# Interaction Design with Direct Manipulation

## Lecture #5

### Part-A: Overview

# Agenda

- **Overview**
- Scope
- Applications

# Concept of Direct Manipulation

- Ben Shneiderman introduced the term Direct Manipulation in (1983)

Reference:

*Direct Manipulation: A Step Beyond Programming Languages*, Ben Shneiderman, IEEE Computer, Vol. 16, No. B, August 1983, pp 57-69

# Direct Manipulation?

- Direct manipulation (DM) is a style of human-computer interaction design which features a natural representation of task objects and actions promoting the notion of people performing a task themselves (directly) not through an intermediately like a computer

# Direct Manipulation by Shneiderman

- It is better to quote the words from Shneiderman (1983)

- The system that best exemplify direct manipulation give us the quality feeling that we are directly engaged with control of the objects – not with the programs, not with the computer, but with the semantic objects of our goals and intentions. This kind of requirement does not require an interface of pictures, diagrams, or icons. It can be done with words and descriptions…. The key properties are that the objects, whatever their form, have behaviors, can be referred to by other objects, and that referring to an object causes it to behave. The goal is to permit the user to act as if the representation is the thing itself.

# Direct Manipulation: An Example

- Driving a car

| | |
|---|---|
| Object: | Car |
| Task: | Drive the car |
| Actions: | From driver to car |

Lets consider the three scenarios

| | |
|---|---|
| Scenario 1: | Interface with command language |
| Scenario 2: | With an intermediately style of interaction |
| Scenario 3: | With direct manipulation |

# Driving a Car: Scenario 1

- Driver is a good programmer
- Using his palmtop /laptop computer he gives instructions to the car

START
TURN LEFT 37 DEGREES
SLOW 5
TURN RIGHT 10 DEGREES
FAST 10
FAST 20
TURN 0
STOP

# Driving a Car: Scenario 2

- Driver sits in the backseat of the car giving a stranger directions

- Further, imagine the stranger possessing poor interpersonal skills and having a limited vocabulary

# Driving a Car: Scenario 3

- Driver himself drives the car by manipulating the steering wheel and pedals

# Three Scenarios, Three Interaction Styles

- Driver is a good programmer
- Using his palmtop /laptop computer he gives instructions to the car

- Scenario 1
  - Require superman level mastery of interface
  - Usually with less competence in performing tasks
  - Very less joy of driving

# Three Scenarios, Three Interaction Styles

- Driver sits in the backseat of the car giving a stranger directions

- Scenario 2
  - Driver don't have a direct view of where he is going
  - User has to rely on a stranger who, if they are don't receive explicitly directions using particular phrases in a fixed order, idles in the middle of the road or takes him to unfamiliar places from which he does not know the way out

# Three Scenarios, Three Interaction Styles

- Driver himself drives the car by manipulating the steering wheel and pedals

- Scenario 3
  - The car responds immediately to driver's actions, and these response are immediately evident
  - If the driver makes a mistake, such as turning too sharply, he can quickly recognize that and perform a corrective measure accordingly

# Interaction Style with Direct Manipulation

- The user with direct manipulation user interface has the following direct consequences

1. Mastery of the interface
2. Competence in performing tasks
3. Ease in learning the system originally and in assimilating advanced features
4. Confidence in the capacity to retain mastery over time
5. Enjoyment in using the system
6. Eagerness to show off the system to novices
7. Desire to explore more powerful aspects of the system

# Interaction Style with Direct Manipulation

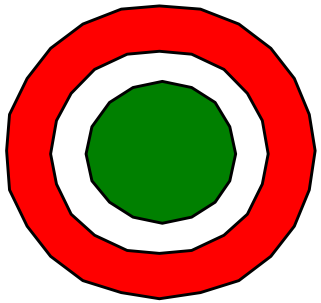
- **Principle**
  - Interactive systems where the user physically interacts with their system
- **Fundamental**
  - The main feature in direct manipulation is user control
  - Instead of typing command and allowing the operating system to act as a strange intermediately, direct manipulation allows the user to feel like s/he is in central control

# Shneiderman's Criteria for DM

- **Visibility of Objects**
  - Continuous representation of the objects of interests
    - have behavior
    - can be referred to by other objects
    - referring to an object causes it to behave

- **Immediate Effect**
  - Replacement of complex command-language syntax with direct, visual manipulation of the object of interest

- **Visibility of Actions**
  - Rapid, incremental, reversible operations, whose effect on the object of interest is immediately visible



Let's get a quick review of

**Direct Manipulation Applications**

# **Word Processing** and …

- **Early 1980**
  - Line-oriented command languages
  - Users can see one line at a time
  - User typed command to edit, insert, delete etc.

  **Examples:**
  - Markup language like SGML
  - Today's HTML, Latex etc. draws the concept from it

  **Advantages:**
  - More flexible
  - Powerful macros are possible
  - Some tasks are simple to express

# **Word Processing** and …

- **Aronud 1985**
  - Display editor

**Examples:**

- PC word processor like WORDSTAR in DOS
- vi / emacs in Unix

**Advantages:**

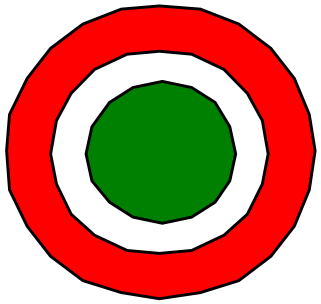
- Users viewed up to a full screen of text
- Edit / insert etc, are directly by typing

# **Word Processing** and …

- **Early 1990**
  - WYSIWYG based word processing

**Examples:**
- Today's word processing system

**Advantages:**
- Display a full page of text
- Display the document in the form that it will appear when the final printing is done
- Show cursor actions to the user
- Control cursor motions …
- Use labeled icon for actions
- Display the result of actions immediately
- Provide rapid response and display
- Offer easily reversible actions



# Windows and …

- The Trash on the desktop is an excellent example of direct manipulation within computer systems
- User can see both the Trash and the Files or Folders they want to move to the Trash
- They then physically selects the File and drag them to the Trash can
- While the user is doing this, all of the selected Files move as well, illustrating which items the user has selected
- When the Mouse is placed over the Trash, there is a shading indication that it has been reached
- The user then has to release the Mouse button to move the Files to the Trash
- If there are many files, a Dialog box will show up illustrating the progress of moving files to the Trash
- Once the action is completed, the Files are no longer visible in their original location
- The user can change her mind at any later time while dragging the Files to the Trash
- Even after placing the them there, they can as easily be taken out of the Trash and put back in place

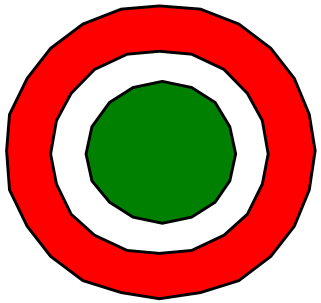
# **Windows** and …

Here ..

- The visual representation takes the form of a metaphor related to the actual task being performed
  - Computer files, directories and trash are represented as document, file cabinet and dust-bin

- The use of metaphors allows a user to trap their analogical reasoning power when determining what actions to take when executing a task on the computer

- Actions are rapid, incremental, and reversible with results being immediately visible



# More Applications …

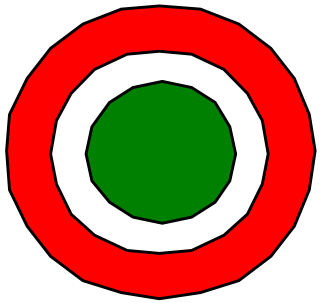
- Computer-aided games
- Video games
- Office automations
  - Spread sheet, spatial data management
  - Time management
  - Collaboration, Communication
- Consumer electronics, home appliances, personal digital appliances
- Virtual reality
- Mobile communications

# References

- Book

  *Designing the User Interface: Strategies for Effective Human-Computer Interaction (3rd Ed.)* **Chapter 6**

  Ben Shneiderman, Pearson Education, New Delhi, 2004



# Recommended Materials

- My Home page

  http://facweb.iitkgp.ernet.in/~dsamanta

  (For the presentation slides of the current lecture

- Paper

  *Direct Manipulation for Comprehensible, Predictable and Controllable User Interfaces*, Ben Shneiderman, 3rd Intl. Conference on Human-Computer Interaction, 1997, pp. 33-39