USABILITY ENGINEERING

USABILITY ENGINEERING

- Definition
- UI Generations
- Evaluation
- Lifecycle
- Classification of Users
- Prototyping
- Usability Testing Stages.

USABILITY ENGINEERING

- **Usability is the Effectiveness, Efficiency and Satisfaction with which specified users can achieve specified goals in particular environments.**
  - **Effectiveness** is the accuracy and completeness with which users achieve specific goals.
  - **Efficiency** is the accuracy and completeness of goals achieved in relation to resources expended.
  - **Satisfaction** is the comfort and acceptability of using the system.

USABILITY

- Usability – one of the key concepts in HCI – focus in on creating systems that are easy to learn and use.

- Usability is Characterized by 5 E's;
  - Easy to Learn
  - Easy to remember - how to use.
  - Effective to Use
  - Efficient to Use
  - Enjoyable to Use

EXAMPLE

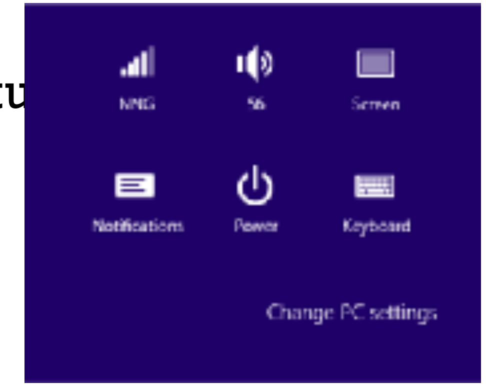
- **How many times have V come across glass doors with a handle that does not indicate the opening mode !**
  - Push AND Pull Stickers are not SIGNS of a GOOD Design
  - Design of the Handle should indicate the affordance!

- **Photocopiers – XEROX machines**
  - Two buttons with and C
  - C is treated by modern day users as COPY !
  - But in the Photocopier, the copier operation and C is for Cancel
  - Not to entirely blame given the C for Cancel model from Calculators usage!!

NIELSEN'S SUMMARY OF WINDOWS 8

- Jacob Nielsen – Father of Usability Engineering & Nielsen Norman Group (nng) – their famous organization

- Nielsen's Summary of Windows 8
  - Hidden features,
  - Shutdown was a real treasure hunt!
  - Reduced discoverability,
  - Reduced power from a single-window UI
  - Smothers usability with big colorful tiles while hiding needed featu
  - New design optimized for touchscreen



GENERATIONS OF USER INTERFACES

- In the field of human-computer interaction, a user interface (UI) is that the space where interactions between humans and machines occur.

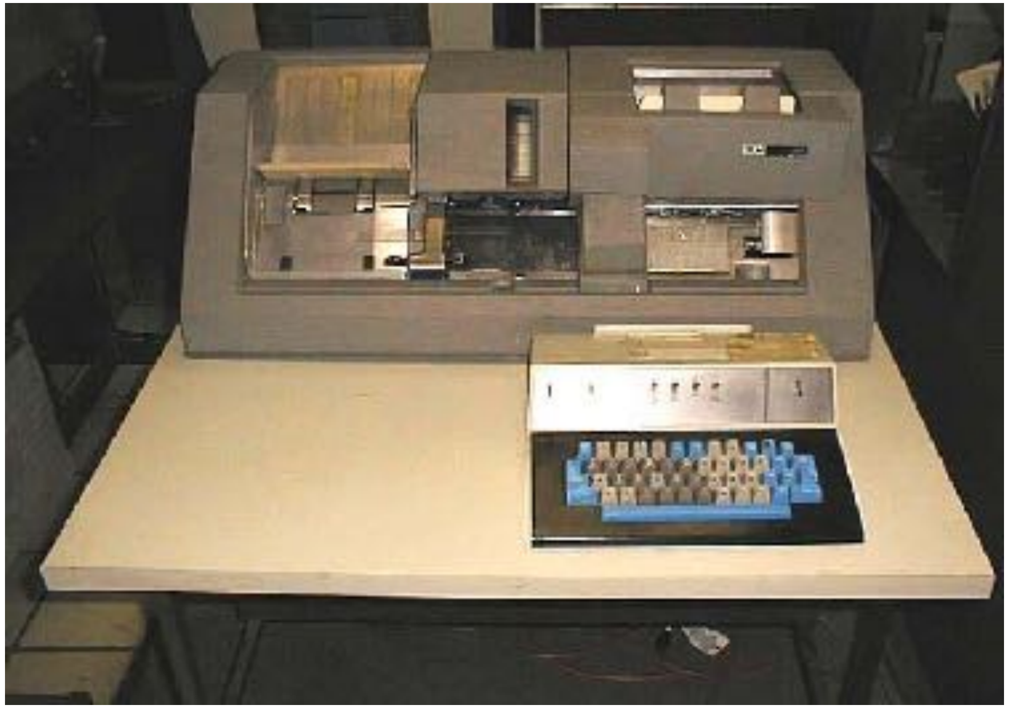
- The goal of this interaction is to permit effective operation and control of the machine from the human end, whilst the machine simultaneously feeds back information that aids the operators' decision-making process

GENERATIONS OF USER INTERFACES

- Batch System
- Line-oriented interface
- Full screen interface
- Graphical user interface
- Future of the User interfaces
  - Augmented Reality
  - Virtual Reality
  - Holographic User Interfaces
  - Brain-Computer interfaces

BATCH SYSTEM

- During the batch era, computing power was extremely scarce and expensive.
- The input side of the user interfaces for batch machines was mainly punched cards or equivalent media.
- The output side added line printers to those media.
- Early batch systems gave the currently running job the whole computer; program decks and tapes had to incorporate what we might now consider as OS code to speak to I/O devices



LINE-ORIENTED INTERFACE

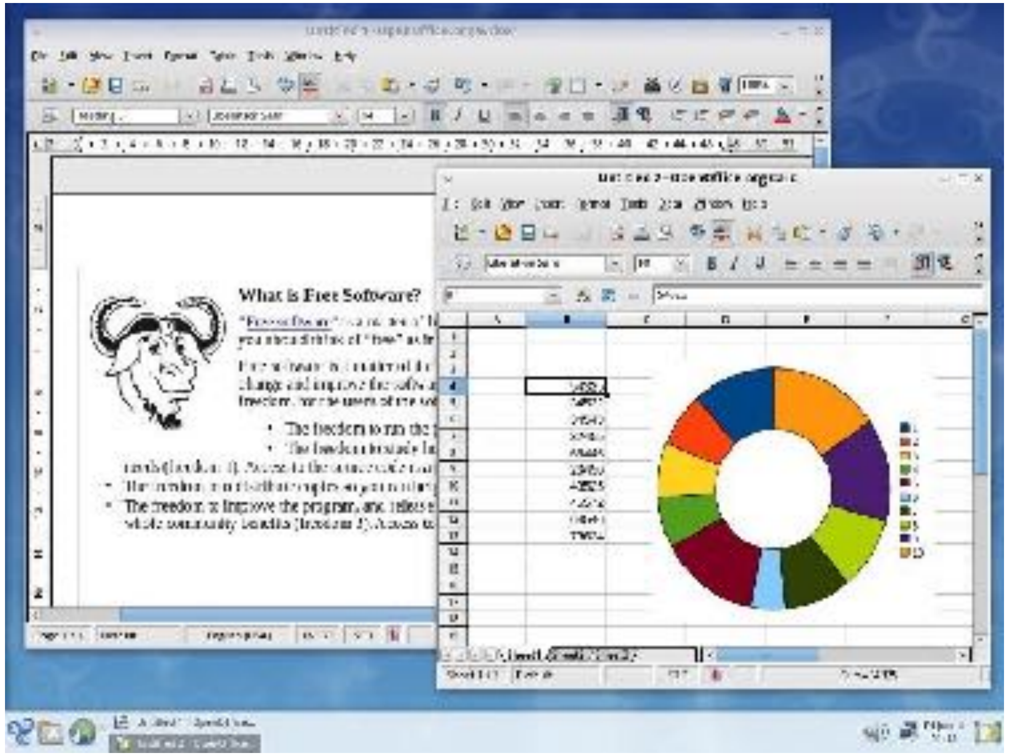
- A user interface based on a user editing individual lines of text at a time, especially with regard to early text editors.
- instead of moving around in the document as in screen-oriented editors or graphical user interfaces, the user could enter commands to list out lines within a document or could specify a line to edit.
- The user could edit an individual line by inserting and removing characters and moving the cursor left and right.

FULL SCREEN INTERFACE

- With the evolution of the User interfaces, entire screen began to use for the use.
- A typical application of the full screen used as form filling dialogues.
- The full-screen interfaces also lead to the invention many items that we use today such as menus, forms, applications etc.
- Many full-screen interfaces also use function keys as a primary interaction style.

GRAPHICAL USER INTERFACE

- 1987 was a significant year in the evolution of UI. when the 386, the first true 32-bit Intel chip, became generally available and opened the possibility of Unix machines built with cheap commodity hardware.
- Direct manipulation can be mentioned as the main interaction method found in many GUI
- Many graphical user interfaces are object-oriented.
- The first commercially available GUI, called “PARC,” was developed by Xerox.



FUTURE OF THE USER INTERFACES

- Today we live surrounded by software products to a much greater extent than surrounded by people.
- Over the past two decades with the effort of designers and developers, interfaces of software products have become more user-friendly, so the users have learned their basic language and now can use the same app on different devices.
- Still software programs are created for the majority of users not considering the of each one of them individually, still, a new application means new language and a new device means a new pattern which has to be studied continuously.

AUGMENTED REALITY

- Augmented reality consists of overlaying data about the real world over real-time images of that world.
- In current applications, a camera (generally attached to either a computer or cell phone) captures real-time images that are then superimposed with information gathered based on your location.
- **Example:**
  - Google translate, and games such as Pokemon Go and Lenskart.

VIRTUAL REALITY

- VR is a simulated experience that can be similar to or completely different from the real world.
- Applications of virtual reality can include entertainment **(eg: Gaming**) and educational purposes **(eg: Medical or Military training)**.
- Currently, these systems use either VR headsets or multi-projected environments to generate realistic images, sounds and other sensations that simulate a user’s physical presence in a virtual environment.

HOLOGRAPHIC USER INTERFACES

- A holographic display is a type of display that utilizes light diffraction to create a virtual three-dimensional image of an object.

- Holograms are distinguished from other forms of 3D imaging in that they do not require the aid of any special glasses or external equipment for a viewer to see the image.

BRAIN-COMPUTER INTERFACES

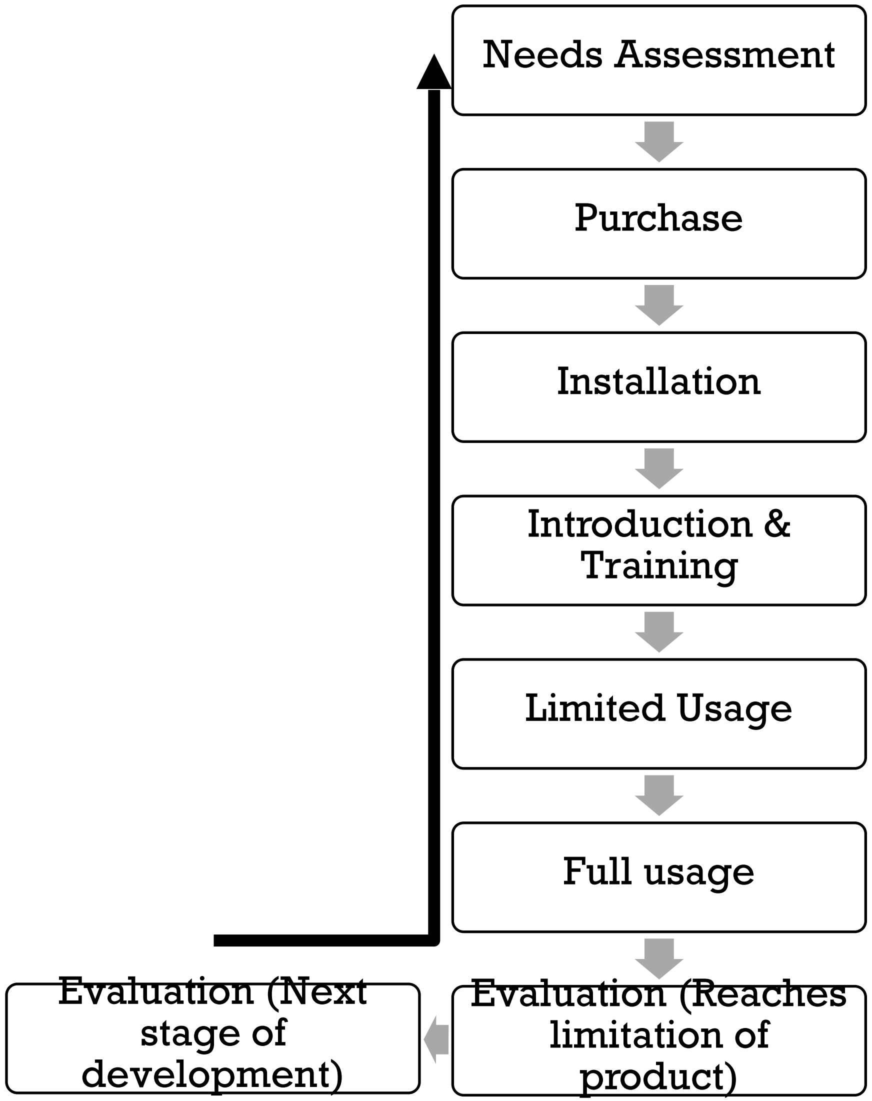
- Brain-computer interfaces could play a big role in the near future.
- As the name implies, humans could soon be controlling computers using nothing but their brains.
- It could allow people to easily control computers, mobile phones, and smart devices with a simple thought.

- List the User Interface that you have come across
- Categorize and order it based on the generations from Past to future

1. GUI
2. Command line interface,
3. Touchscreen
4. command prompt
5. Voice Based UI
6. Wearable User Interfaces

1. Command line interface,
2. Command prompt
3. GUI
4. Touchscreen
5. Voice Based UI
6. Wearable User Interfaces
7. Augmented reality UI

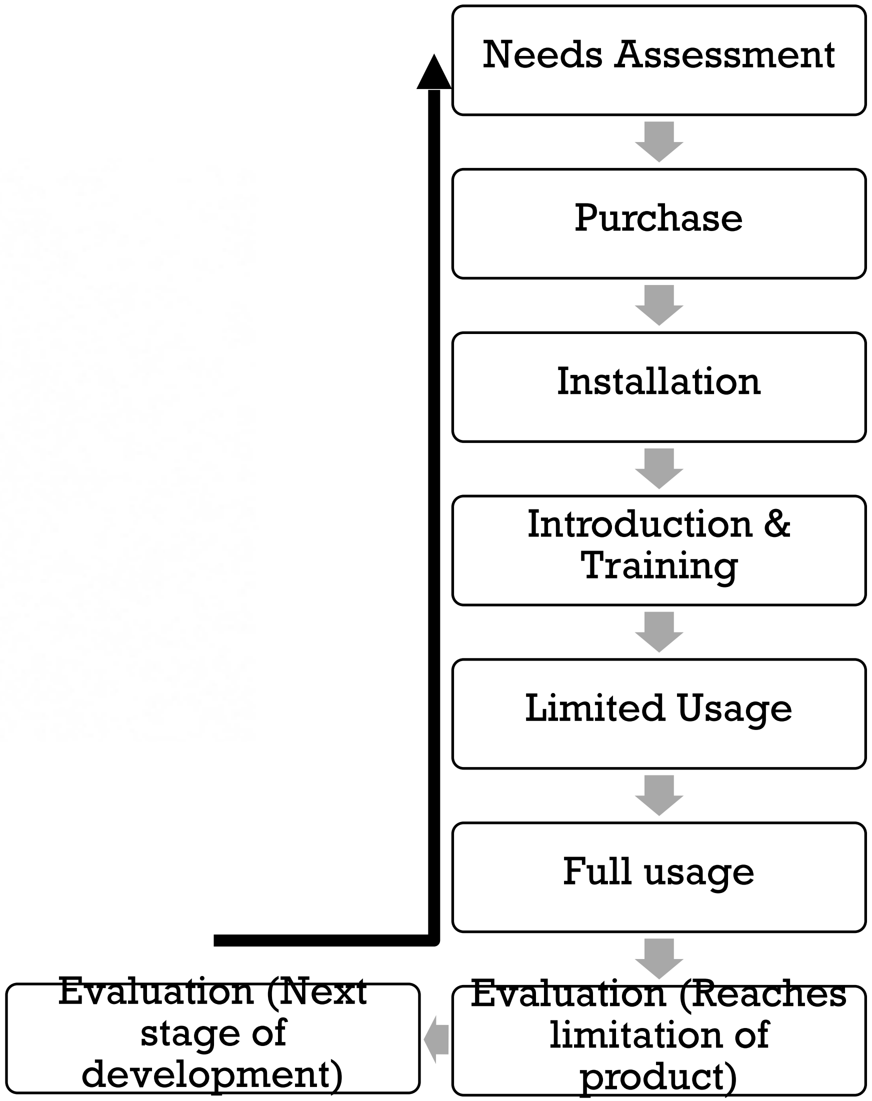
THE CUSTOMERS USAGE CYCLE



THE CUSTOMERS USAGE CYCLE

- Needs Assessment
- Purchase
- Installation
- Introduction & Training
- Limited Usage
- Full usage
- Evaluation (Reaches limitation of product)
- Evaluation (Next stage of development)

THE CUSTOMERS USAGE CYCLE



COST OF POOR USABILITY TO THE CUSTOMER AND THE SUPPLIER

Cost to Customer

System Y is purchased with features
A B C D E

Usability problems

Customer user only features A B C

Cost to Supplier

Cost of producing features D & E which are not used

User/Customer perceived utility is reduced

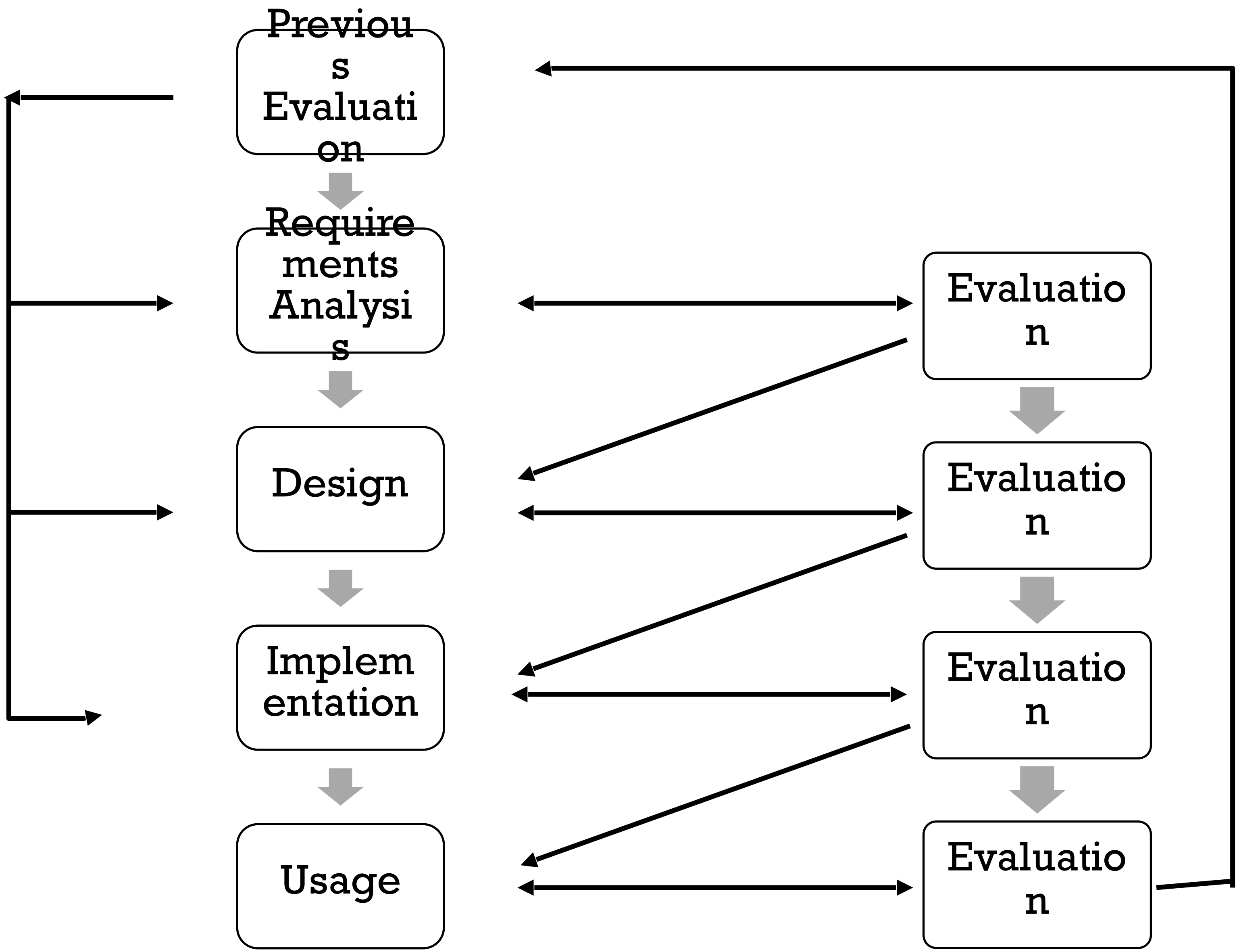
Perception of quality decreases

Perception of value is reduced

Customer becomes dissatisfied

Customer switches supplier

DESIGN LIFE CYCLE & THE ROLE OF EVALUATION



USABILITY OBJECTIVE

- Usability objective should be a part of the requirement.
- Objective - 1:
  - System to Teach Class-5 Mathematics
  - Should be used by students of age 8, without manual
  - Should enable students to learn 80% of the unit 4 in 15 Minutes.

- Objective – 2
  - An Bank teller system to answer customer enquiries
  - Teller will be given one week training course followed by one month job training.
  - After training the teller should able to deal with 85% of customer requirements in 3 minutes.

USABILITY OBJECTIVE (CONTD.,)

- Inference:
  - Objective 1 may consider multimedia user interface with graphics & sound
  - Objective 2 will be dealing with speed and effectiveness.

So the software designer needs to be clear what the objective are before design begins.

STAGES IN USABILITY SPECIFICATION & EVALUATION

Usability Specification

Stage:1 User & Task Analysis

Stage:2 Set Usability objectives and success criteria for critical tasks

Stage:3 Write a usability statement and identify things to be measured

Design & build the system or prototype

Usability Evaluation

Stage:4 Choose techniques for measuring usability

Stage:5 Plan the usability evaluation

Stage:6 Carryout the evaluation

Modify the design according to the result

STAGE 1 :USER AND TASK ANALYSIS

- Who are the users, their characteristics
- What tasks they are undertaking
- Under what circumstances they are undertaking the tasks

STAGE 1 :USER AND TASK ANALYSIS

Office Systems

Systems: Database systems, spread sheets , Word, Management information systems

Users: Discretionary and intermittent users

Environment : colleagues, local expert, manual, documentation

STAGE 1 :USER AND TASK ANALYSIS

Public information systems

Systems: ATM, automatic ticket machine, Public information DB, Home teleshopping

Users: novice, Discretionary, and intermittent users

Environment : local expert

STAGE 1 :USER AND TASK ANALYSIS

Knowledge based systems

Systems: Planning, diagnostic and advice giving systems

Users: Experts

Environment : other expert, on line help

STAGE 1 :USER AND TASK ANALYSIS

Complex real time systems

Systems: military aircraft, large plant processing and monitoring systems(nuclear and chemical power stations), missile and rocket guidance systems

Users: Experts

Environment :support unlikely to be available considerable training required.

STAGE 1 :USER AND TASK ANALYSIS

Computer Supported Cooperative Work (CSCW)

Systems: E-Mail, Electronic conferencing, Electronic meeting

Users: novice and discretionary users

Environment :online support, local expert

STAGE 2:SETTING USABILITY OBJECTIVES AND SUCCESS CRITERIA

- 85% users enjoy using the system
- Users can recall 70% of system commands after two weeks of not using the system
- Users can learn to use 75% of the system features within 15 minutes

USABILITY OBJECTIVES RELATED TO SPECIFIC TASKS

- **Competitive edge**
  - Theater Booking System
- **Market requirements**
  - Automatic Teller Machine
- **Tasks performed first**
  - First task decide the factor for success
- **Tasks performed most frequently**
  - Efficiency of the system

USABILITY OBJECTIVES ARE SET OF CRITICAL TASKS

Usage Cycle / Tasks	Introduction & Training	Limited Usage	Full Usage
Task 3	Effectiveness Satisfaction		
Task 8			Efficiency
Task 9		Effectiveness	

STAGE 3 : WRITING USABILITY STATEMENTS AND IDENTIFYING MEASURES

A usability statement should include

- Title, purpose and brief description of the system
- A description of the intended users and their characteristics(knowledge, skills, motivation)
- A brief description of the shared tasks and their characteristics(frequency, Timing)
- A brief description of the equipment to be used(h/w, s/w)
- A description of the Environment(work place conditions, support environment)
- A specification of the usability objectives for a particular context

STAGE 3 : WRITING USABILITY STATEMENTS AND IDENTIFYING MEASURES

Each usability objective must contain a statement of the thing to be measured

- Number of keystrokes
- Number of commands used
- Number of user actions required to complete a task
- Time taken to perform keystrokes, commands or tasks
- Time taken to learn a set of commands
- Number of commands remembered
- Knowledge of system use
- Attitudes and opinions
- Availability of support materials
- Errors: of understanding ,typographical
- Time to recover from errors

STAGE 4 :CHOOSING TECHNIQUES FOR MEASURING USABILITY

- Carrying out measurement of usability is not an easy task, there may be various problems.
  - Problems with user who take part
  - Problems with person carrying out the measurement
  - Problems with how the results of the measurement are interpreted

STAGE 4 :CHOOSING TECHNIQUES FOR MEASURING USABILITY

- **Group 1 Techniques**
  - Require specialist psychological knowledge
  - Require an expert in UID

- **Group 2 Techniques**
  - Designer can use but only with expert advice

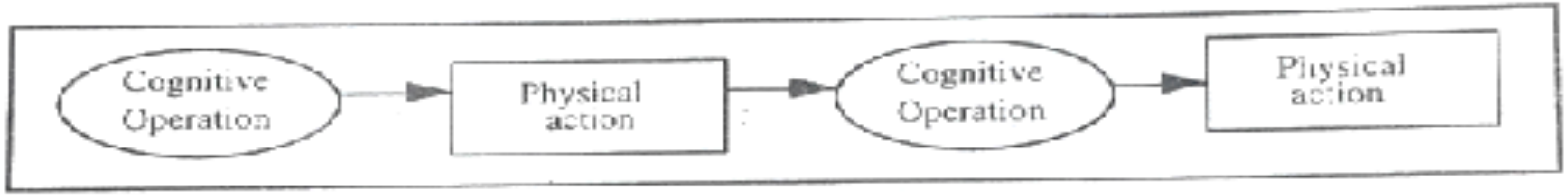
- **Group 3 Techniques**
  - Designer can use without expert advice

GROUP 1 TECHNIQUES

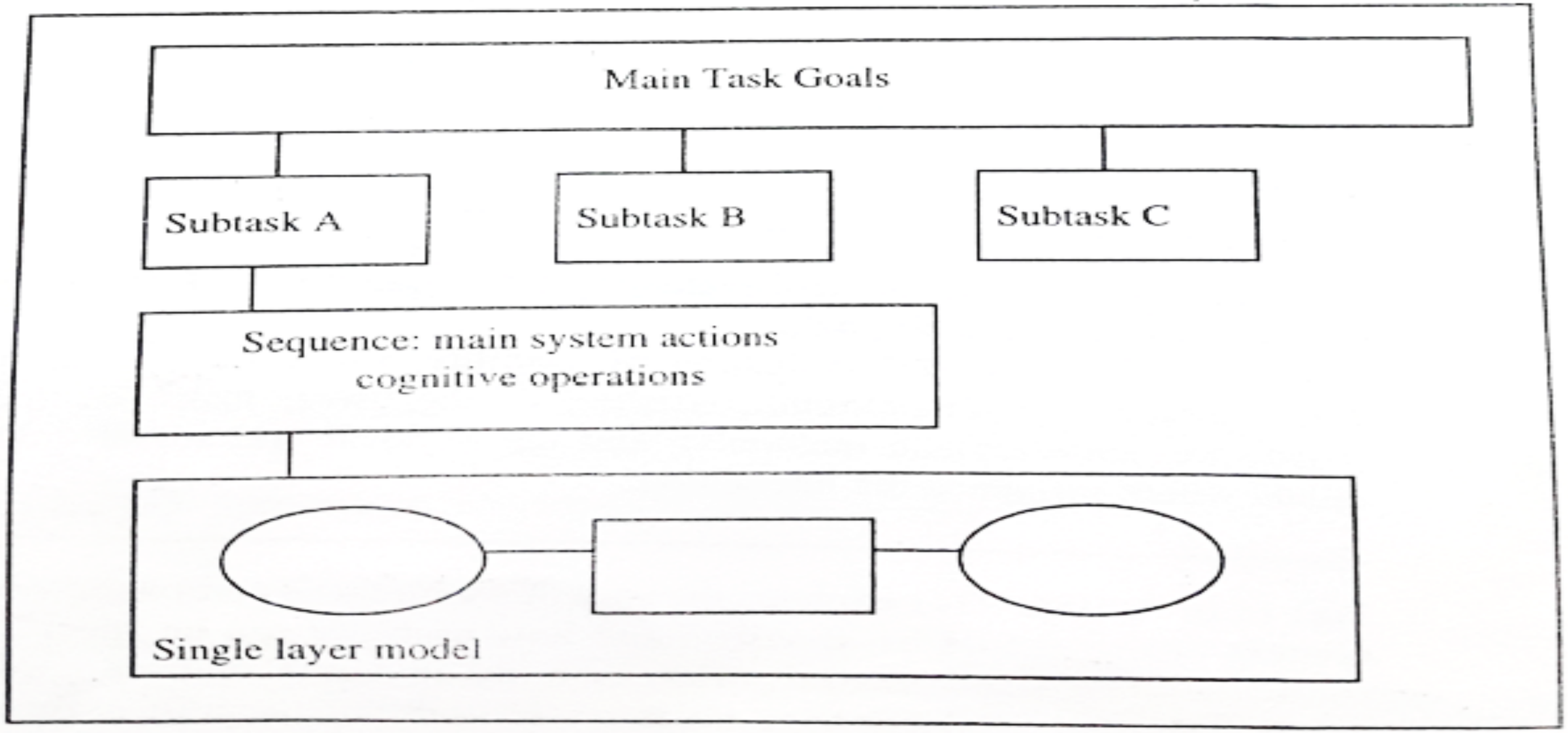
- **Analytical Evaluation**
- **Expert Evaluation**
- **Experimental Evaluation**

GROUP 1 TECHNIQUES

- Analytical Evaluation
  - Used early in the design lifecycle
  - Predict the user performance
  - Represented using semi formal specification lang which enables designers to analyse and predict expert performance
  - Advantages
    - Evaluated without developing prototype without user testing
    - Disadvantages
      - Users are experts
      - Costly and time consuming



Analytical Evaluation – Single Layered Model



Analytical Evaluation – Multi Layered Model

GROUP 1 TECHNIQUES

Expert Evaluation

- Experts use the design principles to evaluate the design , and would write up the results in a report

Experimental Evaluation

- Experiments can be used
- Experiments must be planned with the help of psychologist or human factors expert
- Based on time, keystrokes etc statistical test is performed

GROUP 2 TECHNIQUES

- **Observation in a Usability laboratory**
- **Observation in the work place**
- **Interviews**
- **Questionnaires**
- **Focus groups**

GROUP 2 TECHNIQUES

Observation in a Usability laboratory

- In a usability lab or user's normal place of work
- Video camera and data logging

Observation in the work place

- Without disturbing users make a log of user actions and user problems
- Users are asked to say out loud what they are doing and this can be recorded

GROUP 2 TECHNIQUES

Interviews

Evaluator having fixed set of questions

Questionnaires

Evaluator should seek expert opinion in the design of a questionnaire

Focus groups

- To allow a group of users to talk in a free form discussion with each other for 45 mins
- 4 to 6 users along with investigator(designer)
- Audio recorder
- Investigator should not take part in the discussion but should facilitate free discussion
- How did they get started with the first task?
- What difficulties did they have?

GROUP 2 TECHNIQUES

Closed Questions

Can you use the following text editing commands?

DUPLICATE	yes	no	don't know
PASTE	yes	no	don't know

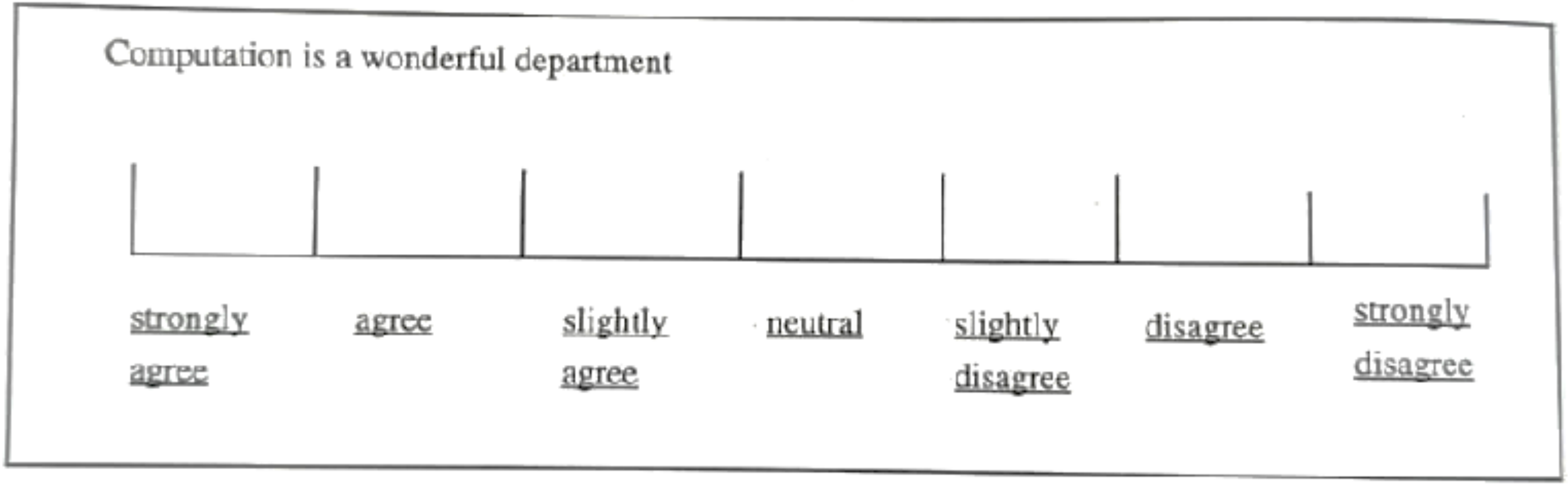
Multi-point scales

Rate this course on the following scale:

very useful | | | | | | | of no use

GROUP 2 TECHNIQUES

Likert Scale (strength of agreement with a clear statement)



GROUP 2 TECHNIQUES

Rate the Superpaint drawing package along the following dimensions:

	extremely	quite	slightly	neutral	slightly	quite	extremely	
easy								difficult
clear								confusing
fun								dreary

Example of a semantic differential scale.

GROUP 2 TECHNIQUES

<u>Place the following commands in order of usefulness:</u>

(use a scale of 1 to 4 where 1 is most useful)

PASTE ☐ DUPLICATE ☐ GROUP ☐ CLEAR ☐

Example of ranked order questions.

GROUP 3 TECHNIQUES

- Feature checklists
- Co operative Evaluation
- Incident Diaries

GROUP 3 TECHNIQUES

Feature checklists

- Which features available on the system are used by the users
- To find out the features which are not used

Co operative Evaluation

- Developed at York University, UK
- Small handbook prepared for designers
- Procedure for obtaining data about problems experienced by users when working with a prototype
- Users and designers evaluate the sys together
- Hand book contains step by step guide of how to prepare tasks for users ,how to interact with them ,recording etc

GROUP 3 TECHNIQUES

Incident Diaries

- To provide the user with a means of recording incidents
- Structured forms(Series of questions)
- The form contains series of question
- Eg 1. At what time did the problem occur?

  2. What started the problem?

     (i) did not know how to carry on?

     (ii) unhelpful error msg

     (iii) other, Please state

GROUP 3 TECHNIQUES

3. Which help facilities did you try?
    (i) on screen help;
    (ii) manual
    (iiii) asked another user
    (iv) watched another user
    (v) other, Please state
4. Did the information obtained resolve your problem?
    (i) yes,Completely
    (ii) yes,Partly
    (iii) No
5. How long did you spend trying to resolve the problem?
    (i) less than a minute
    (ii) Between 1 and 5 minutes
    (iii) other , please state

GROUP 3 TECHNIQUES

Hypercard Edit Commands	Heard of?	Used?
Background	✓	✓
Copy	✓	✓
Cut	✓	x
New Card	✓	✓
Paste	✓	x
Text Style	x	x
Undo	✓	x

A Simple feature checklist

GROUP 3 TECHNIQUES

Hypercard Edit Commands	Heard of?	Used?	Frequency?	Learnt?
Background	✓	✓	2	1
Copy	✓	✓	3	2
Cut	✓	x	0	
New Card	✓	✓	4	3
Paste	✓	x	0	
Text Style	x	x	0	
Undo	✓	x	0	

Expanded feature checklist

STAGE 5 : PLANNING A USABILITY EVALUATION

- Usability evaluation will probably require the use of more than one evaluation technique.
  - Example 1 : Testing a CSCW prototype
  - Example 2 : Testing a system which is in use

STAGE 5 : PLANNING A USABILITY EVALUATION

Example 1 :

- Testing a CSCW prototype

A full day was taken by one team to take part in the evaluation system

Following is a summary of the plan for the day:

8.30am	Introduction/coffee.
9.00am	Training for task 1.
9.30am	Briefing for task 1.
	Task 1 (Competition — 20 mins).
	Completion of incident diary 1.
10.00am	Break/coffee and focus group 1.
10.45am	Briefing/training 2.
	Task 2 (Job advert 45 mins).
	Completion of incident diary 2.
12.00noon	Lunch.
1.15pm	Briefing for task 3.
	Task 3 (Requirements task — 1hr).
	Completion of incident diary 3.
2.30pm	Break/coffee.
2.35pm	Focus group 2.
4.00pm	End.

A combination of incident diary and focus group are used to obtain feedback from users.

EVALUATION TECHNIQUES

EVALUATION TECHNIQUES

- Evaluation
  - Tests usability and functionality of system
  - Occurs in laboratory, field and/or in collaboration with users
  - Evaluates both design and implementation
  - Should be considered at all stages in the design life cycle

GOALS OF EVALUATION

- Assess extent of system functionality
- Assess effect of interface on user
- Identify specific problems

EVALUATING DESIGNS

- Cognitive Walkthrough
- Heuristic Evaluation
- Review-based evaluation

EVALUATING DESIGNS: COGNITIVE WALKTHROUGH

Proposed by Polson *et al.*

- Evaluates design on how well it supports user in learning task
- Usually performed by expert in cognitive psychology
- Expert 'walks though' design to identify potential problems using psychological principles
- Forms used to guide analysis

EVALUATING DESIGNS: COGNITIVE WALKTHROUGH (CTD)

- For each task walkthrough considers
  - what impact will interaction have on user?
  - what cognitive processes are required?
  - what learning problems may occur?

- Analysis focuses on goals and knowledge: does the design lead the user to generate the correct goals?

EVALUATING DESIGNS: HEURISTIC EVALUATION

- Proposed by nielsen and molich.

- Usability criteria (heuristics) are identified
- Design examined by experts to see if these are violated

- Example heuristics
  - System behaviour is predictable
  - System behaviour is consistent
  - Feedback is provided

- Heuristic evaluation `debugs' design.

EVALUATING DESIGNS: REVIEW-BASED EVALUATION

- Results from the literature used to support or refute parts of design.
- Care needed to ensure results are transferable to new design.
- Model-based evaluation
- Cognitive models used to filter design options
- Design rationale can also provide useful evaluation information

EVALUATING THROUGH USER PARTICIPATION

LABORATORY STUDIES

- Advantages:
  - specialist equipment available
  - uninterrupted environment
- Disadvantages:
  - lack of context
  - difficult to observe several users cooperating
- Appropriate
  - if system location is dangerous or impractical for constrained single user systems to allow controlled manipulation of use

FIELD STUDIES

- Advantages:
  - natural environment
  - context retained (though observation may alter it)
  - longitudinal studies possible

- Disadvantages:
  - distractions
  - noise

- Appropriate
  - where context is crucial for longitudinal studies

EVALUATING IMPLEMENTATIONS

- Requires an artefact:
- Simulation, prototype,
- Full implementation

EXPERIMENTAL EVALUATION

- Controlled evaluation of specific aspects of interactive behaviour
- Evaluator chooses hypothesis to be tested
- A number of experimental conditions are considered which differ only in the value of some controlled variable.
- Changes in behavioural measure are attributed to different conditions

EXPERIMENTAL FACTORS

- Subjects
  - who – representative, sufficient sample
- Variables
  - things to modify and measure
- Hypothesis
  - what you'd like to show
- Experimental design
  - how you are going to do it

EXPERIMENTAL FACTORS: VARIABLES

- Independent variable (IV)
  - Characteristic changed to produce different conditions
  - E.G. Interface style, number of menu items
- Dependent variable (dv)
  - Characteristics measured in the experiment
  - E.G. Time taken, number of errors.

EXPERIMENTAL FACTORS: HYPOTHESIS

- Prediction of outcome
  - Framed in terms of IV and DV

    E.G. “Error rate will increase as font size decreases”

- Null hypothesis:
  - States no difference between conditions
  - Aim is to disprove this

    E.G. Null hyp. = “No change with font size”

EXPERIMENTAL FACTORS: EXPERIMENTAL DESIGN

- Within groups design
  - Each subject performs experiment under each condition.
  - Transfer of learning possible
  - Less costly and less likely to suffer from user variation.
- Between groups design
  - Each subject performs under only one condition
  - No transfer of learning
  - more users required
  - Variation can bias results.

EXPERIMENTAL FACTORS: ANALYSIS OF DATA

- Before you start to do any statistics:
  - look at data
  - save original data

- Choice of statistical technique depends on
  - type of data
  - information required

- Type of data
  - discrete - finite number of values
  - continuous - any value

ANALYSIS - TYPES OF TEST

- Parametric
  - Assume normal distribution
  - Robust
  - Powerful
- Non-parametric
  - Do not assume normal distribution
  - Less powerful
  - More reliable
- Contingency table
  - Classify data by discrete attributes
  - Count number of data items in each group

ANALYSIS OF DATA (CONT.)

- What information is required?
  - is there a difference?
  - how big is the difference?
  - how accurate is the estimate?

- Parametric and non-parametric tests mainly address first of these

EXPERIMENTAL STUDIES ON GROUPS

More difficult than single-user experiments

Problems with:

- Subject groups
- Choice of task
- Data gathering
- Analysis

EXPERIMENTAL STUDIES ON GROUPS: SUBJECT GROUPS

Larger number of subjects

$\Rightarrow$ more expensive

Longer time to `settle down’

… even more variation!

Difficult to timetable

So … often only three or four groups

EXPERIMENTAL STUDIES ON GROUPS: THE TASK

Must encourage cooperation

Perhaps involve multiple channels

Options:

- Creative task
- Decision games
- Control task

EXPERIMENTAL STUDIES ON GROUPS: DATA GATHERING

Several video cameras
+ direct logging of application

Problems:

- Synchronisation
- Sheer volume!

One solution:

- Record from each perspective

EXPERIMENTAL STUDIES ON GROUPS: ANALYSIS

N.B. Vast variation between groups

Solutions:

- Within groups experiments
- Micro-analysis (e.G., Gaps in speech)
- Subjective and qualitative analysis

Look at interactions between group and media

Controlled experiments may `waste' resources!

FIELD STUDIES

Experiments dominated by group formation

Field studies more realistic:

- *Distributed cognition* ⇒ work studied in context
- Real action is *situated action*
- Physical and social environment both crucial

Contrast:

- Psychology – controlled experiment
- Sociology and anthropology – open study and rich data

OBSERVATIONAL METHODS

- Think Aloud
- Cooperative evaluation
- Protocol analysis
- Automated analysis
- Post-task walkthroughs

OBSERVATIONAL METHODS: THINK ALOUD

- User observed performing task
- User asked to describe what he is doing and why, what he thinks is happening etc.

- Advantages
  - Simplicity - requires little expertise
  - Can provide useful insight
  - Can show how system is actually use
- Disadvantages
  - Subjective
  - Selective
  - Act of describing may alter task performance

OBSERVATIONAL METHODS: COOPERATIVE EVALUATION

- Variation on think aloud
- User collaborates in evaluation
- Both user and evaluator can ask each other questions throughout

- Additional advantages
  - Less constrained and easier to use
  - User is encouraged to criticize system
  - Clarification possible

OBSERVATIONAL METHODS: PROTOCOL ANALYSIS

- Paper and pencil – cheap, limited to writing speed
- Audio – good for think aloud, difficult to match with other protocols
- Video – accurate and realistic, needs special equipment, obtrusive
- Computer logging – automatic and unobtrusive, large amounts of data difficult to analyze
- User notebooks – coarse and subjective, useful insights, good for longitudinal studies

- Mixed use in practice.
- Audio/video transcription difficult and requires skill.
- Some automatic support tools available

OBSERVATIONAL METHODS: AUTOMATED ANALYSIS

- Workplace project
- Post task walkthrough
  - User reacts on action after the event
  - Used to fill in intention
- Advantages
  - Analyst has time to focus on relevant incidents
  - Avoid excessive interruption of task
- Disadvantages
  - Lack of freshness
  - May be post-hoc interpretation of events

OBSERVATIONAL METHODS: POST-TASK WALKTHROUGHS

- Transcript played back to participant for comment
  - Immediately → fresh in mind
  - Delayed → evaluator has time to identify questions
- Useful to identify reasons for actions and alternatives considered
- Necessary in cases where think aloud is not possible

QUERY TECHNIQUES

- Interviews
- Questionnaires

QUERY TECHNIQUES: INTERVIEWS

- Analyst questions user on one-to -one basis usually based on prepared questions
- Informal, subjective and relatively cheap

- Advantages
  - Can be varied to suit context
  - Issues can be explored more fully
  - Can elicit user views and identify unanticipated problems
- Disadvantages
  - Very subjective
  - Time consuming

QUERY TECHNIQUES: QUESTIONNAIRES

- Set of fixed questions given to users

- Advantages
  - Quick and reaches large user group
  - Can be analyzed more rigorously
- Disadvantages
  - Less flexible
  - Less probing

QUERY TECHNIQUES: QUESTIONNAIRES (CTD)

- Need careful design
  - What information is required?
  - How are answers to be analyzed?

- Styles of question
  - General
  - Open-ended
  - Scalar
  - Multi-choice
  - Ranked

PHYSIOLOGICAL METHODS

- Eye tracking
- Physiological measurement

PHYSIOLOGICAL METHODS: EYE TRACKING

- Head or desk mounted equipment tracks the position of the eye
- Eye movement reflects the amount of cognitive processing a display requires
- Measurements include
  - Fixations: eye maintains stable position. Number and duration indicate level of difficulty with display
  - Saccades: rapid eye movement from one point of interest to another
  - Scan paths: moving straight to a target with a short fixation at the target is optimal

PHYSIOLOGICAL MEASUREMENTS

- Emotional response linked to physical changes
- These may help determine a user's reaction to an interface
- Measurements include:
  - Heart activity, including blood pressure, volume and pulse.
  - Activity of sweat glands: galvanic skin response (GSR)
  - Electrical activity in muscle: electromyogram (EMG)
  - Electrical activity in brain: electroencephalogram (EEG)
- Some difficulty in interpreting these physiological responses - more research needed

CHOOSING AN EVALUATION METHOD

When in process: design vs. Implementation

Style of evaluation: laboratory vs. Field

How objective: subjective vs. Objective

Type of measures: qualitative vs. Quantitative

Level of information: high level vs. Low level

Level of interference: obtrusive vs. Unobtrusive

Resources available: time, subjects, equipment, expertise