CS 349
18 Models of Interaction

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Spring 2009

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Direct Manipulation

- Defining characteristic of many GUIs is *direct manipulation*

- Direct manipulation (Shneiderman, 1982)
    - Sense of directly manipulating objects of interest

Direct Manipulation

- Objects of interest visible

- Incremental action with rapid feedback

- Reversibility of all actions
  - Users can explore without severe consequences

- Syntactic correctness of all actions
  - Every user action is a legal operation

- Complex command languages replaced by directly manipulating visible objects

- *What is, is not, direct manipulation in modern UIs?*

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DM Falling Short…

- Many commands invoked *indirectly*
  - Menus, dialog boxes, toolbars
  - *Not* direct manipulation
  - Mediators that pull users away from objects of interest

- Many objects of interest hidden
  - Style sheets
  - Alignment constraints (can be fleeting)

- Lots of objects in interface *not* objects of interest
  - Toolbar palettes

(From Beaudouin-Lafon [2000])

Instrumental Interaction

- Beaudouin-Lafon (2000) proposes *Instrumental Interaction* as an extension to direct manipulation

- Shifts focus to *interaction instruments* that manipulate *domain objects*

- *Task-centric* rather than *interface-centric* design

- Provides a lens for informing interaction design

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Domain Object

- A first-class object representing the data (object) of interest
  - Text in a text editor
  - Shapes in a vector drawing program…

- Objects of interest change throughout a task
  - For example, can be word, sentence, paragraph, document in a word processing application

Interaction Instruments

- Method by which domain objects are manipulated

- Two-way transducer between user and domain objects
  - What does it mean for the instrument to be a transducer?

- To achieve direct manipulation ideal, want to consider the instrument across several dimensions
  - Spatial vs. temporal offsets
  - Degree of indirection
 - Degree of integration
  - Degree of compatibility

Spatial vs. Temporal Offsets

- Spatial offset
  - Considers how "close" instrument must be to operate on domain object
  - Example: Alignment command vs. guides in Illustrator

- Temporal offset
  - Is action immediate or does it take time to compose command?
  - Example: Resize via handles vs. dialog box

- Associated Costs

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Degree of Indirection

- Sum of spatial and temporal offsets

- As spatial and temporal offsets increase, degree of indirection increases

- An indicator of how "direct" the direct manipulation actually is

Temporal Offset

● Dialog Boxes

● Drag 'n Drop

● Handles　　● Scrollbars　　● Property sheets

Spacial Offset
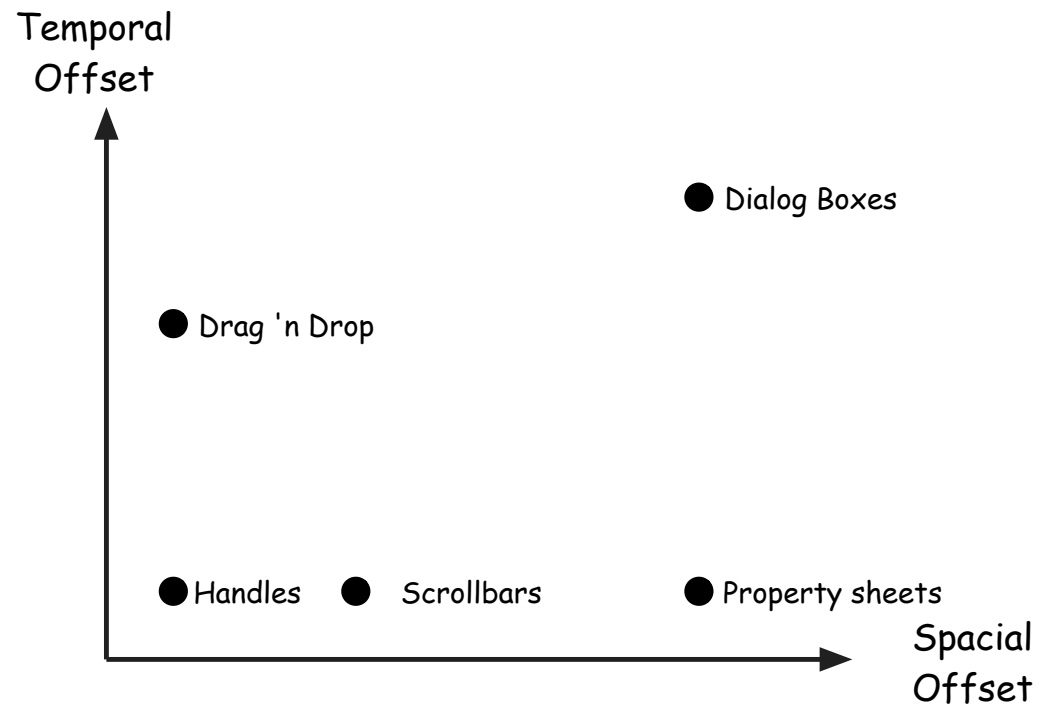
20-July-09 Announcements

- VM/SVN Survey: partial results

- Marks are available. Please check.

- Midterm 2 remarking requests are due *today.*

- A3: see newsgroup for comments from the TA

- Today's Agenda:
  - UI Video: Toolglass and Magic Lens
  - Course Evaluations
  - Return A3 (maybe…)
  - Finish Models of Interactions
  - Users

Degree of Integration

- Ratio of degrees of freedom (DoF) of instrument to DoF of input device
  - Example: Scrollbars and mouse: ½
  - What would yield 3/2?

- Indicates degree to which the input devices *map* onto the logical part of the interface instrument
  - Ratios >1 indicate more effort required on part of user
  - Why?

Degree of Compatibility

- Degree to which physical action is similar to actual action/response of screen
  - Dragging object has high degree of compatibility
  - Using scroll bar has low degree of compatibility. Why?
  - Inputting numbers to change font size has low degree of compatibility. Why?

Putting it All Together…

- Instrumental interaction encourages one to focus on the *task* by forcing one to think in terms of *domain objects* (first-class objects) and *instruments* that manipulate those objects

- Encourages a more literal mapping from the world to interface

- Encourages more first class objects whose affordances are visible, manipulable

- An alternative lens with which to think about interface design

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