

Metaphors and Direct Manipulation

Human Computer Interaction

Based on slide deck

Part 4: Designing and building visual interfaces. Metaphors and Direct Manipulation

Human Computer Interaction I: Principles and Design

by

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*The new slides are marked with a **

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Metaphors and Direct Manipulation

Metaphors

Direct manipulation

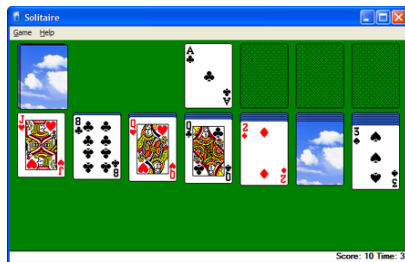
Dynamic queries

Metaphors in interfaces

Pervade excellent interfaces

	A	B	C	D
1	Market value	Land	Improvement	Total assess
2	140.0	65,850.	73,120.	138,970.
3	147.0	77,780.	72,070.	149,850.
4	151.0	74,850.	88,740.	163,590.
5	152.0	80,110.	99,410.	179,520.
6	155.0	79,050.	109,130.	188,180.
7	170.0	94,750.	50,960.	145,710.
8	172.0	82,150.	106,250.	188,400.
9	178.0	78,560.	132,660.	211,220.
10	180.0	92,840.	105,670.	198,510.
11	180.0	80,090.	103,130.	183,220.
12	182.0	76,650.	115,210.	191,860.
13	185.0	75,590.	152,710.	228,300.
14	185.0	85,870.	105,330.	191,200.
15	185.0	80,060.	113,600.	193,660.
16	193.4	80,140.	131,340.	211,480.
17	194.5	73,400.	176,210.	249,610.
18	197.0	84,960.	129,800.	214,760.
19	203.0	91,600.	119,170.	210,770.
20	205.0	79,460.	137,250.	216,710.
21	213.0	87,060.	124,350.	211,410.
22	221.0	97,330.	167,500.	264,830.
23	225.0	87,160.	157,290.	244,450.
24	245.0	79,520.	144,840.	224,360.
25	248.0	89,470.	183,500.	272,970.
26	278.0	82,150.	168,720.	250,870.
27	302.5	118,500.	109,800.	228,300.
28	308.0	83,100.	141,730.	224,830.

spreadsheet (actuary sheet)

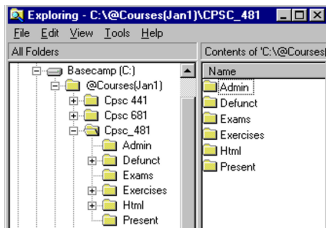


games (literal world)

Metaphors in interfaces

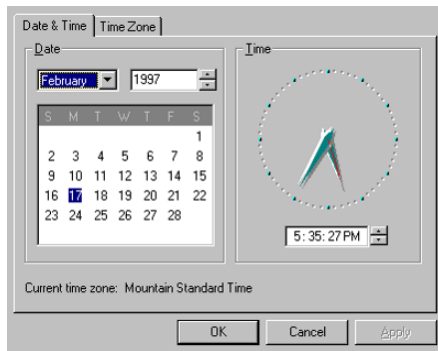
Name: _____
Address: _____
City: _____
Province: _____
Postal Code: _____

Forms



Hierarchical folders

Metaphors in interfaces



Control Panels with familiar control

Metaphors in interfaces

Definition

- represents a system object as if it were another type of object
 - disc / network file structure *represented as* file folders

Purpose

- leverages our knowledge of familiar, concrete objects to understand abstract computer and task concepts

Problem

- metaphor portrays inaccurate/naive conceptual model of the system



A presentation tool is a slide projector



Metaphors in interfaces

Things to watch for

- Use metaphors that matches user's conceptual task
 - desktop metaphor for office workers
 - paintbrush metaphor for artists...
- Given a choice, choose the metaphor close to the way the system works
- Ensure emotional tone is appropriate to users
 - e.g. file deletion metaphors
 - trashcan
 - black hole
 - paper shredder
 - pit bull terrier
 - nuclear disposal unit...

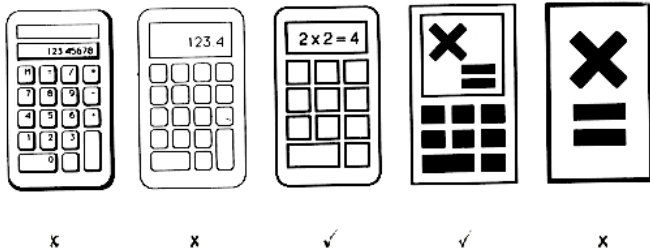
Metaphors in interfaces

Things to watch for

- will it restrict what people could actually do?
 - strict file/folder hierarchy
vs
system allows links between directories
- will it set unrealistic expectations?
 - Chat-bot

Metaphors in interfaces

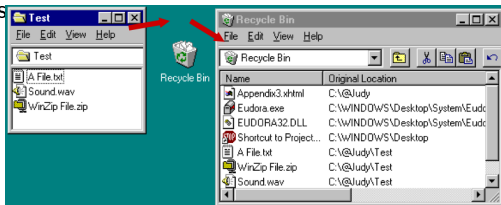
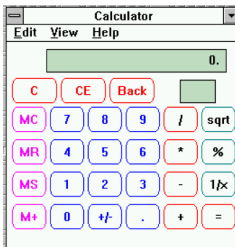
Choosing levels of abstraction



Metaphors in interfaces

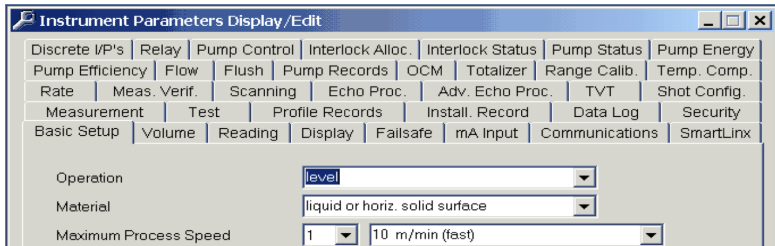
Common pitfalls

- overly literal
 - unnecessary fidelity
 - excessive interactions
 - unnecessary restrictions
- overly cute
 - novelty quickly wears off
- mismatched
 - does not match user's task and/or thinking



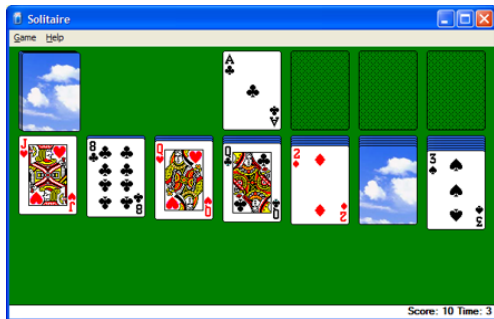
Metaphor misuses

Milltronics' Dolphin Plus - a configuration package for industrial level and flow sensors



Direct manipulation

Microsoft Solitaire

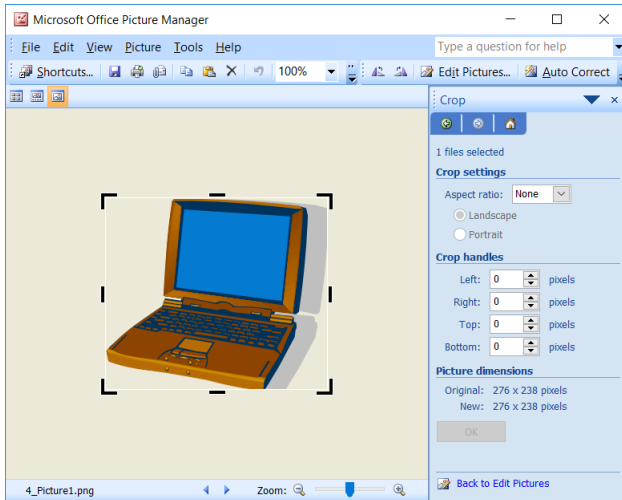


"A subtle thing happens when everything is visible:
the display becomes reality."

Xerox Star inventors

Direct manipulation

Cropping by drag and drop



Direct manipulation

Black Panther film



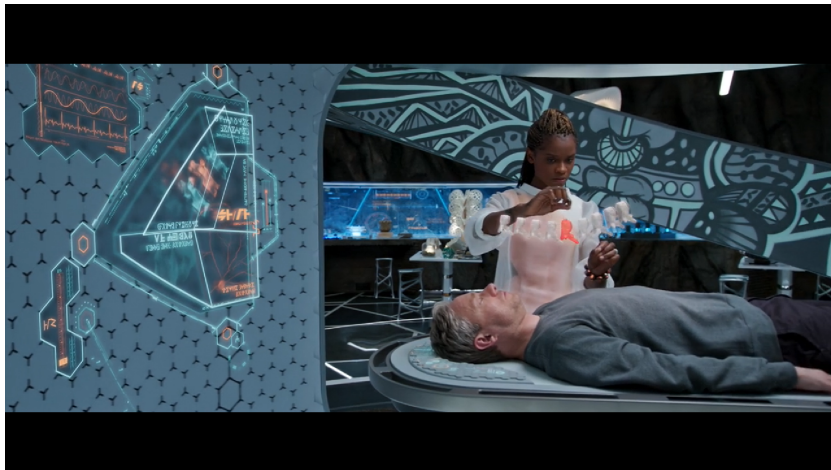
Direct manipulation

Black Panther film



Direct manipulation

Black Panther film



Direct manipulation

Direct Manipulation

- interface behaves as though the interaction was with a real-world object rather than with an abstract system
- the feeling of working *directly* on the task

Central ideas

- visibility of the objects of interest
- rapid, reversible, incremental actions
- manipulation by pointing and moving
- immediate and continuous display of results (*dynamic queries*)

Almost always based on a *metaphor*

- mapped onto some facet of the real world task semantics

Direct manipulation

objects understood in terms of their visual characteristics

- affordances, constraints

actions understood in terms of their effects on the screen

- causality

intuitively reasonable actions can be performed at any time

- conceptual model

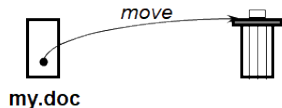
Object-Action vs Action-Object

Select object, *then* do action

- interface emphasizes 'nouns' (visible objects) rather than 'verbs' (actions)

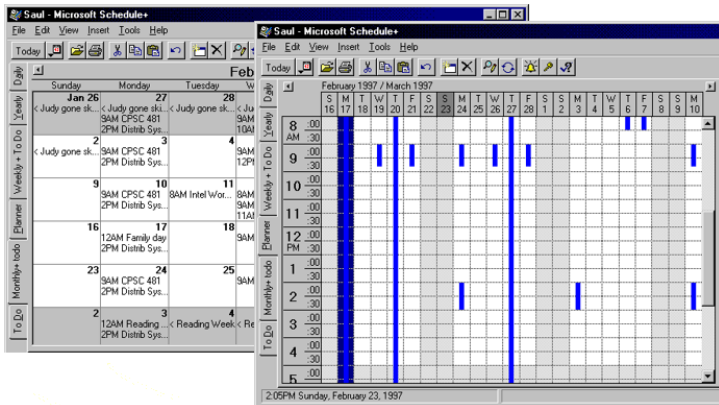
Advantages

- closer than real world
- modeless interaction
- *actions* always within context of object
 - inappropriate ones can be hidden
- *generic commands*
 - the same type of action can be performed on the object
 - eg drag 'n drop:
 - folders
 - files
 - paragraphs
 - text
 - numbers...



Direct manipulation

Representation affects what can be directly manipulated



Is direct manipulation the way to go?

ill-suited for abstract operations

tedious

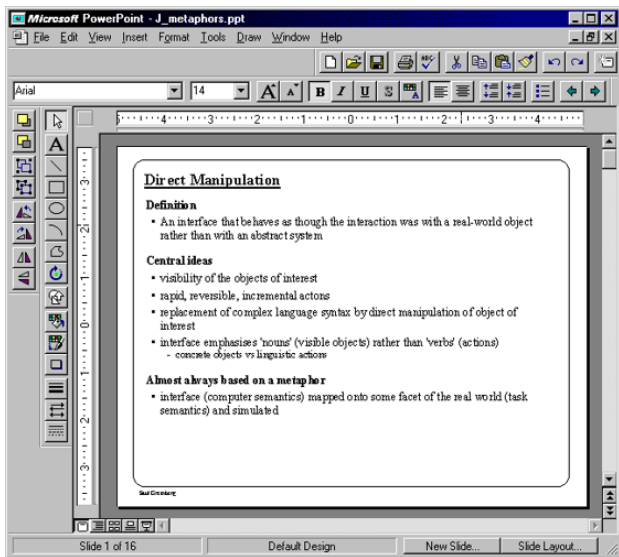
- manually search large database vs query

solution

- most systems combine direct manipulation and abstractions
 - word processor:
 - WYSIWYG document (direct manipulation)
 - buttons, menus, dialog boxes (abstractions, but direct manipulation "in the small")

Direct and abstract manipulation

Most good applications mix the two for power



Dynamic queries

Searches and queries by

- adjust sliders, buttons, check boxes, and other control widgets
- display immediate updates *as* the control is adjusted

Why?

- rapid searching with imprecise queries
- people explore data interactions and limits

HomeBay

Dynamic
Queries

Radar
Overview

Progressive
details on
demand

The screenshot shows the HomeBay application window. On the left, there are search filters for Price Range, Square Footage, Property Type, and Advanced filters for Bedrooms, Bathrooms, Age of Property, and Description Keywords. Below these is a table of search results. On the right, there is a map of Calgary with a mini-map inset. A property is highlighted on the map, and a pop-up window shows details for a two-story house in North Crowchild, priced at \$199,900. The bottom of the window includes a History button, a Print button, and a Favorites section with two property images.

Search Filters:

- Price Range: Min: \$0, Max: no limit
- Square Footage: Min: 0 sqft, Max: 5,177 sqft
- Property Type: [Dropdown]
- Area: [Dropdown]
- Advanced:
 - Number of Bedrooms: Min: 1, Max: 5
 - Number of Bathrooms: Min: 1, Max: 5
 - Age of Property: Min: 0, Max: no limit
 - Description Keywords: [Dropdown]

Search Results:

#	Price	Area	Property Type
01	\$154,888	Marlborough Park	Bungalow
02	\$199,900	North Crowchild	Two-Story
03	\$199,900	Westgate	Bungalow
04	\$199,900	Coventry Hills	Two-Story
05	\$199,900	Brentwood	Bungalow
06	\$239,735	Inglenood	Condo
07	\$239,000	Tuscany	Mansion
08	\$249,900	Capitol Hill	Duplex
09	\$249,900	Arbour Lake	Townhouse
10	\$249,900	Barill Trail	Bungalow
11	\$288,000	Strathcona Park	Two-Story
12	\$288,900	Patterson	Townhouse
13	\$310,000	Arbour Lake	Two-Story

Map Details:

- Display Locations on Map: ☐ Green Space, ☐ Parks, ☐ Shopping Centres, ☐ Schools, ☐ Playgrounds
- Property Details (North Crowchild):
 - Price: \$199,900
 - Area: North Crowchild
 - Type: Two-Story

What you now know

Metaphors

- leverages our knowledge of the familiar and concrete

Direct manipulation

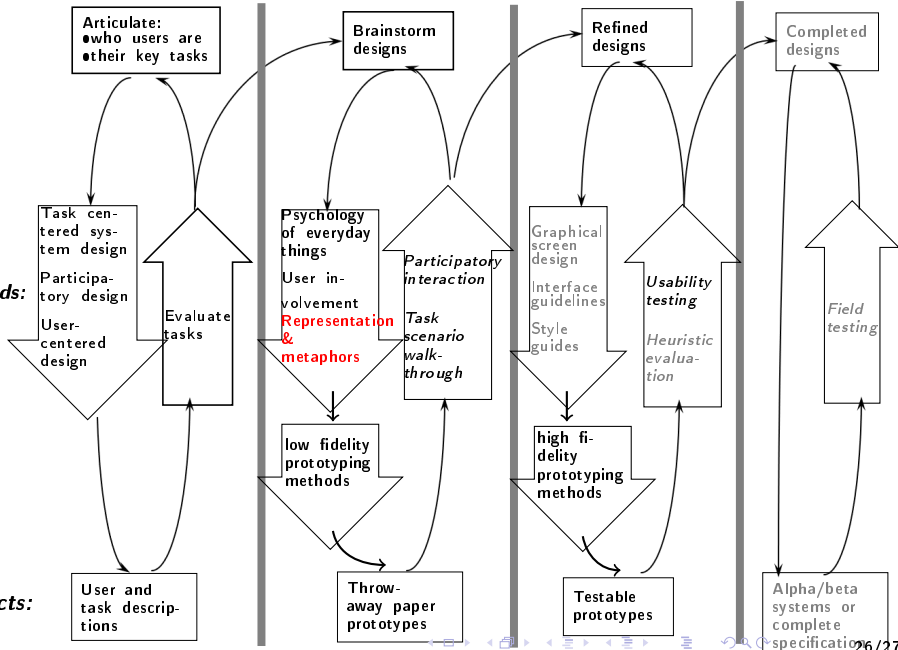
- visibility of the objects of interest
- rapid, reversible, incremental actions
- manipulation by pointing and moving
- immediate and continuous display of results (dynamic queries)

Interface Design and Usability Engineering

Goals:

Methods:

Products:



*Bibliography

- Saul Greenberg, **Designing and building visual interfaces. Metaphors and Direct Manipulation**, University of Calgary, Canada
<http://pages.cpsc.ucalgary.ca/~saul/481/>
- Keith Andrews, **Human Computer Interaction, Chapter 12. Icon Design**, TU Graz, Austria
<https://courses.isds.tugraz.at/hci/hci.pdf>