

Graphical interaction (part 1)

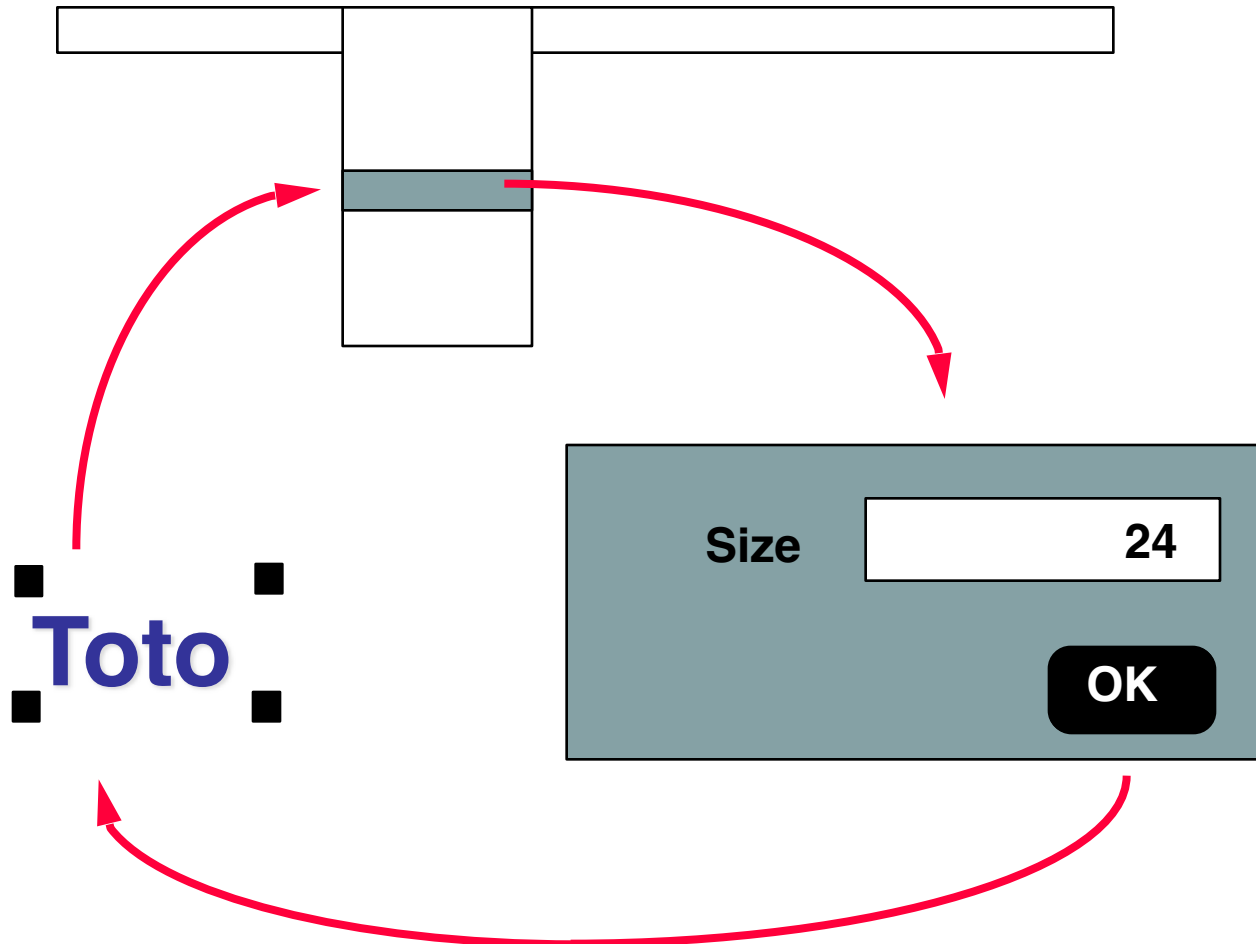
Michel Beaudouin-Lafon
Université Paris-Saclay
mbl@lisn.fr
<http://ex-situ.lri.fr>

Direct manipulation

Shneiderman (1983)

1. Continuous representation of the objects of interest
2. Physical actions instead of complex syntax
3. Rapid, incremental, reversible actions whose effects on the objects of interest are immediately visible
4. Layered approach to discover the interface progressively, so that it can be used with little previous knowledge

(In)direct manipulation



Hello

World



Direct manipulation + menus + forms

BEWARE of the notion of **object of interest**

Objects of the application domain

Characters, words, paragraphs of a text

Pixels of an image, graphical shapes, ...

Menus and forms are NOT objects of interest

Direct manipulation vs. **Indirect Manipulation**

Direct manipulation of the *objects of interest*

≠

Interaction with *menus and forms*

3 levels of graphical interaction

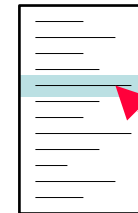
Basic actions

“alphabet” of graphical interaction



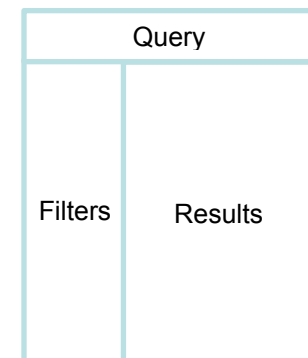
Basic interaction tasks

“vocabulary” of graphical interaction



Interaction patterns

“syntax” of graphical interaction



Basic actions

Interaction through a mouse or trackpad and a **cursor**



Pointing: move cursor to designate an object

Activation: click (simple / multiple / with modifier)

Drag: move cursor with button pressed

Keyboard input: keys and/or modifiers

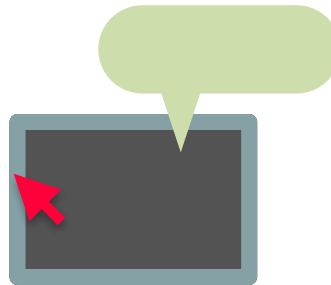
Feedback of basic actions

Pointing



Feedback of basic actions

Pointing



Feedback of basic actions

Pointing



Feedback of basic actions

Pointing



Activation



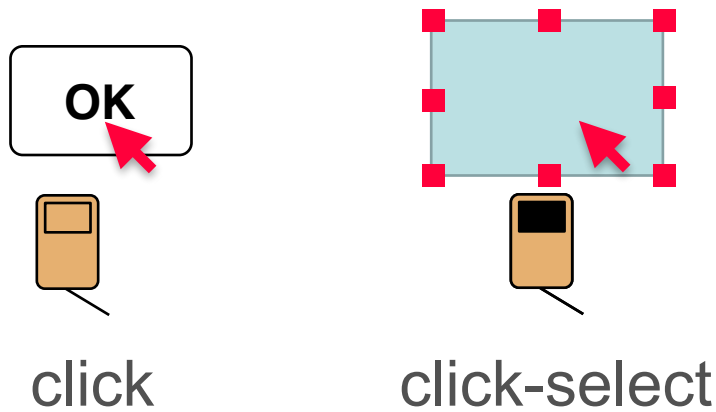
click

Feedback of basic actions

Pointage



Activation

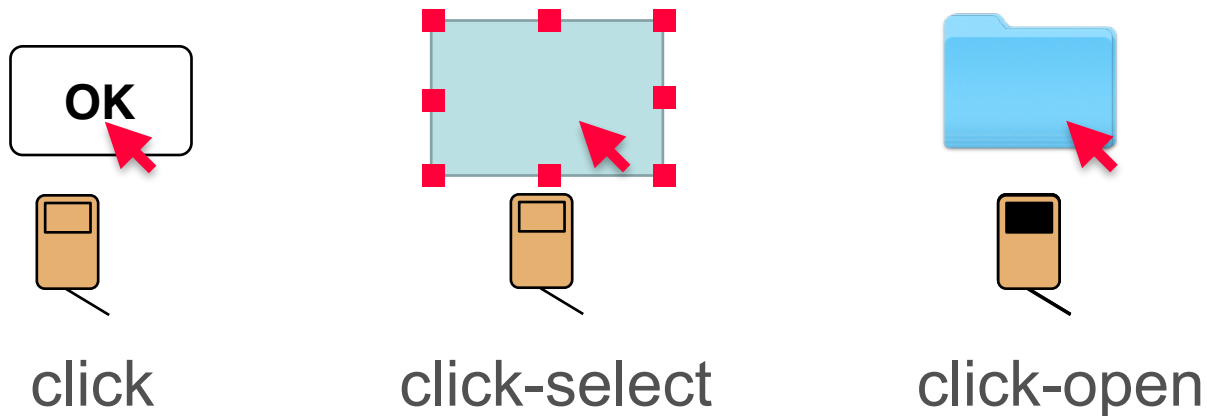


Feedback of basic actions

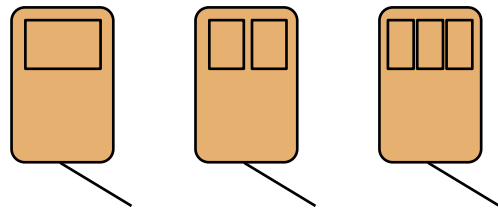
Pointage



Activation



Extend activation actions



several buttons



multiple clicks



modifiers

Conventions:

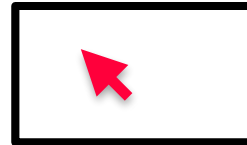
Right click = contextual menu

Simple click = select ; Double click = open

Shift-click = add/remove from selection

Feedback of basic actions

Drag



Feedback of basic actions

Drag

ghosts



Feedback of basic actions

Drag

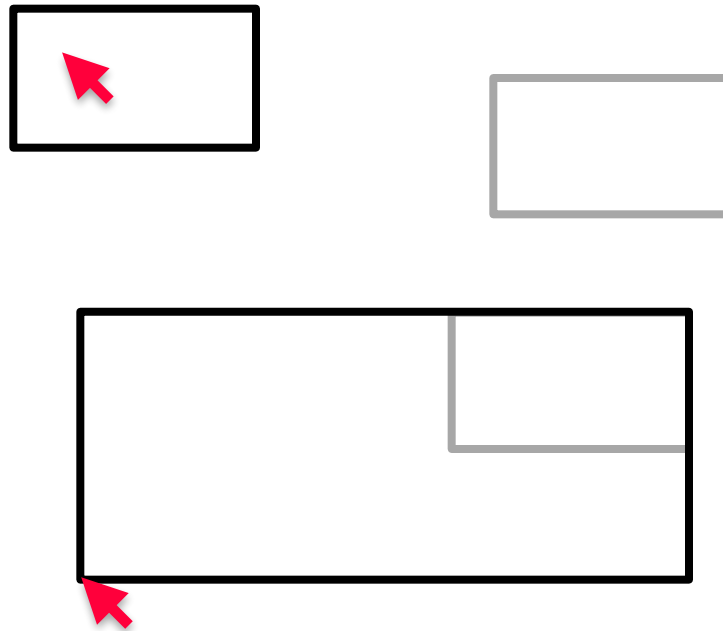
ghosts



Feedback of basic actions

Drag

ghosts



Feedback of basic actions

Drag

ghosts



ink



Basic actions

Interaction through a mouse or trackpad and a **cursor**



Pointing: move cursor to designate an object

Activation: click (simple / multiple / with modifier)

Drag: move cursor with button pressed

Keyboard input: keys and/or modifiers

Interaction through a touch screen (finger or pen)



Tap: one or more contact points without movement

Swipe: short motion of one or more contact points

Mark: motion of one or more contact points

Pinch: motion of 2 contact points in opposite directions

Basic interaction tasks

Input tasks

Selection tasks

Trigger tasks

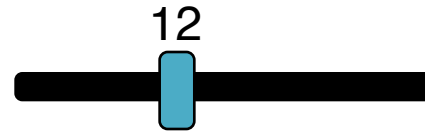
Navigation tasks

Property setting tasks

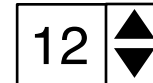
Transformation tasks

Input task : numbers

Slider



Counter



Gauge



Interval



Note : the scale needs not be linear

logarithmic scale:



Input task : text

Single-line text field

Text cursor

Validate with Return or Tab key

Default value

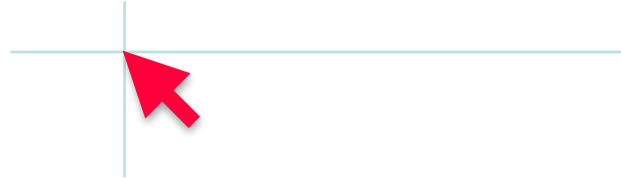
Label

Name:

Multi-line text area

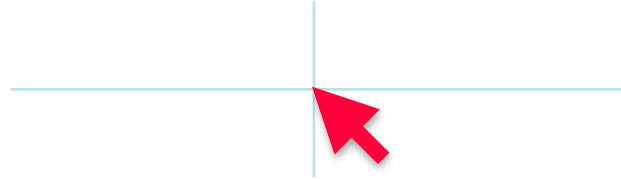
Input task : shapes

Position



Input task : shapes

Position

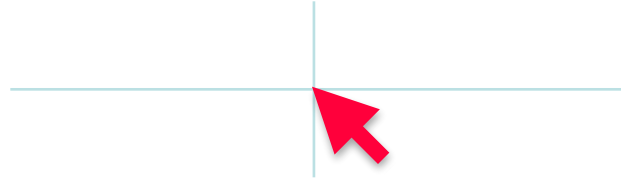


Bounding rectangle

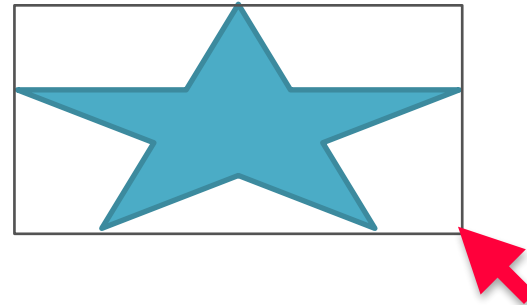


Input task : shapes

Position



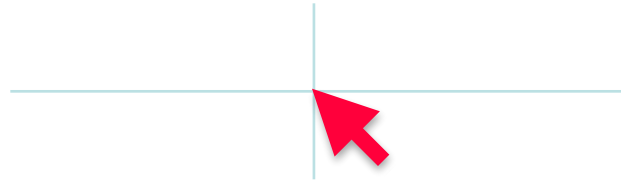
Bounding rectangle



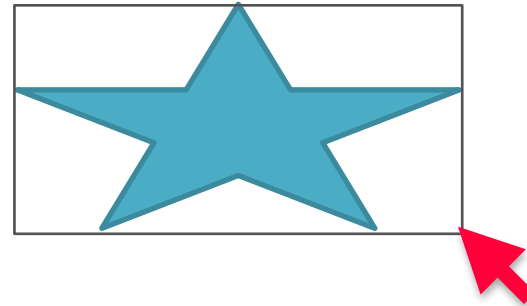
Control points

Input task : shapes

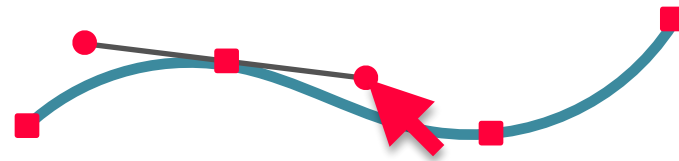
Position



Bounding rectangle

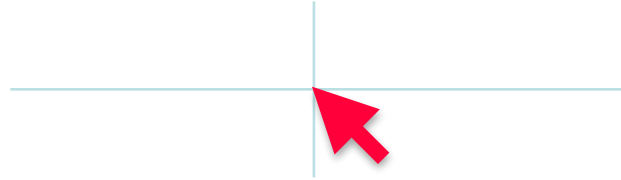


Control points

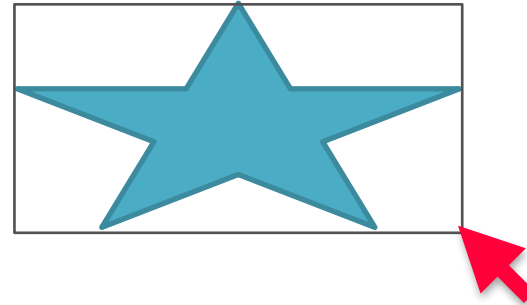


Input task : geometry

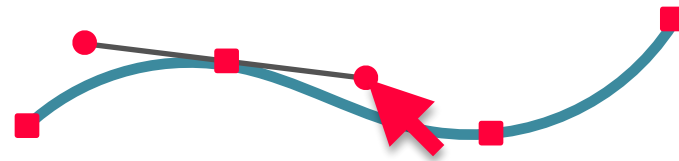
Position



Bounding rectangle



Control points

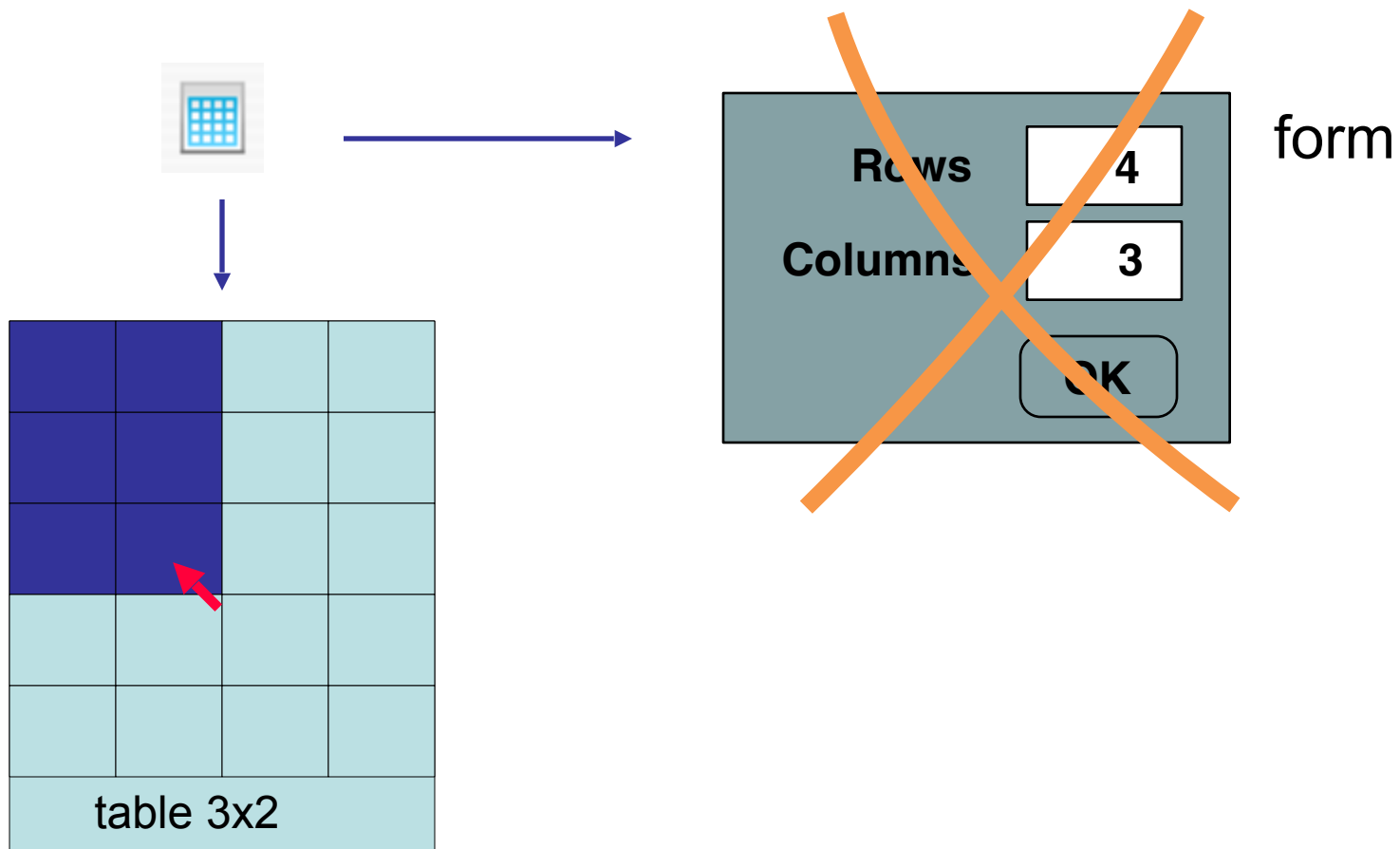


Free form



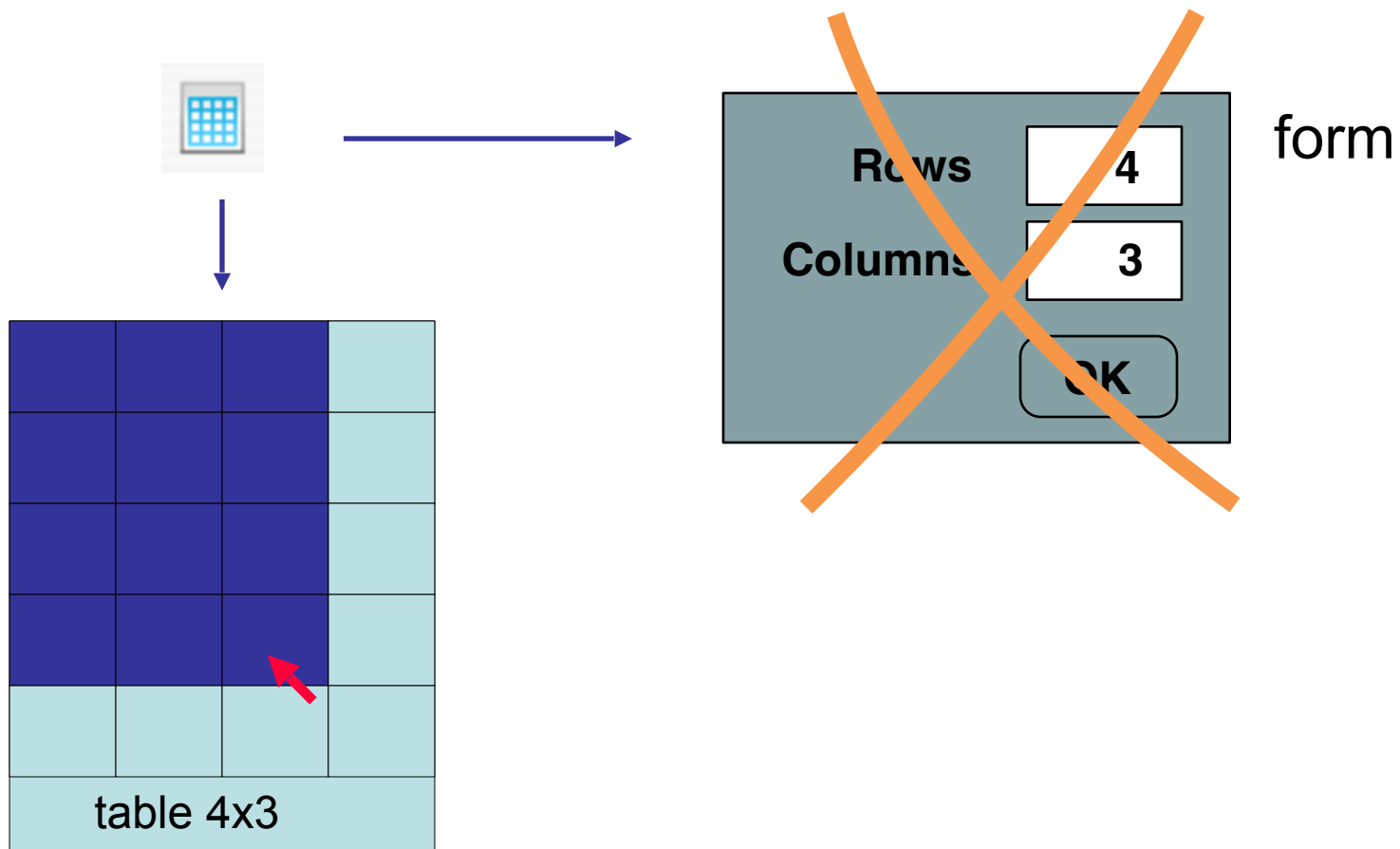
Input task

Adapt interaction to the type of value : size of a table



Input task

Adapt interaction to the type of value : size of a table



Selection task

Select one or more items in a set

Size of the set : small, medium, large

Content of the set : fixed or variable

Selection : one or more items

Selection task

Select one or more items in a set

Size of the set : small, medium, large

Content of the set : fixed or variable

Selection : one or more items

Fixed content, small/medium size

Single selection: Radio buttons, Combo box



Selection task

Select one or more items in a set

Size of the set : small, medium, large

Content of the set : fixed or variable

Selection : one or more items

Fixed content, small/medium size

Single selection: Radio buttons, Combo box



- Left
- Center
- Right

Selection task

Select one or more items in a set

Size of the set : small, medium, large

Content of the set : fixed or variable

Selection : one or more items

Fixed content, small/medium size

Single selection: Radio buttons, Combo box



- Left
- Center
- Right



Selection task

Select one or more items in a set

Size of the set : small, medium, large

Content of the set : fixed or variable

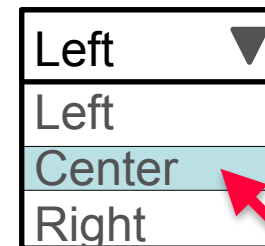
Selection : one or more items

Fixed content, small/medium size

Single selection: Radio buttons, Combo box



- Left
- Center
- Right



Selection task

Select one or more items in a set

Size of the set : small, medium, large

Content of the set : fixed or variable

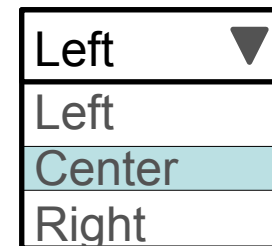
Selection : one or more items

Fixed content, small/medium size

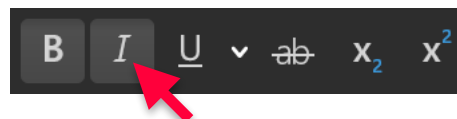
Single selection: Radio buttons, Combo box



- Left
- Center
- Right



Multiple selection: Checkboxes



Selection task

Select one or more items in a set

Size of the set : small, medium, large

Content of the set : fixed or variable

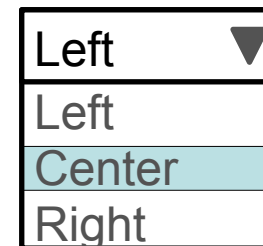
Selection : one or more items

Fixed content, small/medium size

Single selection: Radio buttons, Combo box



- Left
- Center
- Right



Multiple selection: Checkboxes



- Bold
- Italics
- Underline
- Strikethrough

Selection task

Select one or more items in a set

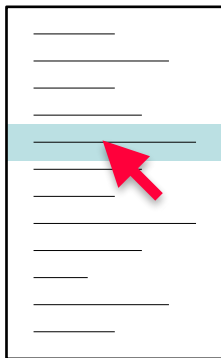
Size of the set : small, medium, large

Content of the set : fixed or variable

Selection : one or more items

Variable content, medium/large size

Simple selection : List, Hierarchical list, Icons



Selection task

Select one or more items in a set

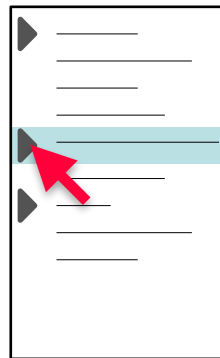
Size of the set : small, medium, large

Content of the set : fixed or variable

Selection : one or more items

Variable content, medium/large size

Simple selection : List, Hierarchical list, Icons



Selection task

Select one or more items in a set

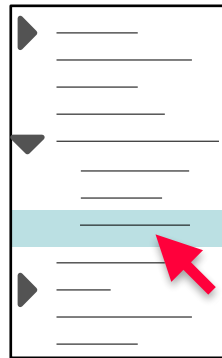
Size of the set : small, medium, large

Content of the set : fixed or variable

Selection : one or more items

Variable content, medium/large size

Simple selection : List, Hierarchical list, Icons



Selection task

Select one or more items in a set

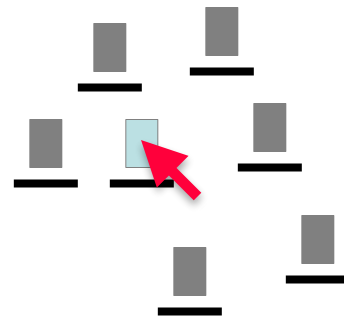
Size of the set : small, medium, large

Content of the set : fixed or variable

Selection : one or more items

Variable content, medium/large size

Simple selection : List, Hierarchical list, Icons



Selection task

Select one or more items in a set

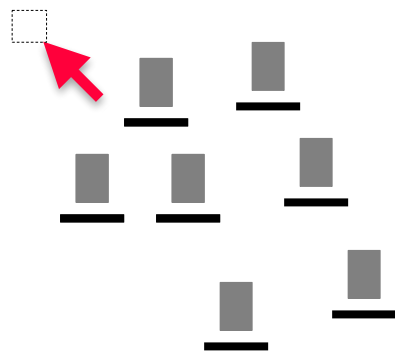
Size of the set : small, medium, large

Content of the set : fixed or variable

Selection : one or more items

Variable content, medium/large size

Multiple selection : by group, by interval, by add/remove



Selection task

Select one or more items in a set

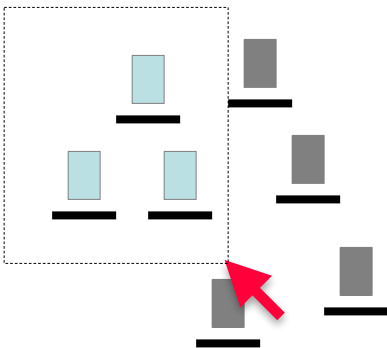
Size of the set : small, medium, large

Content of the set : fixed or variable

Selection : one or more items

Variable content, medium/large size

Multiple selection : by group, by interval, by add/remove



Selection task

Select one or more items in a set

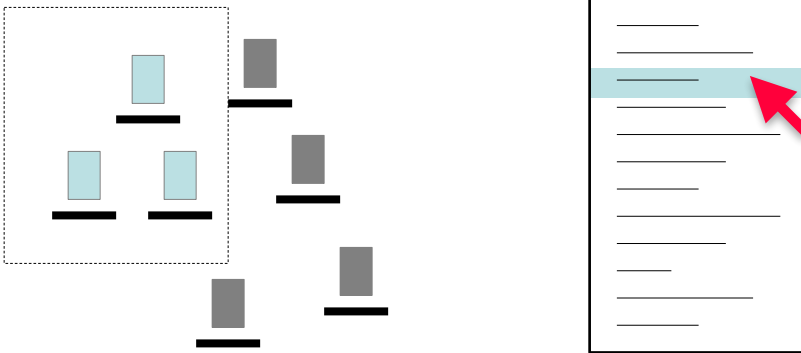
Size of the set : small, medium, large

Content of the set : fixed or variable

Selection : one or more items

Variable content, medium/large size

Multiple selection : by group, by interval, by add/remove



Selection task

Select one or more items in a set

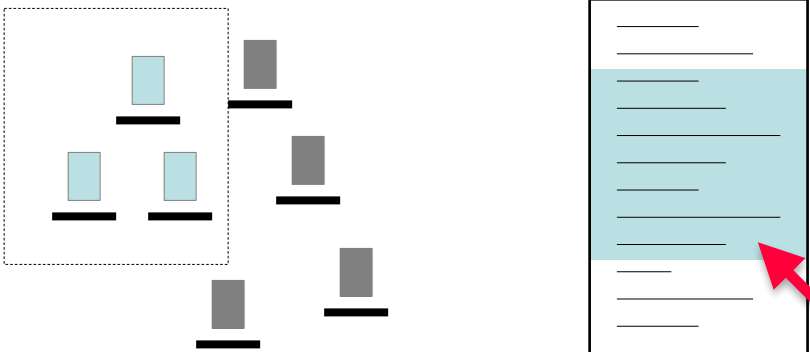
Size of the set : small, medium, large

Content of the set : fixed or variable

Selection : one or more items

Variable content, medium/large size

Multiple selection : by group, by interval, by add/remove



Selection task

Select one or more items in a set

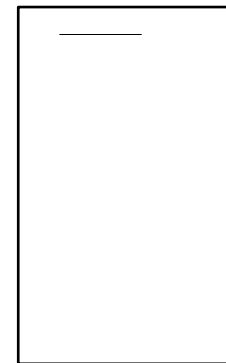
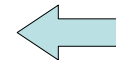
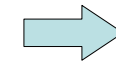
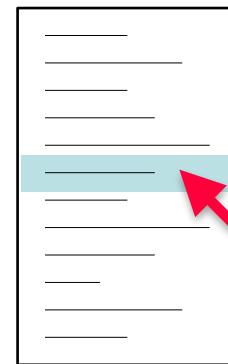
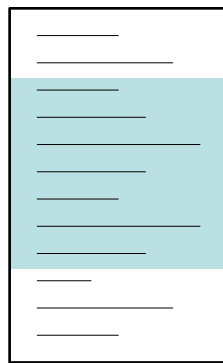
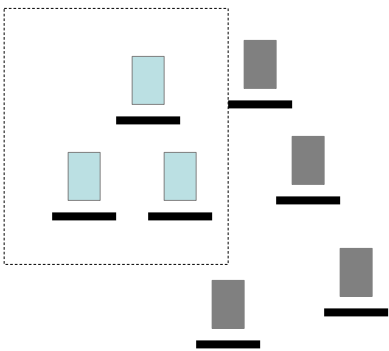
Size of the set : small, medium, large

Content of the set : fixed or variable

Selection : one or more items

Variable content, medium/large size

Multiple selection : by group, by interval, by add/remove



Selection task

Select one or more items in a set

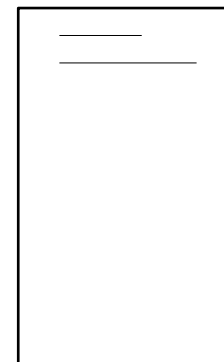
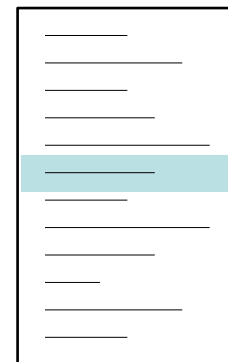
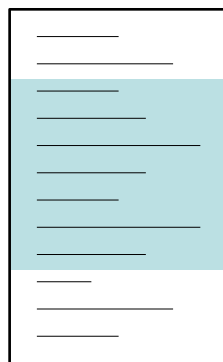
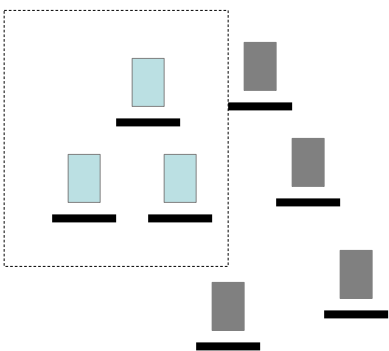
Size of the set : small, medium, large

Content of the set : fixed or variable

Selection : one or more items

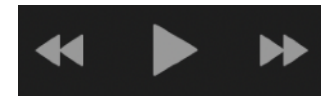
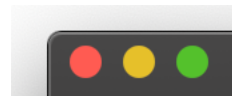
Variable content, medium/large size

Multiple selection : by group, by interval, by add/remove



Trigger task

Buttons



Links

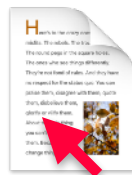
[Add comment](#)

mb1@lisn.fr

Drag-and-drop

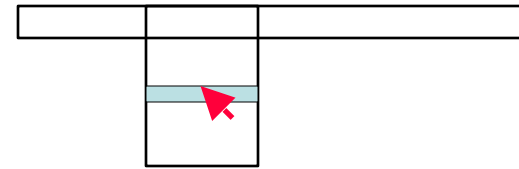
Move an object to a drop zone

The action depends on both the source and destination



Trigger tasks: Menus and palettes

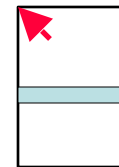
Menu bar +
pull-down menu



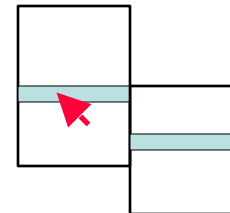
Tool palette



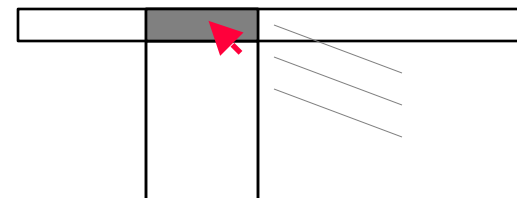
Pop-up menu



Hierarchical menus

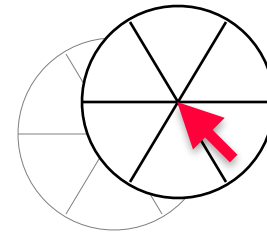
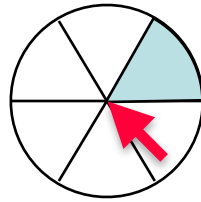


Pull-off menus



Trigger task: Radial menus

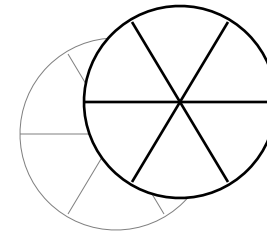
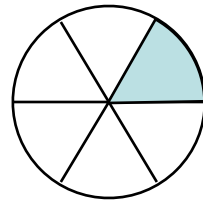
Pie Menus (Hopkins)



Selection three times as fast as a linear menu
but limited to 8 items

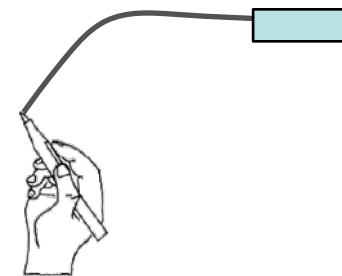
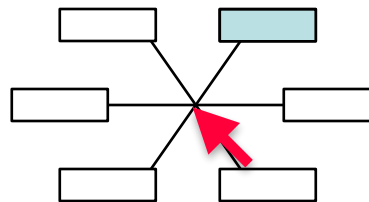
Trigger task: Radial menus

Pie Menus (Hopkins)



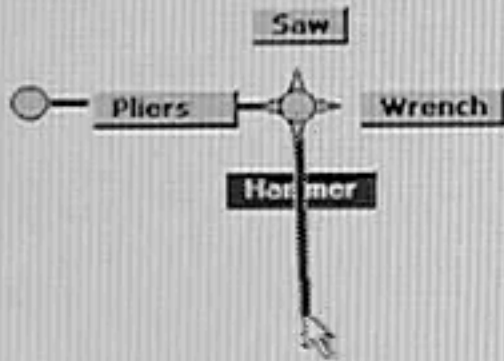
Selection three times as fast as a linear menu
but limited to 8 items

Marking menus (Kurtenbach)



Transition to expert mode : the menu is not displayed
when the selection gesture is executed quickly

Marking Menu



time: 1.19 secs.

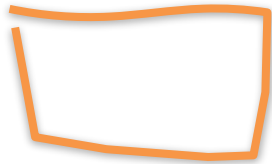
Hammer

Linear Menu

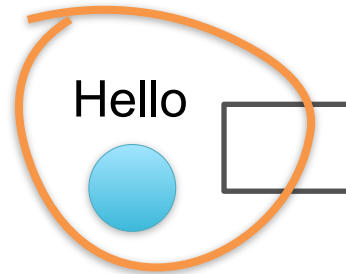
time: 1.58 secs.

Hammer

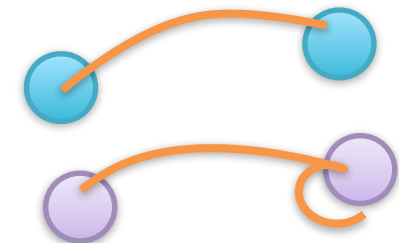
Trigger task: gestural input



Create



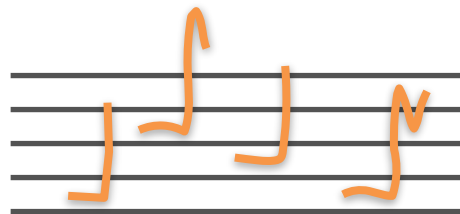
Select



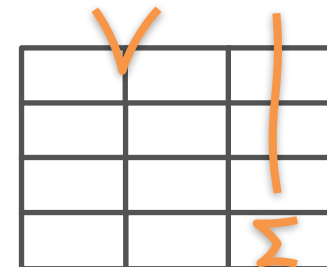
Move / Copy



Delete



Edit musical score



Edit spreadsheet



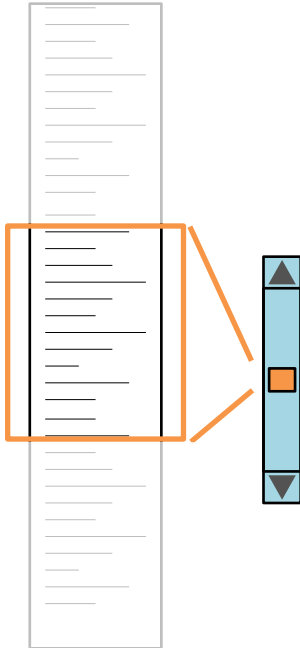
Octopus - Bau & Mackay, 2008

Navigation task

Access content that is not visible

Scrollbars

The thumb represents the position of the view in the document

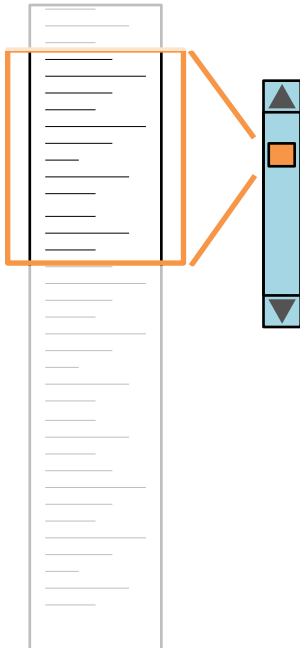


Navigation task

Access content that is not visible

Scrollbars

The thumb represents the position of the view in the document



Navigation task

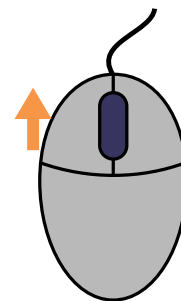
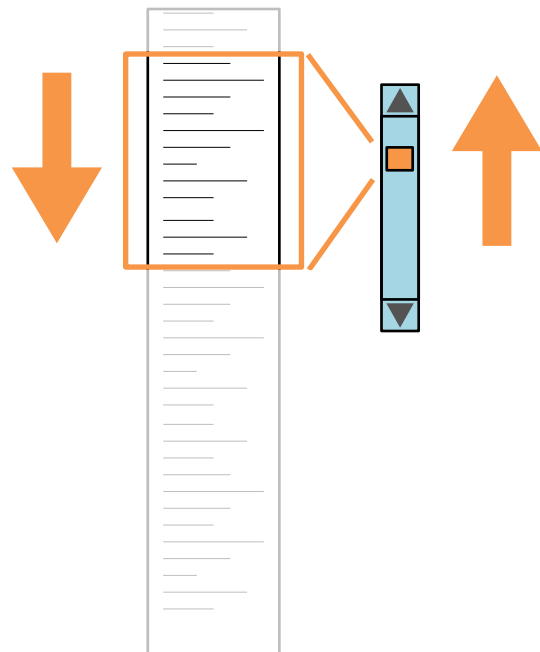
Access content that is not visible

Scrollbars

The thumb represents the position of the view in the document

Scrolling direction is the opposite of direction of motion of the thumb

Division of attention between scrollbar and content



The wheel controls
the thumb or
the document?



Amount of information

Navigation task

Access content that is not visible

Direct scrolling

Direct manipulation of the content



Navigation task

Access content that is not visible

Direct scrolling

Direct manipulation of the content



Navigation task

Access content that is not visible

Direct scrolling

Direct manipulation of the content



Navigation task

Access content that is not visible

Direct scrolling

Direct manipulation of the content

Automatic scrolling when reaching the side of the view



Navigation task

Access content that is not visible

Direct scrolling

Direct manipulation of the content

Automatic scrolling when reaching the side of the view



Navigation task

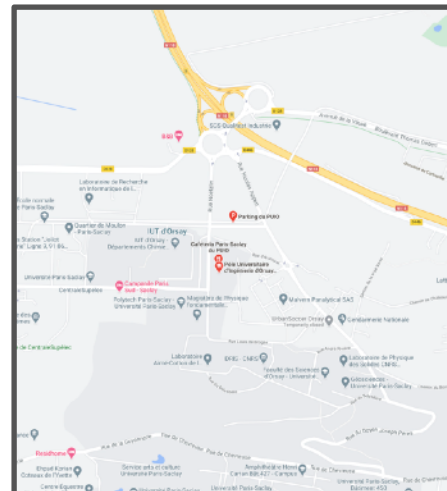
Access content that is not visible

Pan-and-Zoom

Zoom in to see detail

Pan to scroll

Zoom out to see context



Navigation task

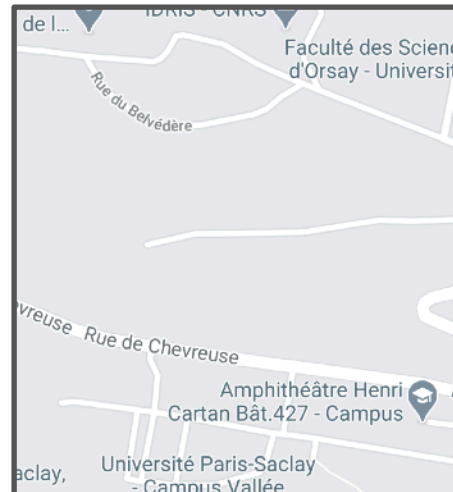
Access content that is not visible

Pan-and-Zoom

Zoom in to see detail

Pan to scroll

Zoom out to see context



Navigation task

Access content that is not visible

Pan-and-Zoom

Zoom in to see detail

Pan to scroll

Zoom out to see context



Navigation task

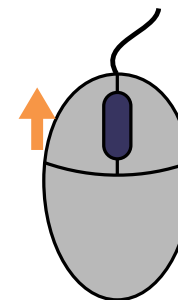
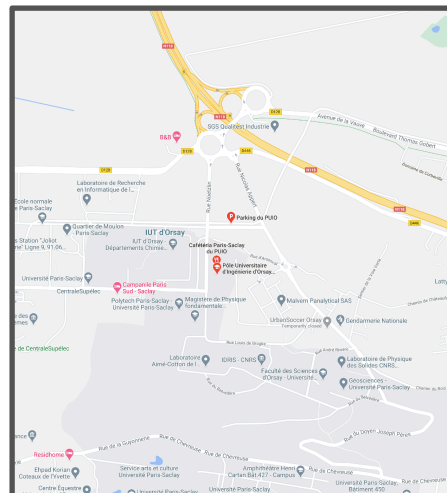
Access content that is not visible

Pan-and-Zoom

Zoom in to see detail

Pan to scroll

Zoom out to see context



Push the wheel
to zoom in
or to zoom out?

Navigation task

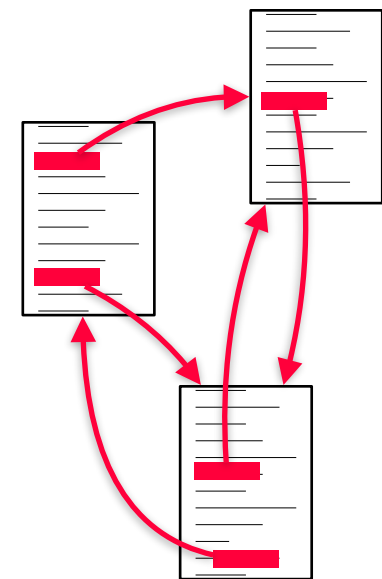
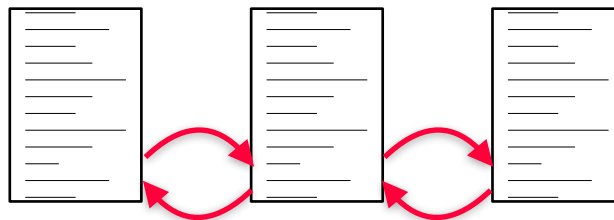
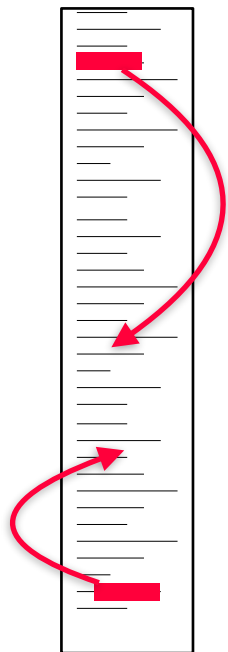
Access content that is not visible

Hypertext links or navigation buttons

Navigate to other part of the content (table of content, references, ...)

Navigate to next/previous page

Navigate to other content



Property and parameter specification task

Dialog boxes

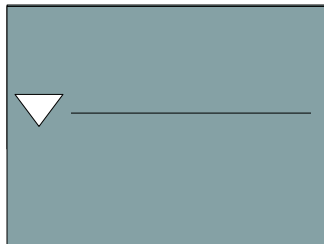
Fields + OK / Apply / Cancel buttons

Modal or non-modal



Temporal and spatial decoupling between the specification of the command, its parameters, and its execution

Optional parts



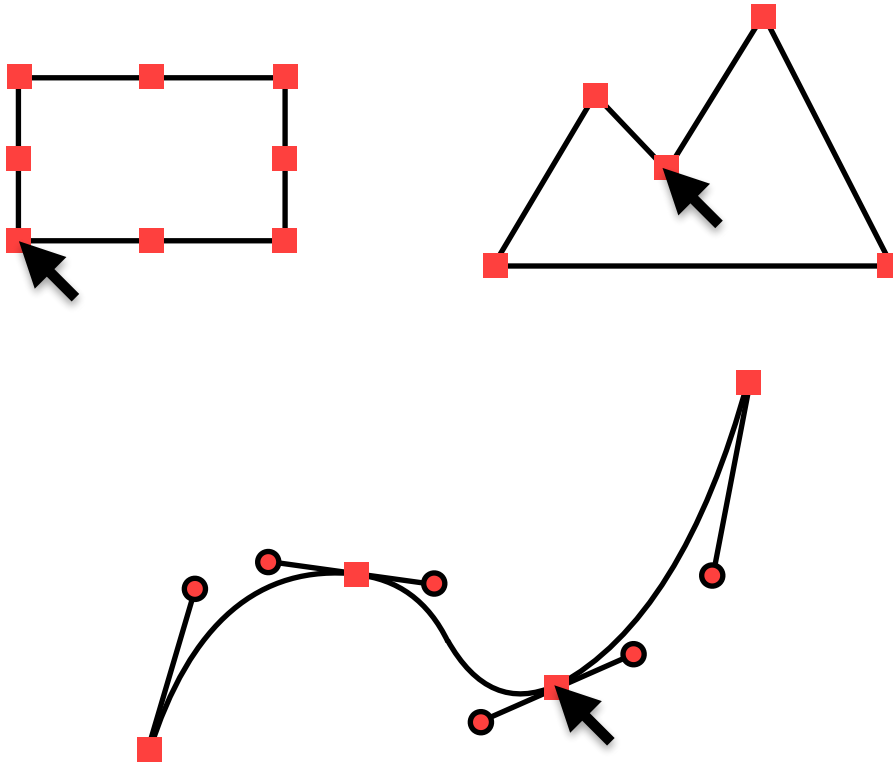
Tabs



Problem with OK button

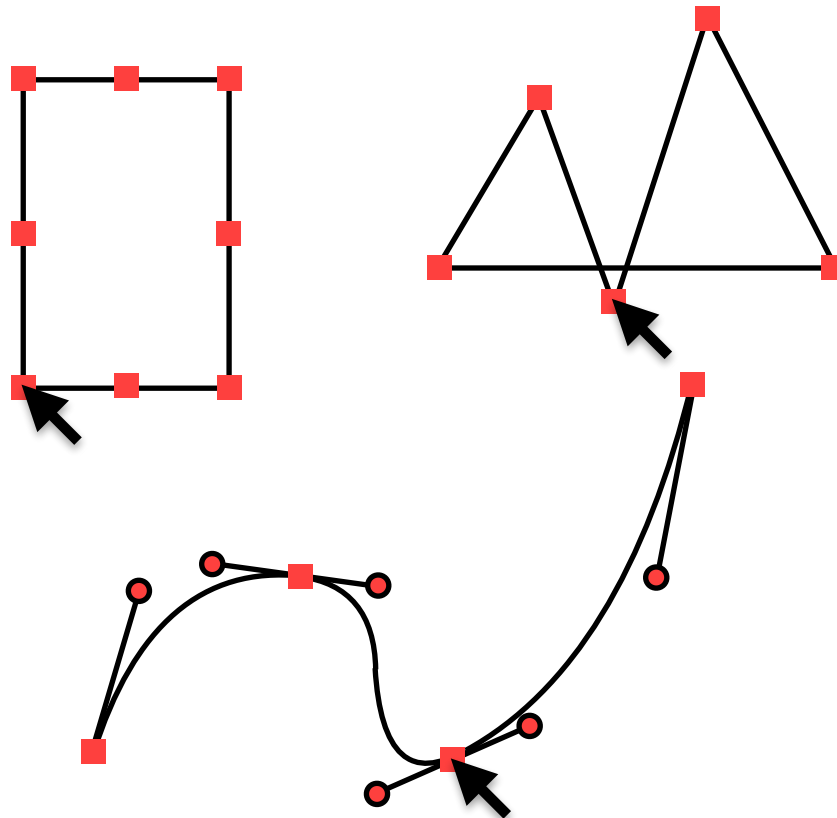
Transformation task

Manipulation handles



Transformation task

Manipulation handles



Conclusion

3 levels of analysis of graphical interaction

Basic actions:

Pointing, Activation, Dragging

Basic interaction tasks:

Input, Selection, Trigger, Navigation,
Property/parameter specification, Transformation

Interaction patterns:

[next lecture]

Conclusion

Direct manipulation vs. **Indirect manipulation**
Objects of interest Menus & Forms

Analyzing interfaces in terms of basic interaction tasks

Select (among existing info.) vs. **Input (new information)**

Recognition vs. **Recall**

Generic methods vs. specific ones

Exercise: analyze (multi-)touch interfaces