



# SASTRA

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# CSE332

## USABILITY DESIGN OF SOFTWARE APPLICATIONS

Chapter 1  
Interaction Design

Handled By  
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# Outline

- 1. Good and Poor Design**
- 2. Interaction Design**
- 3. Process**
- 4. Goals**
- 5. Design**
- 6. Usability Principles**

# Interactive products



# Interaction Design

## *Interaction Design - Beyond Human-Computer Interaction:*

- It is a mixed set of skills from psychology, human-computer interaction, web design, computer science, information systems, marketing, entertainment, and business.
- The exact meaning of interaction design is :  
*“Designing interactive products to support people in their everyday and working lives”.*
- This entails creating user experiences that enhance and extend the way people work, communicate, and interact.
- Brings usability into the design process
- Develops interactive products that are Easy, Effective, and Enjoyable to use from the user's perspective

- Users interact with many products to carry out tasks
  - Buying ticket online
  - Photocopying an article
  - Withdrawing money
- The products are engineered to perform tasks
- The concern is
  - How the product is used by real people

- Interaction design
  - concerns to develop interactive products that are usable
  - meant
    - Easy to learn
    - Effective to use
    - Provide an enjoyable user experience

# Good and Poor Design

- Design of usable interactive products may start with
  - comparison of well and poorly designed products
  - Identifying the
    - Strength
    - Weaknesses



# Example of a poorly designed system

- Voice mail



- It takes
  - six steps to access a message
  - Five steps to leave a message

- To access the message,
  - Touch 491
  - Touch\*, room number, and #
  - Password (it may be different other than room number)
  
- Involves steps like
  - Typing in, at appropriate times
    - Room number
    - Extension number
    - Password

- Problems with voice-mail system
  - Infuriating
  - Confusing
  - Inefficient
  - Difficult to use
  - It is not obvious what to do

# The marble answering machine

- <https://boingboing.net/2013/03/21/internet-of-things-answering-m.html>
- Uses familiar objects to indicate how many messages have been left
- Aesthetically pleasing and enjoyable to use
- One-stop actions to perform core tasks
- Simple but elegant design
- Offers less functionality and allows anyone to listen to any of the messages

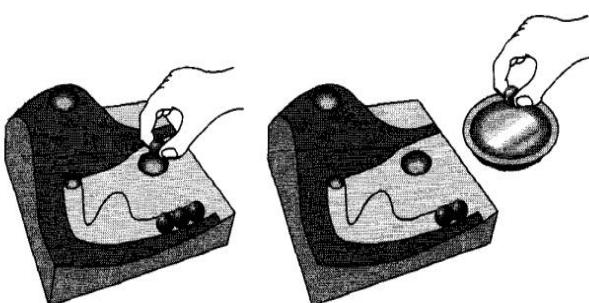


Figure 1.1 Two small sketches showing answering phone.

- Cannot be used
  - In Hotel (marbles may get lost or taken by souvenirs)
  - by kids (tempted to play with marbles)
- It is important to take into account
  - Where the product is going to be used
  - Who is going to use

- Key concern
  - Who is going to use?
  - Where is going to be used?
  - Kind of activities people do during the interaction
  - Arrangements of input and output devices
  - Appropriateness of interfaces

- Range of activities are diverse, to name a few of computer-based systems
  - Send messages
  - Gather information
  - Write essays
  - Control power plants
  - Draw
  - Calculate
  - Play games

- Available interfaces and interactive devices
  - Multimedia applications
  - Virtual-reality environments
  - Speech-based systems
  - Personal digital assistants
  - Large displays
  - Via use of menus, commands, forms, icons

- Novel forms of interaction with embedded computational power
  - Interactive toys
  - Smart fridges
  - Microwave oven
- Designers have multitude of choices and decisions to develop interactive products

- Key question of interaction design
  - How to optimize user's interactions with
    - a system
    - Environment
    - Product
  - How to match user's activities that are being supported and extended?

- The answer is understanding users, involves
  - Taking into account of what people are good and bad at
  - Considering what might help people with the way they currently do things
  - thinking through what might provide quality user experiences
  - listening to what people want and getting them involved in the design
  - using "tried and tested" user-based techniques during the design process

# Interaction Design

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# What is interaction design

- creates user experiences to enhance and extend the way people
  - Work
  - Communicate
  - Interact
- Finds ways of supporting people
- Design of spaces for human communication and interaction (Winograd)

- Contrasts with Software Engineering
  - SE focuses primarily on production of software solutions for applications
- Analogy of architect/software engineer building house
  - Architect
    - Concerns with the people and their interactions
    - Eg.
      - Is there the right mix of family and private spaces?
      - Are spaces for cooking and eating in close proximity?

- Civil Engineers
  - Interested in issues to do with realizing the project
  - Eg.
    - Cost
    - Durability
    - Structural aspects
    - Environmental aspects
    - Fire regulations
- Interaction design in S/E is the same way as architecture is related to civil engineering

# The makeup of interaction design

- Many disciplines involve in the success of interaction design
- Many people involve to understand how users act and react to events
  - Eg.
    - Psychologists
    - Sociologists
- Many practitioners involve to design different kinds of aesthetic interactive media
  - Eg.
    - Graphic designers
    - Artists
    - Animators
    - Photographers
    - Film experts
    - Product designers

- Earlier, Computer interface was straight forward
  - Comprising various
    - Switch panels
    - Dials that controlled set of internal registers



- Interface design came into being (late 1970s and early 1980s)
  - With the advent of
    - Monitors (Visual Display Units)
    - Personal workstations



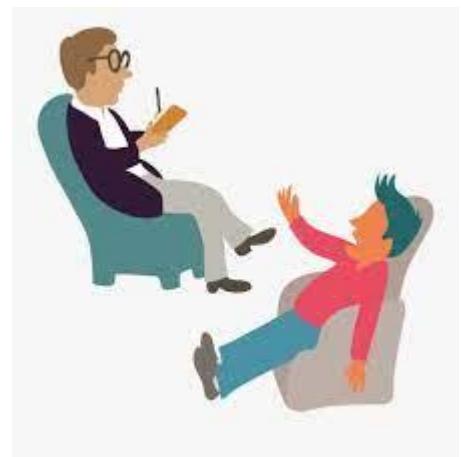
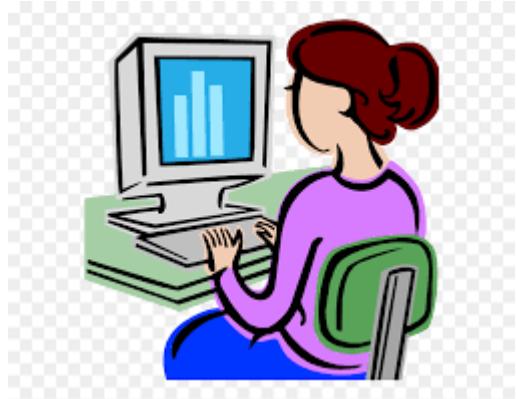
- The concept of user interface presented many challenges

*Terror. You have to confront the documentation. You have to learn a new language. Did you ever use the word 'interface' before you started using the computer?*

—Advertising executive Arthur Einstein (1990)

- The challenge was to develop computers
  - to be used by other people (besides engineers)
  - To support tasks involving human cognition
  - Doing sums/writing documents/managing accounts/drawing plans
- Thus, computer scientists and psychologists involved in user interface designing

- Computer scientists and Software Engineers developed
  - High level programming language (BASIC, Prolog)
  - System architectures
  - Command-based languages
- Psychologists provided information about
  - Human capabilities
    - Eg.
      - Memory
      - Decision making



- Combined use of visual displays and interactive keyboards brought
  - Widgets
    - Menus
    - Windows
    - Palettes
    - icons
  - Best structure to present them in GUI

- The next wave of computing technologies, such as (in the mid 1980's)
  - Speech recognition
  - Multimedia
  - Information visualization
  - Virtual reality

presented more opportunities for designing applications

- Education and training received much attention
  - The outcomes were
    - Interactive learning environment
    - Educational software
    - Training simulators

- The next wave of technological development such as (in 1990's)
  - Networking
  - Mobile computing
  - Infrared sensing

Enabled

- The creation of diversified applications for all people

- All aspects of person's life is enhanced and extended by
  - Designing and integrating various arrangements of computer technologies
  - Eg.
    - Applications to be used at
      - Home
      - On the move
      - At school
      - Leisure as well as work
      - Alone
      - With family or friends

- Envisioned new
  - Learning
  - Communicating
  - Working
  - Discovering
  - Living

- Design of new generation of interactive systems (In the mid 1990's)
  - Companies extended existing multidisciplinary design teams with
    - Professionals trained in
      - media and design that includes
        - Graphical design
        - Industrial design
        - Film
    - Sociologists
    - Anthropologists
    - dramaturgists

- Emerging of hardware capabilities such as (in 2000's)
  - Radio frequency tags
  - Large interactive screens
  - Information appliances
    - Enable
      - Hardware
      - Software
      - Electronics
    - To communicate with each other (middleware)

Year	people	Technology	Applications
Before 1970	Engineers	No interface	Basic applications for Computing
Late 1970 and early 1980	Computer scientists and psychologists	Virtual display Personal workstations	GUI based applications with menus, windows, palettes, icon
Mid of 1980's	Computer programmers Educational technologists Developmental psychologists Training experts	Speech recognition Multimedia Information visualization Virtual reality	Interactive learning environments Educational software Training simulators
1990's	Computer programmers Psychologists	Networking Mobile computing Infrared sensing	Applications to be used at Home On the move At school etc
Mid 1990's	Professionals trained in media Sociologists Anthropologists dramaturgists	New generation of Interactive systems	Interactive story kit for children Interactive guide for art-gallery visitors
2000's	Engineers Computer scientists and psychologists	Radio frequency tags Large interactive systems Information appliances	IoT based applications

# Working together as a multidisciplinary team

- People with different background and training may result
  - New ideas
  - New methods
  - Creative and original designs
- Disadvantages
  - Communication breakdowns
  - Same terms mean quite different things
    - Confusion
    - Misunderstanding

- Philips Vision of the Future Project's multidisciplinary teams faced issues
  - Team members did not have a clear idea of
    - Who needed what information
    - When
    - In what form

- Is a big business
- The usability of a website greatly influenced by
  - Number of hits
  - Customer return rate
  - Customer satisfaction
  - Branding
- Presence or absence of good interaction design
  - Make or break company

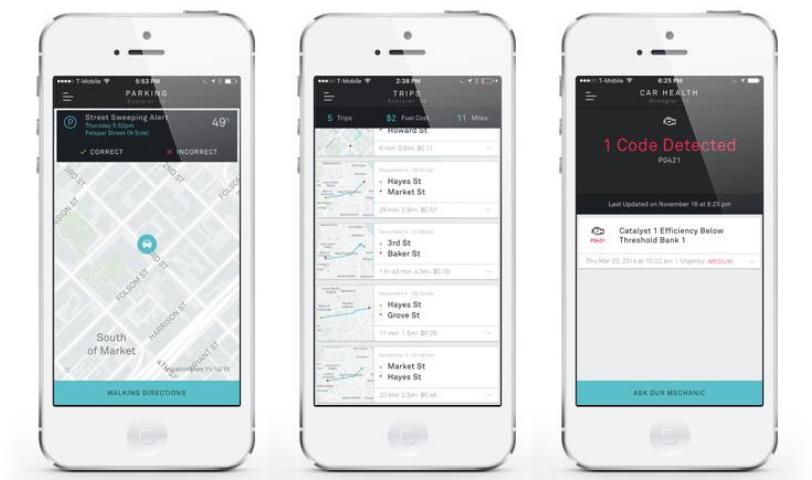
- <https://dot.com/>

- Failed to appreciate the importance of good interaction design
- designed with glossy 3D interface
- Interface took
  - Several minutes to download
  - More than 20 minutes to place an order
  - long and slow process to fill online form
- Customer got frustrated with the site and never returned
- Ended up in bankrupt



- <https://www.swimstudio.com/html/work.html>

- Set up by Gitta Salomon
- Assist clients with design of interactive products



- <https://cantwait.ideo.com/>

- Practices interaction design
- 20 years of experience in interaction design
- Design
  - products
  - Services
  - Environments

For other companies



- Involves four basic activities
  - Identifying the needs and establishing requirements
  - Develop alternative designs that meet the requirements
  - Building interactive versions of designs that can be communicated and assessed
  - Evaluating what is being built throughout the process

- Activities
  - Communicate with one another
  - Iterative based on the changes

## Evaluation

- heart of interaction design
- Ensures the product is usable
- Addressed by
  - user-centered approach to design
  - Understanding what people currently do

- **User-centered approach to design** is achieved through user involvement
- User involvement is ensured
  - Observing them
  - talking to them
  - Interviewing them
  - Testing them using performance tasks
  - Modeling their performance
  - Asking them to fill questionnaires
  - Asking them to become co-designers

- Understanding what people currently do
  - How people
    - act and interact with one another
  - Strength and weaknesses

- Key characteristics of interaction design process
  - Users should be involved through the development of the project
  - Specific usability and user experience goals should be
    - Identified
    - Documented
    - Agreed upon at the beginning of the project
  - Iteration through the four activities is inevitable

# The goals of interaction design

- Classified as
  - Usability goals
    - Meeting specific usability criteria (efficiency)
  - User experience goals
    - Concerns with explicating the quality of user experience (e.g. to be aesthetically pleasing)

# Usability Goals

- Ensures interactive products are
    - Effective to use (effectiveness)
    - Efficient to use (efficiency)
    - Safe to use (safety)
    - Have good utility(utility)
    - Easy to learn (learnability)
    - Easy to remember how to use (memorability)



- Effectiveness
  - How good a system is at doing what it is supposed to do
- Question
  - Is the system
    - capable of allowing people to learn well?
    - Carrying out their work efficiently?
    - Access the information they need?
    - Allow user buy the goods?

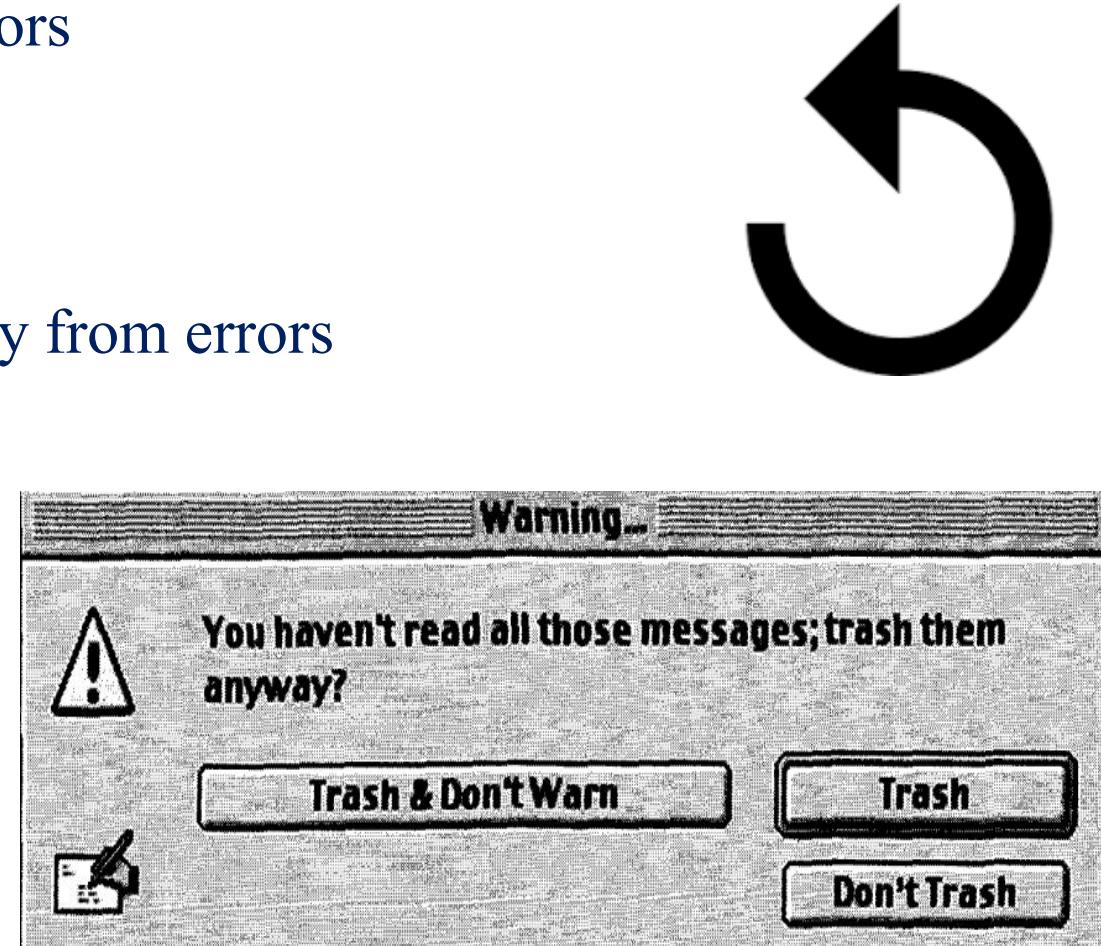


- Efficiency
  - Supporting user in carrying out their tasks
    - Eg.
      - Amazon's one click option to make purchase
  - Question
    - Once users have learnt how to use a system to carry out their tasks, can they sustain high level of productivity?



- Safety

- Protecting user from dangerous conditions and undesirable situations
- Preventing users from making serious errors
- Reducing the risk of wrong keys/buttons
- Providing users various means of recovery from errors
  - Eg.
  - Undo facilities
  - Confirmatory dialogue boxes



- Question
  - Does the system prevent users from making serious errors
  - Does it permit them to recover easily from an error

- Utility
  - Extent to which the system provides right kind of functionality
- Question
  - Does the system provide appropriate set of functions to enable user carryout all tasks?

- Learnability
  - How easy a system is to learn to use?
- Question
  - How easy is it?
  - How long does it take to learn
    - To perform core tasks?
    - Range of wider set of tasks?



- Memorability
  - How easy a system is to remember how to use, once learnt
- Question
  - What kind of interface support have been provided to help users remember to carryout tasks
    - Especially, for systems and operations that are used infrequently

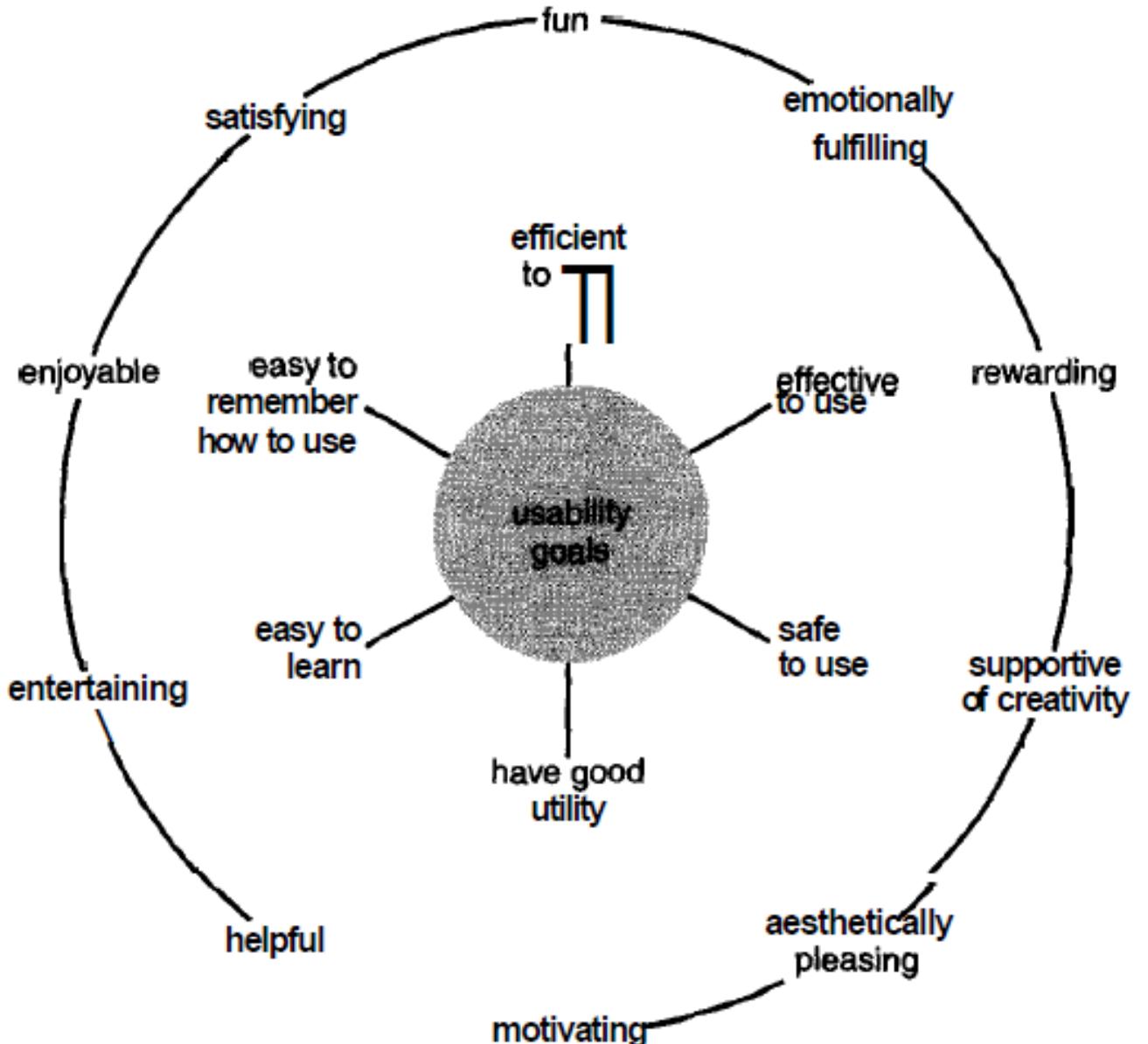


- Usability goals

- Well-suited for design of business systems
- Highly relevant for companies/organizations
  - To increase productivity
- Turned into usability criteria
  - Specific objectives to assess the usability of a product
    - Eg.
      - Time to complete a task (efficiency)
      - Time to learn a task (learnability)
      - Number of errors made when carrying out a given task over time (memorability)

## User Experience Goals

- Interaction design increasingly concern itself with creating systems that are
  - Satisfying
  - Enjoyable
  - Fun
  - Entertaining
  - Helpful
  - Motivating
  - Aesthetically pleasing
  - Supportive of creativity rewarding
  - Emotionally fulfilling
- Concerns
  - primarily with user experience
  - How the interaction with the system feel like to the users



## Usability Goals and user experience goals

- Generalizable abstractions to orient designers to think about various aspects of design
- Mix of theory-based
  - Knowledge
  - Experience
  - Common sense
- Prescription suggesting designers
  - What to provide & what to avoid in the interface
  - Do's and Dont's in the interaction design

- Help designers
  - Explain
  - Improve design
- Specify
  - Set of reminders to designers to provide certain things at the interface

- Common Design Principles

- Visibility
- Feedback
- Constraints
- Mapping
- Consistency
- Affordances

- **Visibility**

- Sighting functions at appropriate places
- Functions “out of sight” make them more difficult
  - to find
  - Know how to use
- Norman describes control of a car
  - Controls for the different operations of a car are clearly visible
    - Indicators, headlights, horn, hazard warning light etc.,

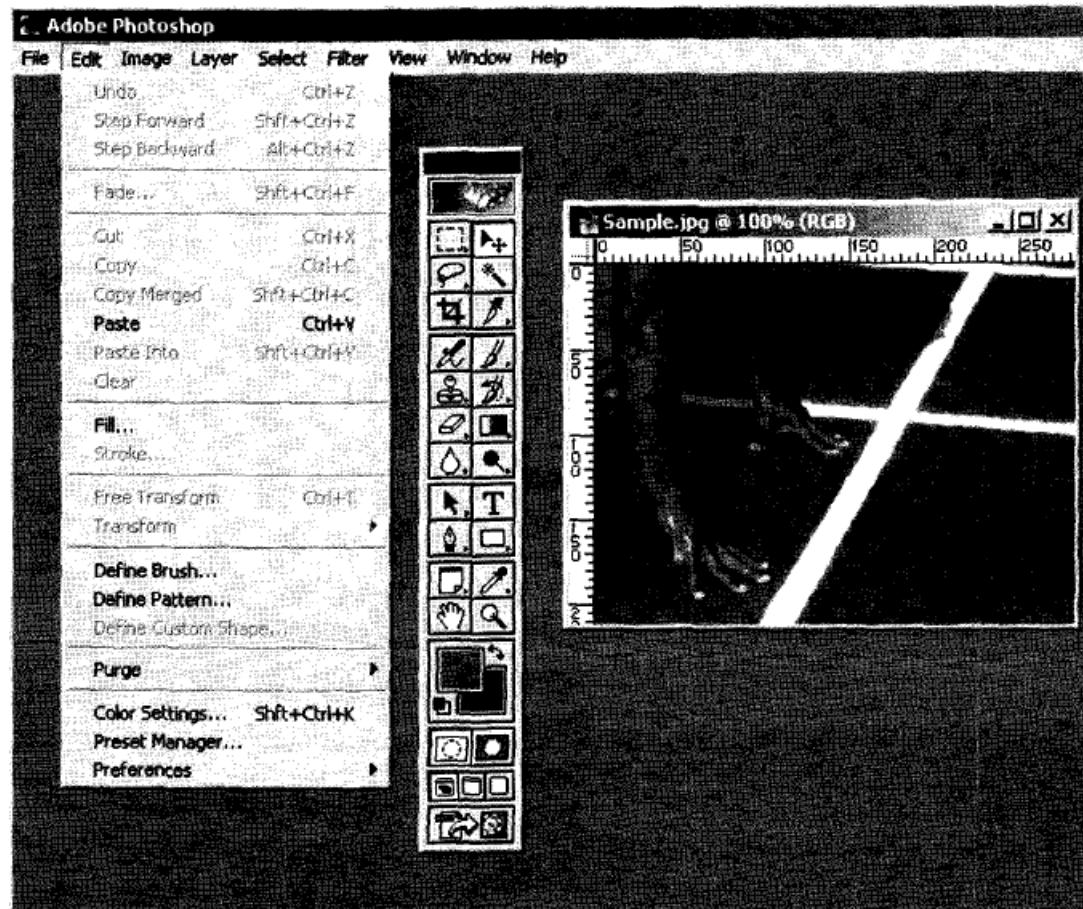
- **Feedback**

- Analogy
  - Playing a guitar
  - Slice bread using a knife
  - Write using a pen
- Sending back information about
  - what action has been done
  - What has been accomplished
  - Allowing the person continue with next activity

- Kinds of feedback available for interaction design
  - Audio
  - Tactile
  - Verbal
  - Visual
  - Combinations of the above

- Constraints

- restricting user interaction at a given moment

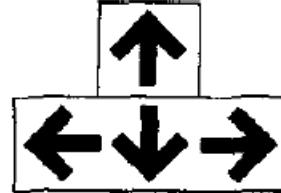
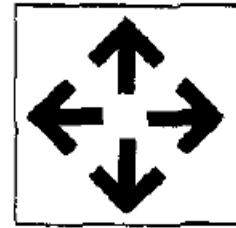


- Advantage
  - Prevents user from selecting incorrect options
  - Reduces the chance of making a mistake
- Three categories of constraints
  - Physical
    - Restricting the movement of things
    - Eg.
      - External disk placed into a disk drive
      - Keys on a pad pressed in only one way

- logical
  - People's common-sense reasoning about actions and their consequences
- Cultural constraints
  - Learned conventions
    - Red for warning
    - Smiley face to represent happy emotions

- **Mapping**

- Right mapping of controls and their effects



- **Consistency**

- Similar elements for similar tasks
- Eg. (word processing softwares')
  - File Menu-> new, open, save and save as
  - Formatting Menu -> cut, copy, paste
- Benefits
  - Easy to learn and use

- **Affordance**

- Means
  - “to give a clue”
- Eg.
  - Icons to afford clicking
  - Scroll bars to afford moving up and down
  - Buttons to afford pushing

- **Nielsen & his colleagues Design Principles**

- Visibility of system status
  - Keep users informed about what is going on
  - Provide appropriate feedback within reasonable time
- Match between system and real world
  - Speak user's language
    - Words
    - Phrases
    - Concepts familiar to the user

- User control and freedom

- Allow users escape from places they unexpectedly find themselves
- Use clearly marked ‘emergency exists’
- Consistency and standards
  - Keep the interface common with family of applications
- Help users recognize, diagnose, and recover from errors
  - use plain language
  - describe the nature of the problem
  - Suggest way for solving the problem

- Error prevention
  - Prevent errors occurring in the first place
- Recognition than recall
  - Make objects, actions, and options visible
- Flexibility and efficiency of use
  - Allow users to carry out tasks more quickly

- Aesthetic and minimalist design
  - Avoid using information that is irrelevant/rarely needed
- Help and Documentation
  - Provide help and documentation facilities

# THANK YOU