Interaction Design with Direct Manipulation

Lecture #5

Part-B

Interaction Design with Direct Manipulation

Lecture #5

Part-B

Agenda

- Overview
- **Scope**
- Applications

Consequences of Direct Manipulation

- Seven benefits from the interface design with direct manipulation
  1. Novices can learn basic functionality, usually through a demonstration by a more experienced user
  2. Experts can work rapidly to carry out a wide range of tasks, even defining new functions and features
  3. Knowledgeable intermittent users can retain operational concepts
  4. Error messages are rarely needed
  5. User can immediately see if their actions are furthering their goals, and if the actions are counterproductive, they can simply change the direction of their activity
  6. Users experience less anxiety because the system is comprehensible and because actions can be reversed so easily
  7. Users gain confidence and mastery because they are the initiators of action, they feel in control, and the system responses are predictable

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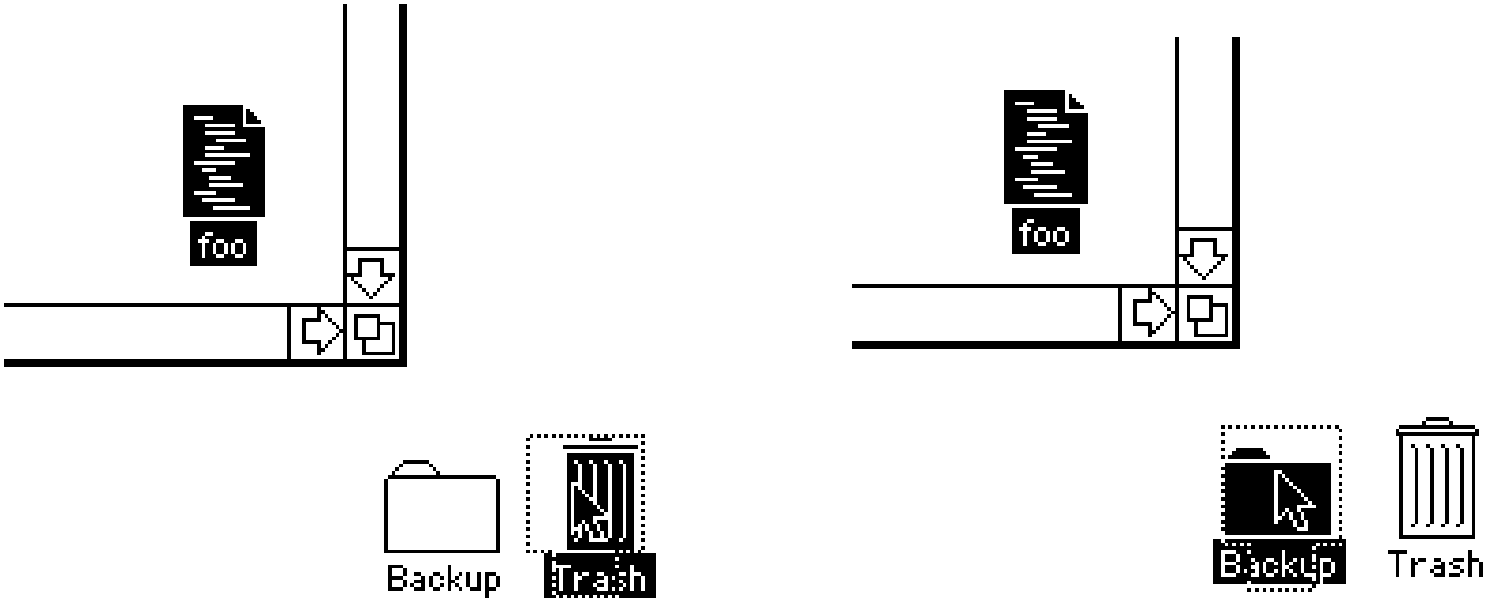
Errors with Direct Manipulation

- It is impossible to make syntax errors in direct manipulation since any movement of the icon is legal and have some meaning
- It is frequently claimed that direct manipulation interfaces reduce the need for error messages
- As a matter of fact,
  - Errors frequently occurs when using direct manipulation systems
  - In many cases error messages are pretty poor

Example 1: Errors with DM

- Deleting a file in Windows Explorer by dragging its icon to the **Trash** icon



Example 1: Errors with DM

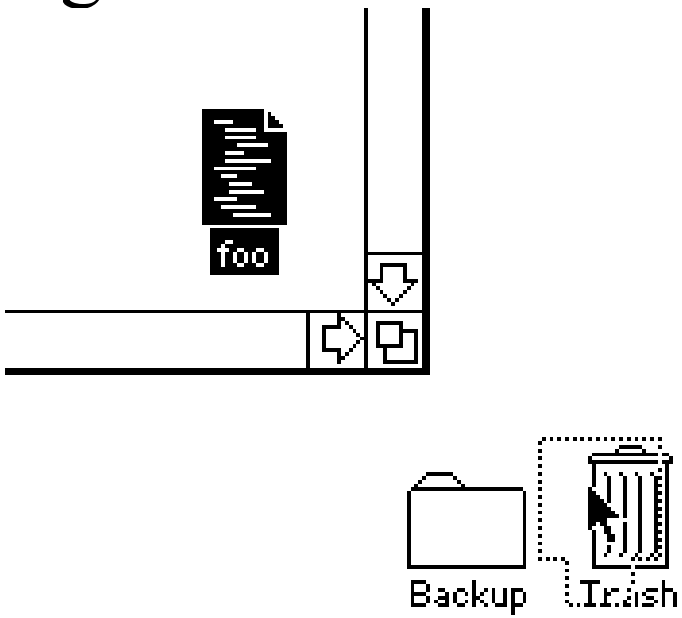
- Lexical level error: The file icon is dragged to the icon representing **Backup** and not to the **Trash** icon as intended

- Why this error?
  - Because syntax of dragging an icon on top of another icon has been correctly specified

  - This problem is due to “Capture error”

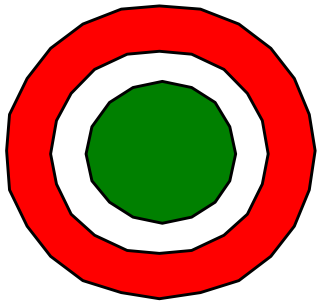
Example 2: Errors with DM

- Alphabetical level error: User is erroneously specify a point on the screen which is outside the desired region



Example 2: Errors with DM

- User has moved the document icon to a position just outside the **Trash** icon
  - Since most of the outline icon overlaps the **Trash** icon, the novice user may think that the **Trash** has been indicated as the destination for the document, but in actual fact, the cursor's "hot spot" is outside the **Trash** icon and therefore indicates another destination for the document
  - The document will not be discarded but will be moved to a new location between the **Backup** and **Trash** icons
  - Experienced user usually does not mislead with this type of errors



More Problems with Direct Manipulation

Problem 1

- Spatial or visual representations are not necessarily an improvement over text
  - They may be too spread out
  - Causing off-page connectors
  - Tedious scrolling on displays

- Direct manipulation may consume valuable screen space
  - Force valuable information off-screen
  - Requiring scrolling
  - Multiple actions

- Graphic displays versus textual displays
  - A tabular textual display of 50 documents is more preferable than only 10 graphic document icons with the name abbreviated to fit the icon size

Problems with Direct Manipulation

Problem 2

- Users must learn the meaning of components of the visual representation

  - A graphic icon may be meaningful to the designer, but may require as much or more learning time than a word

  - Icons with title that appear when the cursor is over them offer only a partial solution

Problems with Direct Manipulation

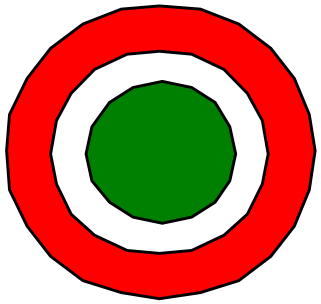
Problem 3

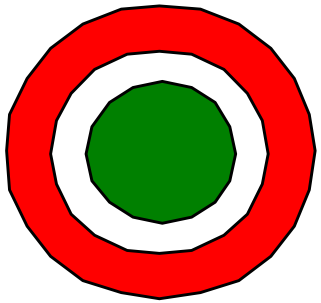
- Visual representation may be misleading
  - Users may grasp the analogical representation rapidly, but then may draw incorrect conclusions about permissible actions
  - Users may overestimate or underestimate the functions of the computer-based analogy
  - Ample testing must be carried out to refine the displayed objects and actions and to minimize negative side effects

Problems with Direct Manipulation

Problem 4

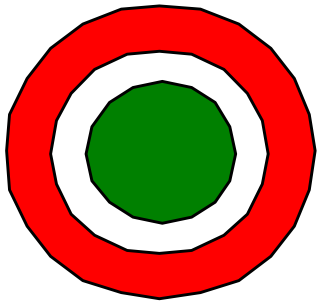
- For experienced typists, taking hand off the keyboard to move a mouse or point with a finger may be slower than typing the relevant command
  - If the user is familiar with a compact notation that is easy to enter from keyboard but may be more difficult to select with mouse
  - The keyboard remains the more effective direct-manipulation device for certain tasks
- Choosing the right objects and actions is not necessarily an easy task
  - Simple metaphors, analogies, or models with a minimal set of concepts are a good starting point





Programming by Direct Manipulation

- Apart from performing task by DM it has better prospects
- A few are listed below…
  - Programming of physical devices
    - Robot programming
    - CAD-VLSI Design
  - Automatic programming
  - Programming with visualization
  - Demonstrational programming
  - Remote direct manipulation
  - Virtual reality and augmented reality ……

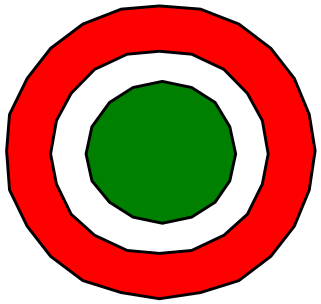


Programming of Physical Devices

- Allow user to program a sequence of settings and then to replay it smoothly when required
  - Television, digital camera, mobile handset etc.

- Robot programming
  - Moving the robot arm through a sequence of steps that are later displayed, possibly at higher speed
  - The same can be used for generalization

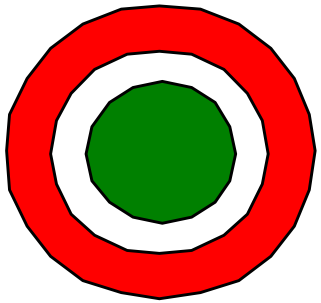
- CAD-VLSI design
  - Manipulate at the front-end and convey code to the back-end tools



Automatic Programming

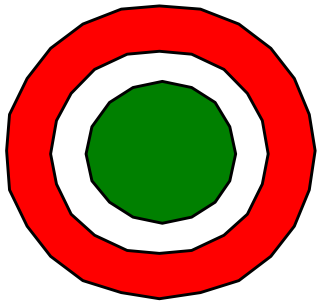
- Allow user to create macros by simply performing a sequence of commands that is stored for later use

- Macros can invoke each other leading to complex programming possibilities
  - Lotus 1-2-3
  - MS Excel etc.



Programming with Visualization

- System with visualization in several application domains
  - Arithmetic systems
    - Polynomial evaluation
    - Matrix algebra
    - Vector analysis
  - Laboratory experiments in Physics, Chemistry etc.
  - Communication aid for motor-impaired or physically disabled user



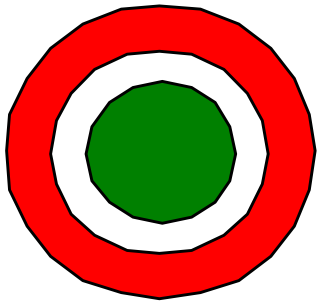
Demonstration Programming

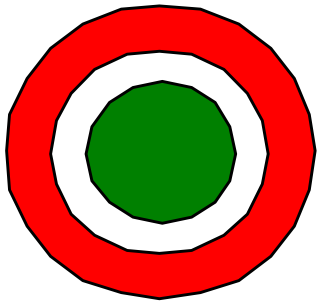
- **Reference:**

  Demonstrational Interfaces: A Step Beyond Direct Manipulation, A Brad Myers, IEEE Computer, Vol. 25, No. 8, 1992, pp. 61-73

- Users can create macros by simply doing their tasks and letting the systems construct the proper generalization automatically

- Computer could reliably recognize repeated patterns and automatically create a useful macro, while the user is engaged in performing a repetitive task interface





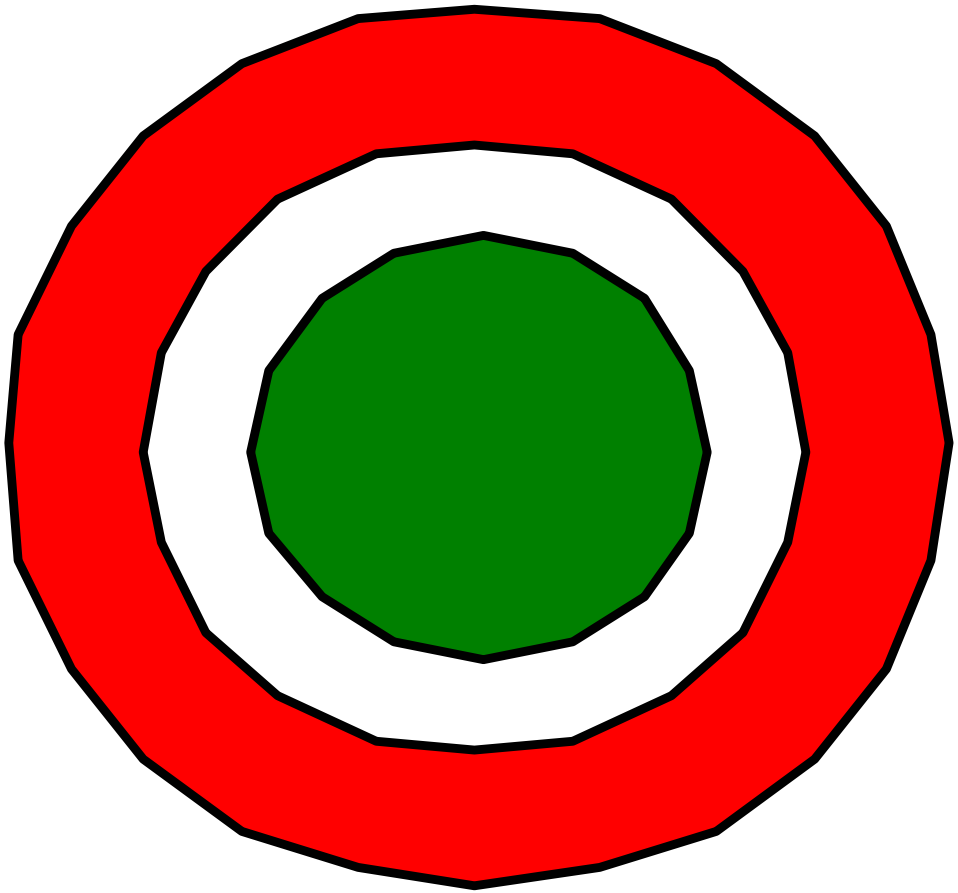
Recommended Materials

- My Home page

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

  (For the presentation slides of the current lecture

- Book

  Designing the User Interface: Strategies for Effective Human-Computer Interaction (3rd Ed.)
  Ben Shneiderman, Pearson-Education, New Delhi

  Chapter 6