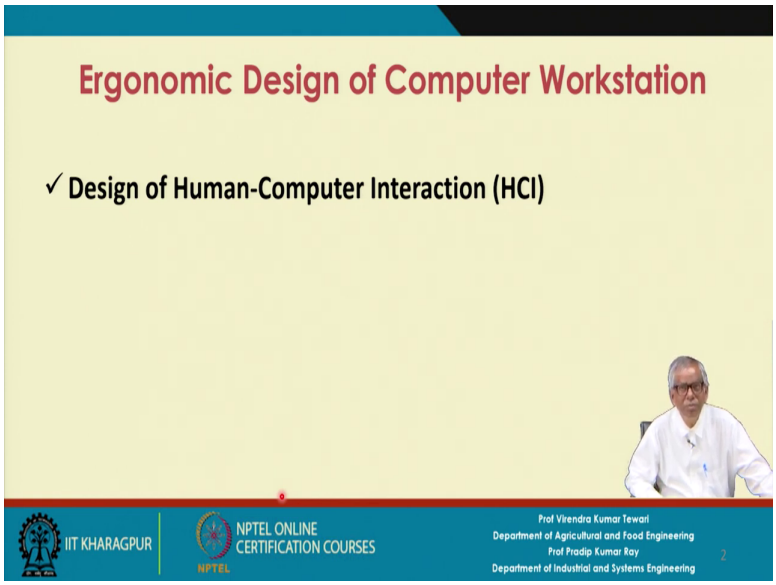
Human Factors Engineering

Prof V K Tiwari
Prof P K Ray
Department of Agricultural and Food Engineering
Department of Industrial and Systems Engineering
Indian Institute of Technology, Kharagpur

Lecture - 24
Design of Human-Computer Interaction

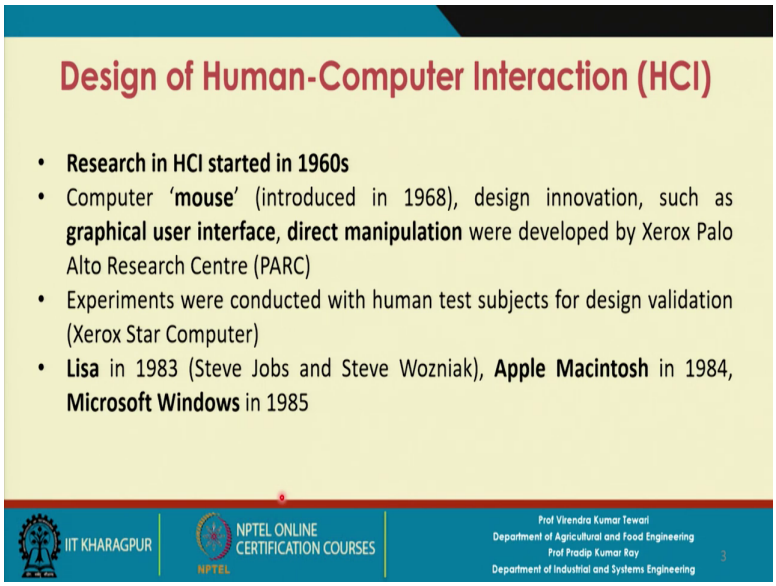
As I have already mentioned that during this lecture session, I am going to discuss a very important topic called Design of Human-Computer Interaction.

(Refer Slide Time: 00:22)



So, the main topic is ergonomic design of say the computer workstation and there are many issues involved. One of the most important issues is the interaction of the interface design. Now, the human computer interaction and its designing is a very complex issue.

(Refer Slide Time: 01:23)



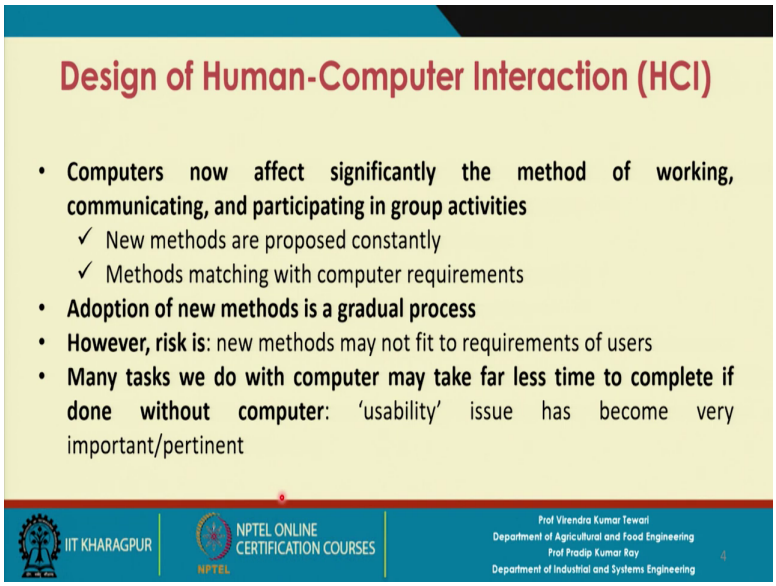
Research in HCI started in 1960s

Computer ‘mouse’ (introduced in 1968), design innovation, such as graphical user interface, direct manipulation were developed by Xerox Palo Alto Research Centre (PARC)

Experiments were conducted with human test subjects for design validation (Xerox Star Computer)

Like the Lisa was introduced in 1983 by Steve Jobs and Steve Wozniak. Apple Macintosh was introduced in 1984 and Microsoft windows was introduced in 1985. There are lot of developments have taken place.

(Refer Slide Time: 0:44)



And, what you find today you cannot avoid the computer say the hue with this interface. Computers now affect significantly the method of working, communicating, and participating in group activities. New methods are proposed constantly. Methods matching with computer requirements. Adoption of new methods is a gradual process.

However, risk is: new methods may not fit to requirements of users.

Many tasks we do with computer may take far less time to complete if done without computer: 'usability' issue has become very important/pertinent.

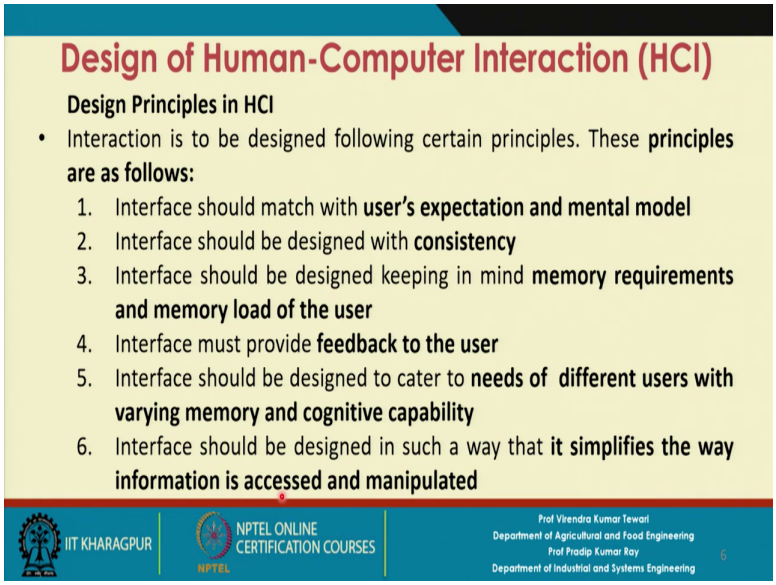
(Refer Slide Time: 12:18)

HCI is a research topic that needs support from various disciplines: ergonomics, human factors, experimental psychology, cognitive science and psychology, anthropology, sociology, linguistics, philosophy: a very complex problem.

Application areas and research: manufacturing, military operations, e-commerce, HCI in mobile phones (interaction with very small size screen).

Mainly three activities are done: text editing, information search, programming.

(Refer Slide Time: 14:45)



Interaction is to be designed following certain principles. These principles are as follows:

i) Interface should match with user's expectation and mental model.

ii) Interface should be designed with consistency.

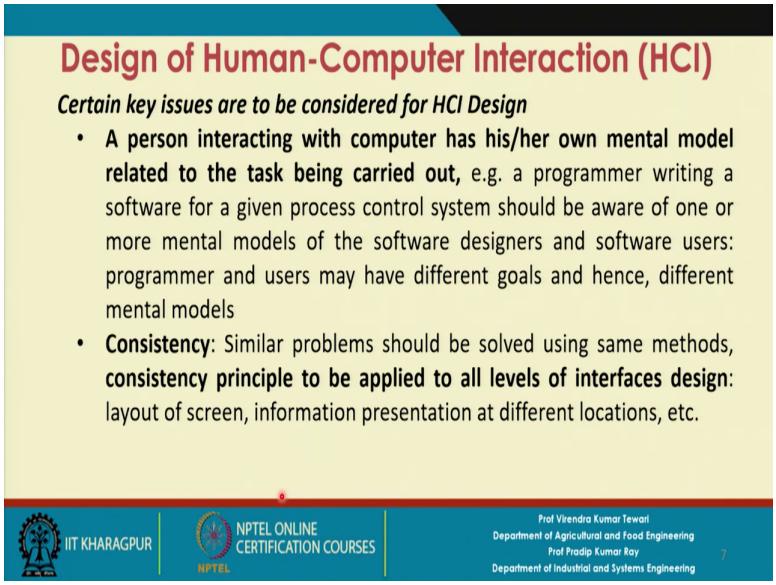
iii) Interface should be designed keeping in mind memory requirements and memory load of the user.

iv) Interface must provide feedback to the user.

v) Interface should be designed to cater to needs of different users with varying memory and cognitive capability.

vi) Interface should be designed in such a way that it simplifies the way information is accessed and manipulated.

(Refer Slide Time: 19:55)

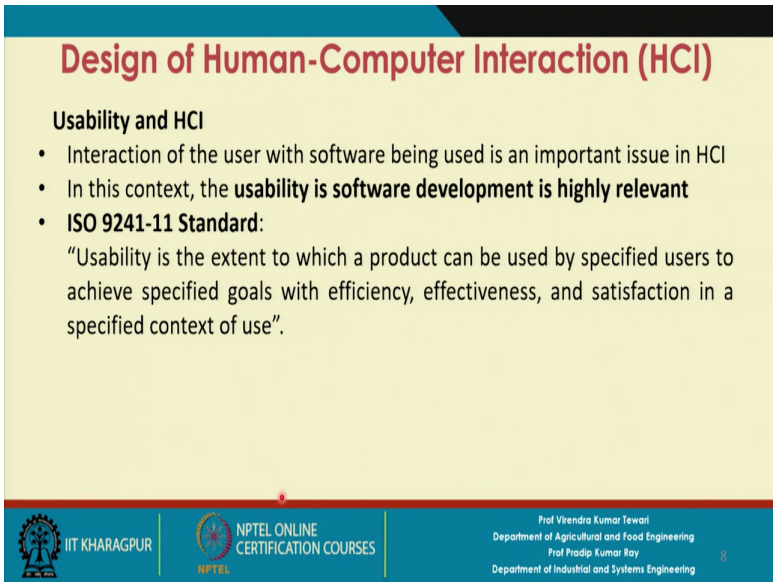


So, now there are many other issues. Like what I have mentioned that the person interacting with computer has his or her own mental model related to the task being carried out.

A person interacting with computer has his/her own mental model related to the task being carried out, e.g., a programmer writing a software for a given process control system should be aware of one or more mental models of the software designers and software users: programmer and users may have different goals and hence, different mental models.

Consistency, Similar problems should be solved using same methods, consistency principle to be applied to all levels of interfaces design: layout of screen, information presentation at different locations, etc.

(Refer Slide Time: 23:46)

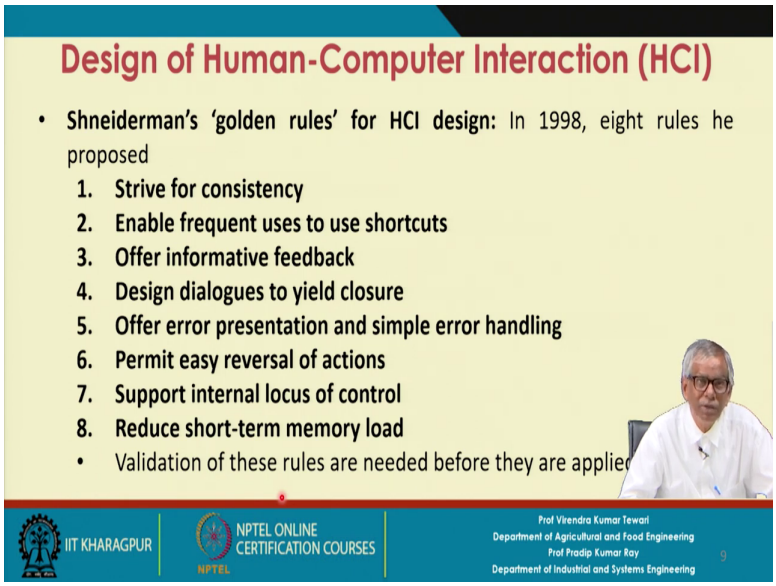


Usability and HCI design is concerned from the ergonomics point of view interaction of the user with software being used is an important issue in HCI. Interaction of the user with software being used is an important issue in HCI. In this context, the usability is software development is highly relevant

ISO 9241-11 Standard:

“Usability is the extent to which a product can be used by specified users to achieve specified goals with efficiency, effectiveness, and satisfaction in a specified context of use”.

(Refer Slide Time: 26:18)

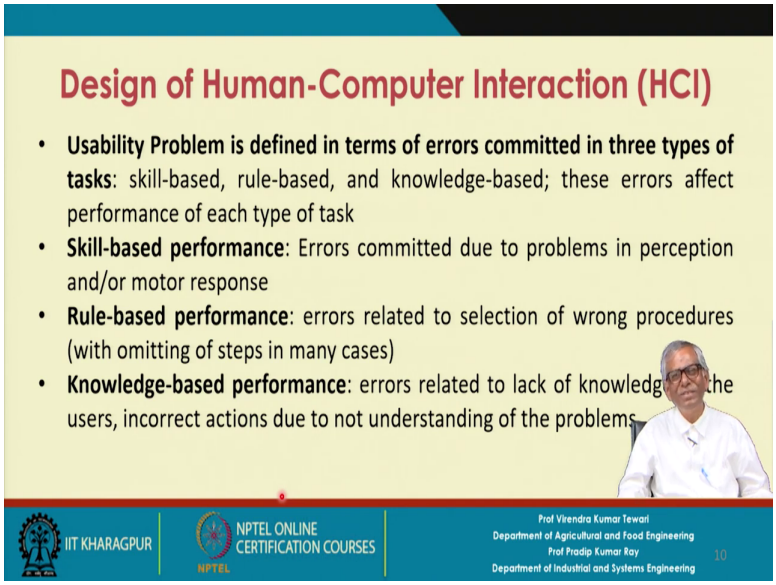


Shneiderman's 'golden rules' for HCI design: In 1998, eight rules he proposed:

1. Strive for consistency
2. Enable frequent uses to use shortcuts
3. Offer informative feedback
4. Design dialogues to yield closure
5. Offer error presentation and simple error handling
6. Permit easy reversal of actions
7. Support internal locus of control
8. Reduce short-term memory load

Validation of these rules are needed before they are applied.

(Refer Slide Time: 28:24)



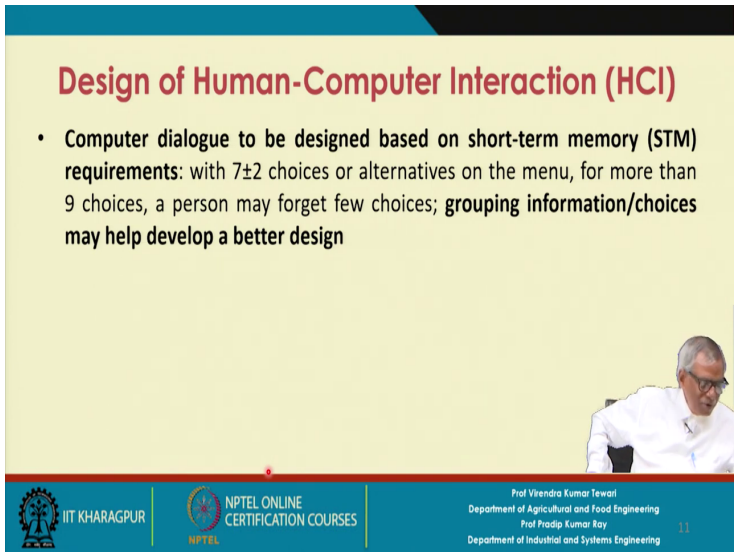
Usability Problem is defined in terms of errors committed in three types of tasks: skill-based, rule-based, and knowledge-based; these errors affect performance of each type of task.

Skill-based performance: Errors committed due to problems in perception and/or motor response.

Rule-based performance: errors related to selection of wrong procedures (with omitting of steps in many cases).

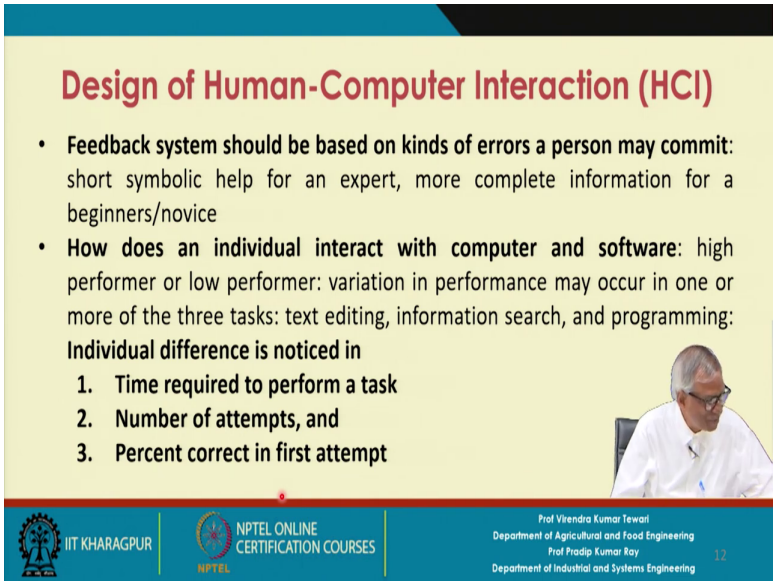
Knowledge-based performance: errors related to lack of knowledge of the users, incorrect actions due to not understanding of the problems

(Refer Slide Time: 30:42)



Now, this is another point I should highlight before I close the session there is a computer dialogue to be designed based on short term memory. You have as a healthy human being you have 7±2 choices or alternatives on the menu it varies from person to person obviously, short term memory capability, it may be from 5 to 9. So, that is why 7±2 for more than 9 choices. Suppose you have 9 choices, a person may forget few choices is common, 9 choices. So, what do you need to do the alternative is you have to group the information of choices if you can do that. In that case many such choices; you have to group them under different categories. In each category there may be 3, 4, 5 choices within say 8 choices you may have.

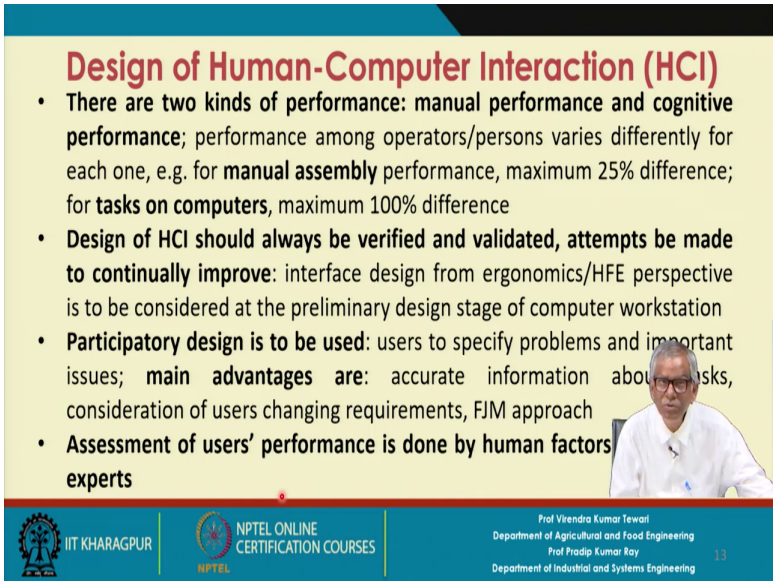
(Refer Slide Time: 32:04)



Feedback system should be based on kinds of errors a person may commit: short symbolic help for an expert, more complete information for a beginners/novice. How does an individual interact with computer and software: high performer or low performer: variation in performance may occur in one or more of the three tasks: text editing, information search, and programming: Individual difference is noticed in

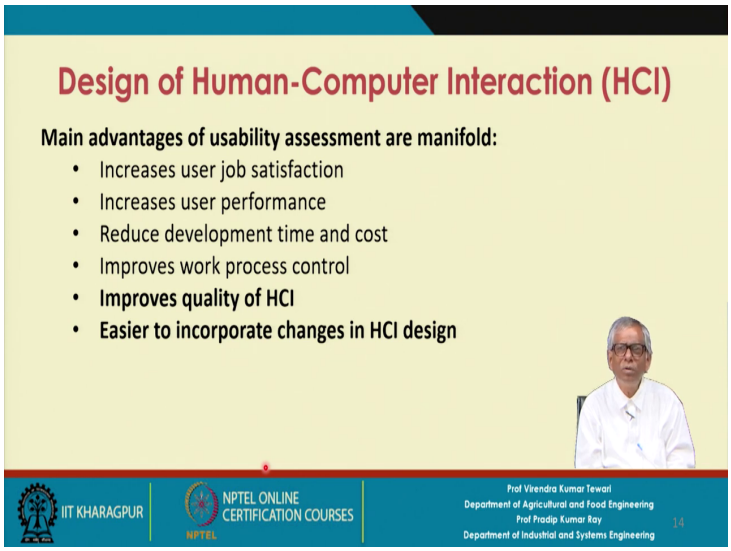
1. Time required to perform a task
2. Number of attempts, and
3. Percent correct in first attempt

(Refer Slide Time: 33:27)



There are two kinds of performance: manual performance and cognitive performance; performance among operators/persons varies differently for each one, e.g. for manual assembly performance, maximum 25% difference; for tasks on computers, maximum 100% difference. Design of HCI should always be verified and validated, attempts be made to continually improve: interface design from ergonomics/HFE perspective is to be considered at the preliminary design stage of computer workstation. Participatory design is to be used: users to specify problems and important issues; main advantages are: accurate information about tasks, consideration of users changing requirements, FJM approach. Assessment of users' performance is done by human factors and usability experts.

(Refer Slide Time: 35:43)



Main advantages of usability assessment are manifold, they are as follow:

1. Increases user job satisfaction
2. Increases user performance
3. Reduce development time and cost
4. Improves work process control
5. Improves quality of HCI
6. Easier to incorporate changes in HCI design

(Refer Slide Time: 36:51)