Programming of Interactive Systems
exam solutions
2011 and 2010
(2012 covered in class)

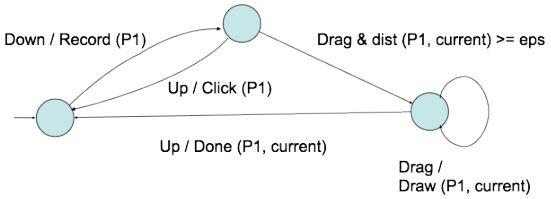
Reminder: State Machines

State machine reminder:

- State (circle) = interaction state NOT location of the application
- Transition (arc/link) = input events (Up, Down, Move, Drag, ...)

State machine

- actions associated with transitions (after the "/" symbol)
- guard conditions (boolean checks) associated with transitions (after the "&" symbol)

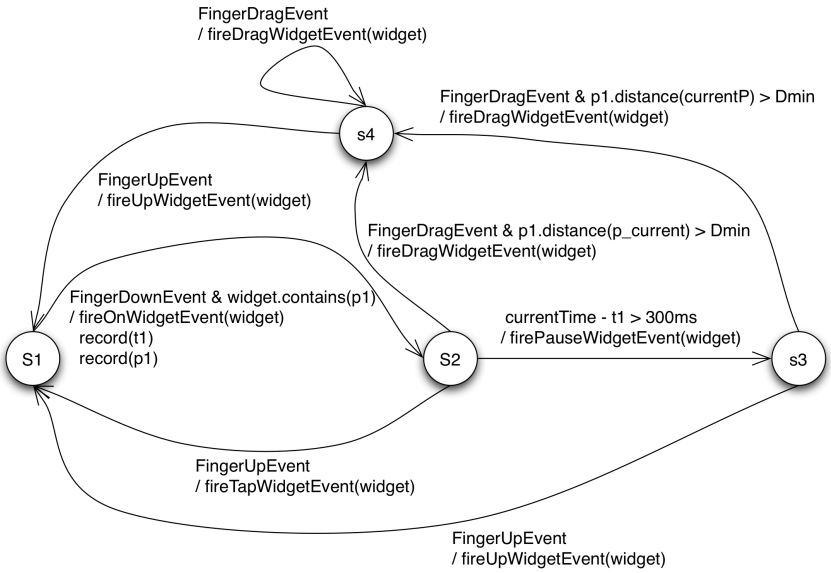


exercise 2010-P1.A

Create a state machine for a touch device:

- using low level events like
  - FingerDownEvent, FingerDragEvent, FingerUpEvent
  - that contain a contact position
  - the time between the start of the session and the event
- can detect events on widgets such as
  - OnWidgetEvent (place finger on widget),
  - ReleaseWidgetEvent,
  - TapWidgetEvent,
  - DragWidgetEvent,
  - PauseWidgetEvent (keep finger on widget > 300 msec)
  - Tap occurs when the time between On and Release is less than 300 msec and there is very little displacement

exercise 2010-P1.A solution



exercise 2011-A

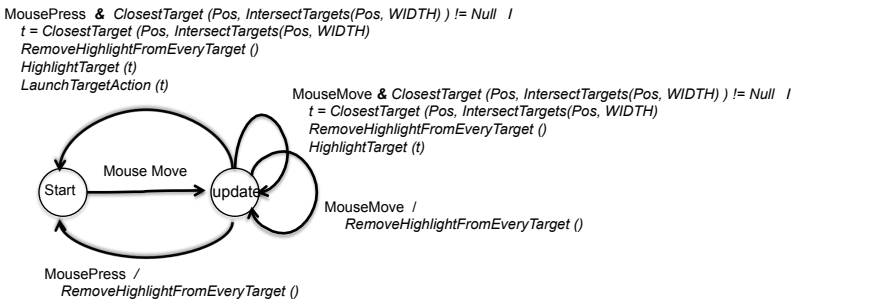
Create a state machine for 3 techniques:

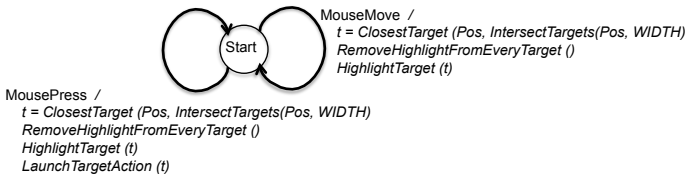
- Area cursor: area around cursor, can click on targets when inside
- Bubble cursor: closest target always selected on click
- Dynaspot:
  - area cursor of MAXWIDTH active when speed > MAXSPEED
  - when speed drops an animation starts that takes REDUCETIME during which the area of the cursor becomes smaller until 0 and the cursor becomes a regular cursor
  - during REDUCETIME we can accelerate, and go to area cursor

Can use:

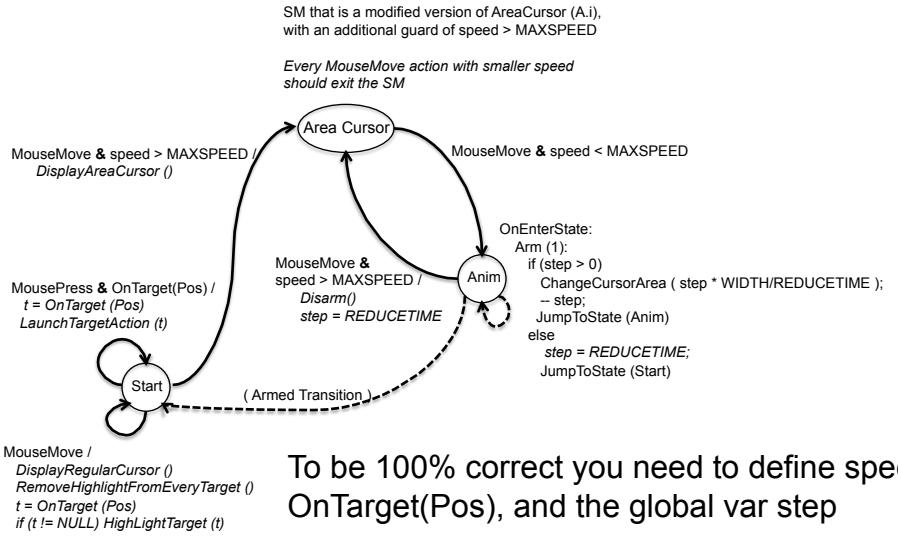
- List = IntersectTargets (mousePos, WIDTH)
- Target = ClosesTarget (mousePos, List)
- ResetTimer(), GetTime (): start a timer and see time passed
- TimeOut (programmable) event to start after n sec with Arm(n), a fuction Disarm() cancels the Arm call if TimeOut has not started

exercise 2011- Solution A.i & A.ii



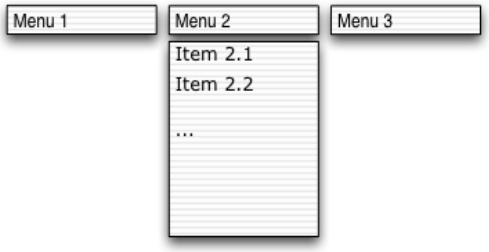


exercise 2011- Solution A.iii



To be 100% correct you need to define speed, OnTarget(Pos), and the global var step

exercise 2010-P1.B

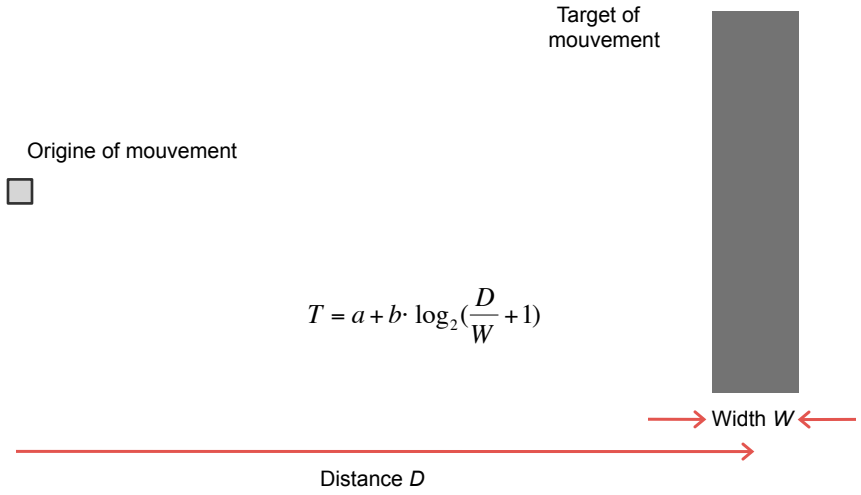


Critique different ways of improving a menu

- double size of targets
- order alphabetically
- order by frequency of use
- group items semantically

using criteria from human performance and models

exercise 2010-P1.B: Fitts' law



exercise 2010-P1.B: Hick-Hyman's law

Describes the time to take a simple decision as a function of number of choices

$T = a + b \cdot \log_2(n+1)$

n : number of choices
a, b : constants

We divide the total number of choices and re - search : binary search

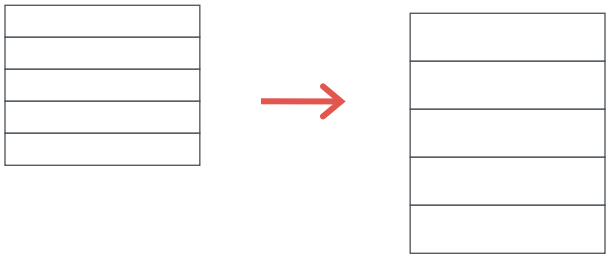
exercise 2010-P1.B: other factors

memorisation

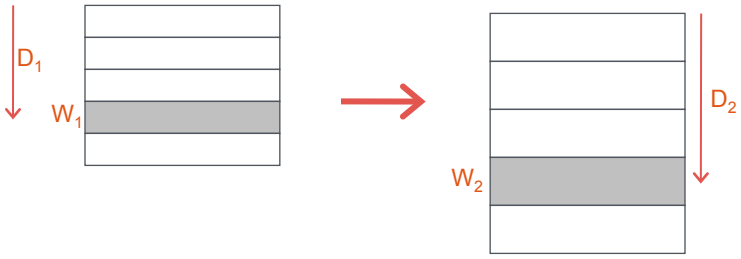
visual search

…

exercise 2010-P1.B: enlarge item size



exercise 2010-P1.B: enlarge item size

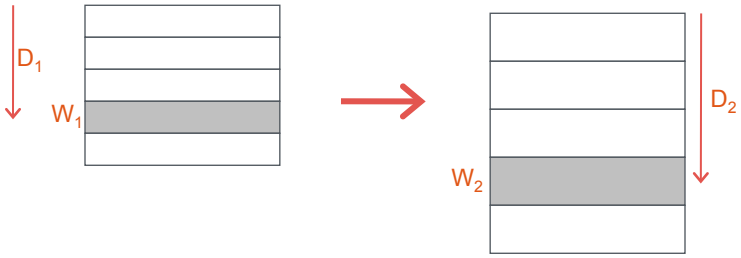


$$T_1 = a + b \cdot \log_2(\frac{D_1}{W_1} + 1)$$

$$T_2 = a + b \cdot \log_2(\frac{D_2}{W_2} + 1)$$

$$T_2 \overset{?}{<} T_1$$

exercise 2010-P1.B: enlarge item size



$$T_1 = a + b \cdot \log_2(\frac{D_1}{W_1} + 1)$$

$$T_2 = a + b \cdot \log_2(\frac{D_2}{W_2} + 1)$$

$$W_2 = \alpha \cdot W_1 \Rightarrow D_2 = \alpha \cdot D_1$$
$$\Rightarrow T_2 = T_1$$

exercise 2010-P1.B: alphabetical order

Find France !

Allemagne
Belarus
Bulgarie
Espagne
France
Italie
Irlande
Islande
Lettonie
Norvège
Pologne

logarithmic

Norvège
Irlande
Islande
Lettonie
Allemagne
Bulgarie
Italie
Pologne
Espagne
France
Belarus

linear

exercise 2010-P1.B: alphabetical order

Allemagne
Belarus
Bulgarie
Espagne
France
Italie
Irlande
Islande
Lettonie
Norvège
Pologne

Disadvantages?

exercise 2010-P1.B: selection frequency

Benefits acording to Fitts' law ?

$$\overline{T} = \sum_{i=1}^{N} (a + b \cdot \log_2(\frac{D_i}{W} + 1)) / N$$

Is the mean movement time different?

exercise 2010-P1.B: selection frequency

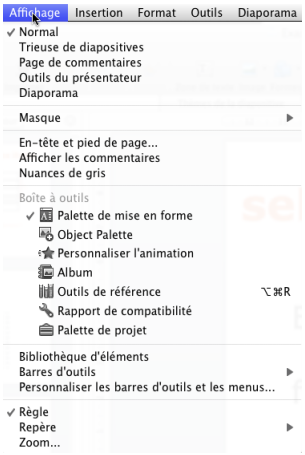
And the time for visual search ?

factors

... before and after the « stabilization » of frequencies
... distribution of selections

and memorization of the item position ?

exercise 2010-P1.B: grouping of items

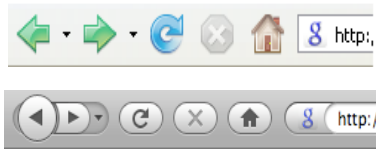


advantages and disadvantages ?

exercise 2011-B

Critique these 2 interfaces based on different (given) criteria

exercise 2012-B : Fitts' law



Top better because all buttons are bigger

or

Bottom better because "back" is bigger and most frequent action

exercise 2012-B : Gestalt laws

bar 1 (left):
Similarity: the first 2 icons similar (Shape and Colour) and different from the rest because of colour
Proximity: not really followed
Bad Closure: targets not grouped and boundaries not visible

bar 2 (right):
Similarity: the first 2 icons similar in Shape and Colour BUT their actual button shape is different, making grouping weaker
Similarity: all buttons look like buttons (including the "g" which in the other bar does not look like a widget)
Proximity: the first 2 buttons are closer together than all the rest, thus forming a group
Closure: the first 2 buttons are inside an enclosure (making them grouped together as related). All other buttons also enclosed to show individual functionality and clear boundaries.

exercise 2012-B : Attention

Information well organized (salient) in bar 2, with groups of related buttons

Less distraction in bar 2 (in bar 1 multiple colors attempt to attract attention). Clearer what is a button in bar 2

In bar 2 important info clearer (larger back button), but in bar 1 larger buttons in general

In bar 2 less clutter (with less color) but also with using one re-visitation list with the entire history (bar 1 has two history lists one for fwd and one for back)

exercise 2012-B : Feedback/Feedfwd

Both gray-out buttons for impossible actions ("Stop") and list of history for FF

Where users can input text is clear (text box) for FF

Clicking options clearer in bar 2 (buttons look like buttons and not images)

Bar 2 has a better grouping of actions to guide users in what to use (e.g. back very close to fwd)

In bar 2 attention is attracted by larger button, in bar 1 colours

exercise 2010-P1.C

Creative exercise asks to

- chose a method for "understanding users" for a magazine layout done on tabletop, explain your choice
- come up with a metaphor, constraint, and interaction technique for this setting

User needs :

Questionnaires
Observation
Interviews
Focus groups
Previous documentation
…

Which method and why ?

Metaphor ?
Constraint ?
Interaction Technique ? How to describe it ?

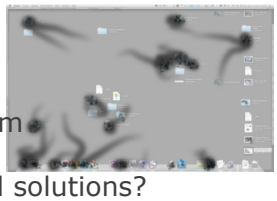
exercise 2011-D

An adaptive interaction technique adjusts CD gain at different screen areas depending on how often and for how long users visit them (at start all CD = 1)

Assuming that highly visited areas where the cursor moves slowly are dense, we reduce CD gain to make interaction more detailed/precise

We increase the CD of unvisited areas or areas the cursor moves fast as they likely do not contain interesting targets

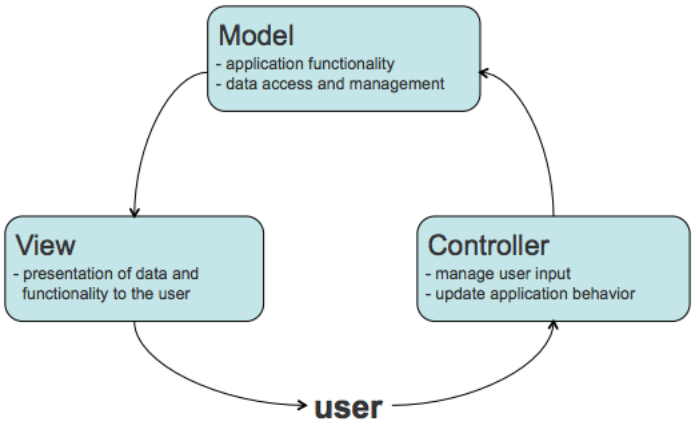
We show visual feedback of "dense" areas and the algorithm continues to adapt



How to implement the algorithm?
Identify the important aspects of the algorithm and present them on the MVC model
What are the drawbacks of the technique and solutions?

exercise 2012-D

MVC (Model View Controller)



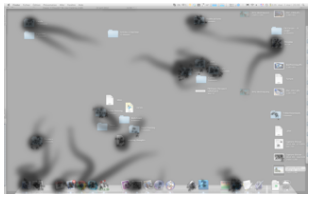
exercise 2012-D

Understand the algorithm (an implementation):

- Represent screen as a grid and create storage for cells
- During interaction add a counter to visited cells
  - (for every 10msec spent on a cell)
- Every 10 registered interaction events
  - Lower the CD gain for top 10%
  - Increase visual "trails" of every CD gain < 1
  - Up the CD gain for bottom 10%

Model: storage, timer & counter, checks and up/lower CD gains
Controller: notify Model of interaction updates, apply CD gain
View: update trails, cursor

Problems: cases of icon movement,
accidental crossing of "dense" area
Solution: track objects, use cursor velocity
as an indicator for updating the CD grid



other exercises

See an interface and identify listeners and which widgets they affect (use the more precise listener)

Critique and redesign an interface