needs of users as opposed to structured task which are more predictable and repetitive. The sequence and frequency with which certain tasks are performed will also affect the optimal design of the user interface.

c) **Functional characteristics :** It refers to the various functions required to perform the tasks and the ease with which these functions can be learnt and made use of by the users. While ascertaining the functional characteristics, the support facilities required to perform the functions, also need to be taken into account. These include facilities like training, on-line help, documentation, expert systems, etc. The other aspect of functional characteristic of a system is its performance criteria like response time, fault tolerance, etc.

Although traditional applications of ergonomics have been a guiding principle in hardware design, similar design principles are applicable to software design, especially that of the software user interface. The software should provide an interface in the system to enable the user to perform the tasks efficiently and effectively. The human factors guiding the design of the software interface is a challenge to design as the interaction between the riser and the system is much more complex than in the static hardware interface. Whilst software interfaces are much more dynamic and interactive, the mental and cognitive processes of the user during interaction still remain as gray areas. Consistent with stability, provision of

feedback and minimising the users' mental loads are the most important considerations in defining software user interfaces Good software design should take into account the kinds of people who use the program, the diversified user background, the complexity of use the need to use any other program and the consequences of human error.

27 SUMMARY

In this unit, you have been able to have a glimpse of who works at the other end of the computer—a human, and ease of use is a major aspect of systems design.

Whether it is input-output *devices* or the software interfaces, it is brought out that different people react differently. There is therefore no such thing as a single user friendly interface for all.

The relevance of ergonomics in office automation systems has also been drawn attention to, because this is the most common application of computers and affects a large number of persons.

Human-Computer Interaction is now a flourishing topic with interdisciplinary inputs and support from various industry quarters, as it is not perceived to be crucial to the effective use of computer based systems.

UNIT 3 INTRODUCTION TO MULTIMEDIA

Structure

3.0 INTRODUCTION

Multimedia is a new **technology born,** in this world of ever changing and demanding technology and diversifying world of **computer.** Since last **few years,** it seems to be much sought **after** and talked about, not only in the world of Information **Technology,** but **also** in various functional fields **like advertisement,** corporate **sector,** cinema, **fashion** design and education, to name a few. **More** and more research work on **this new** technology of sound, animation and **text,** is making it **better** and **better with** every passing day. It is one of the most **realistic** way of working even for a computer literates, where it targets people from almost all **ages** of life from a toddler to a **aged** one. In fact it does not have any **upper** limit for its target audience.

3.1 OBJECTIVES

At the end of this session, you would be able to

- understand the basic concept of multimedia
- appreciate multimedia as a new chapter in information technology
- identify and describe various components of multimedia like, sound, animation and graphics
- understand various hardware and software for multimedia
- describe how images and sound works in multimedia.

3.2 MULTIMEDIA - THE CONCEPT

You can call it by any name, multimedia, intellimedia, hypermedia or newmedia. In its simplest sense, multimedia means the combination of the text, sound, and graphics. But no body is sure, whether it is a computer itself or a computer software product. In practical sense it is the combination of both. And the fact remains is that it has the best potential to be