

Designing Interactive Systems 1

Lab 1: Fitts' Law, CMN Model, Assignment 1: Fitts' Law

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Winter term 2019/20
<http://hci.ac/dis>



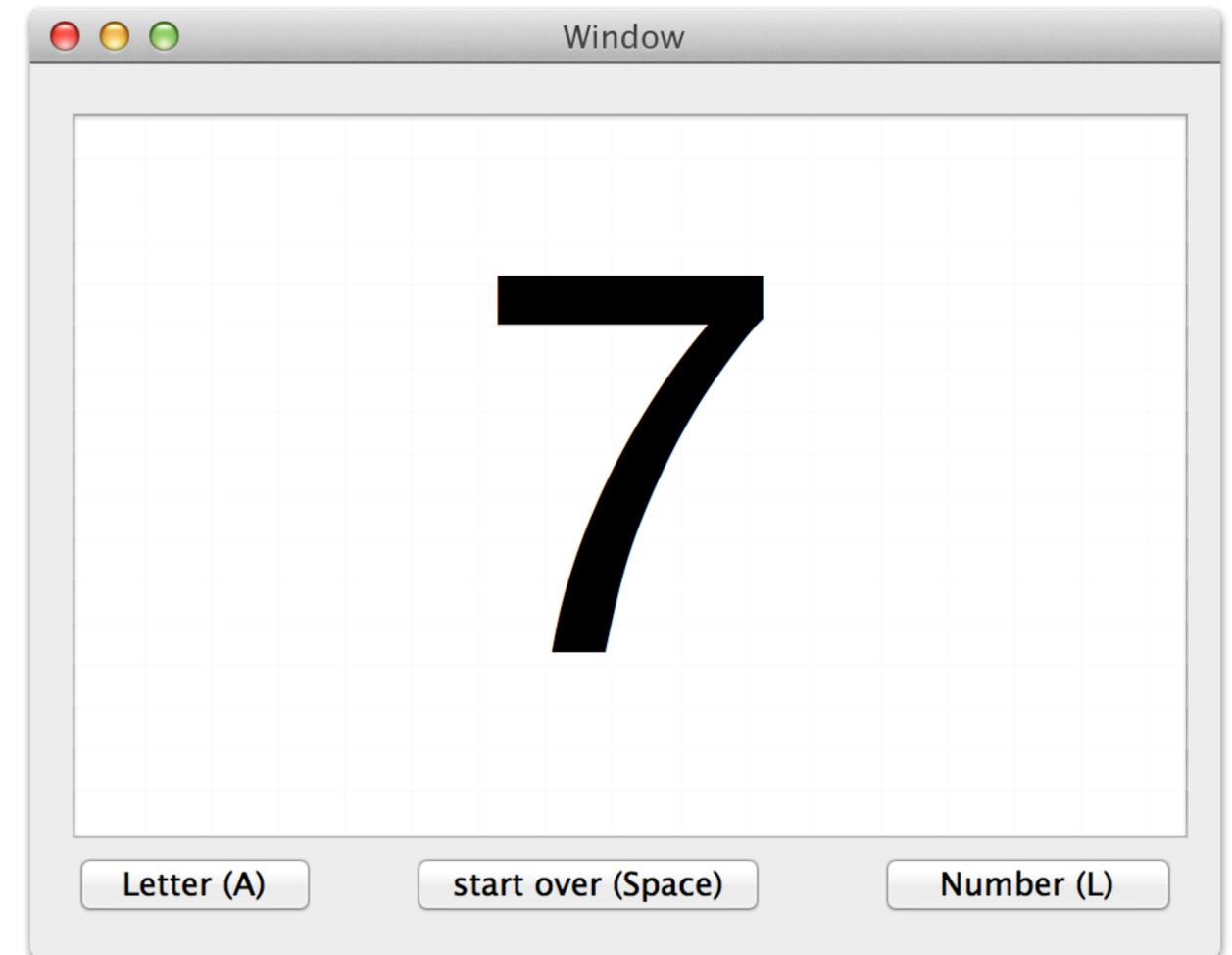
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CMN Model



In-Class Exercise 1

- A letter or a number is displayed randomly
- User has to press A (left) or press L (right) accordingly
- Assumption: user's fingers are already on these keys
- Calculate the average time the user needs to press the correct button



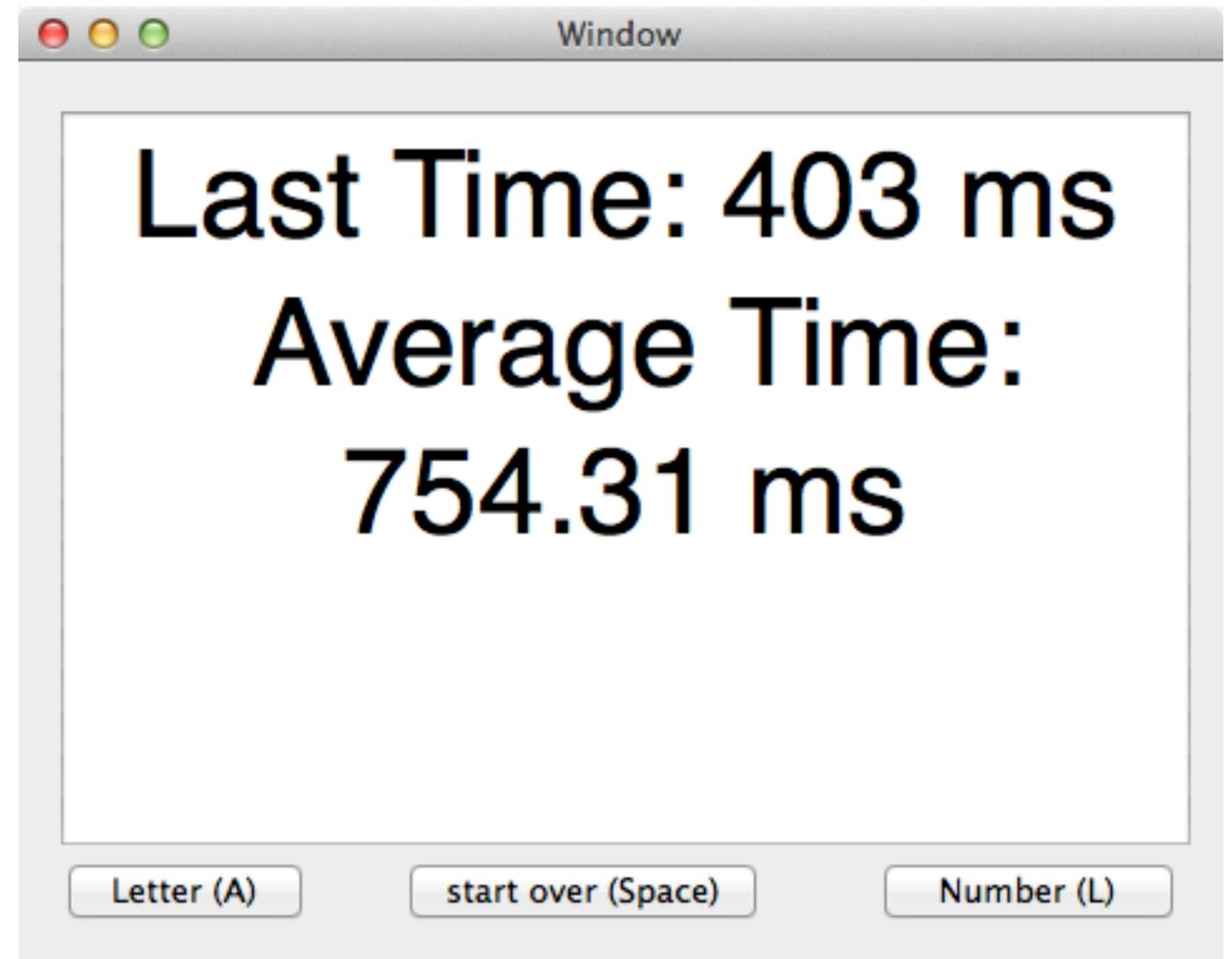
Solution

- Perceptive: 100 ms
- Cognitive (semantic recognition): 70 ms
- Cognitive (categorization): 70 ms
- Cognitive (left or right?): 70 ms
- Cognitive (do something!): 70 ms
- Motor: 70 ms
- Adds up to approximately 450 ms

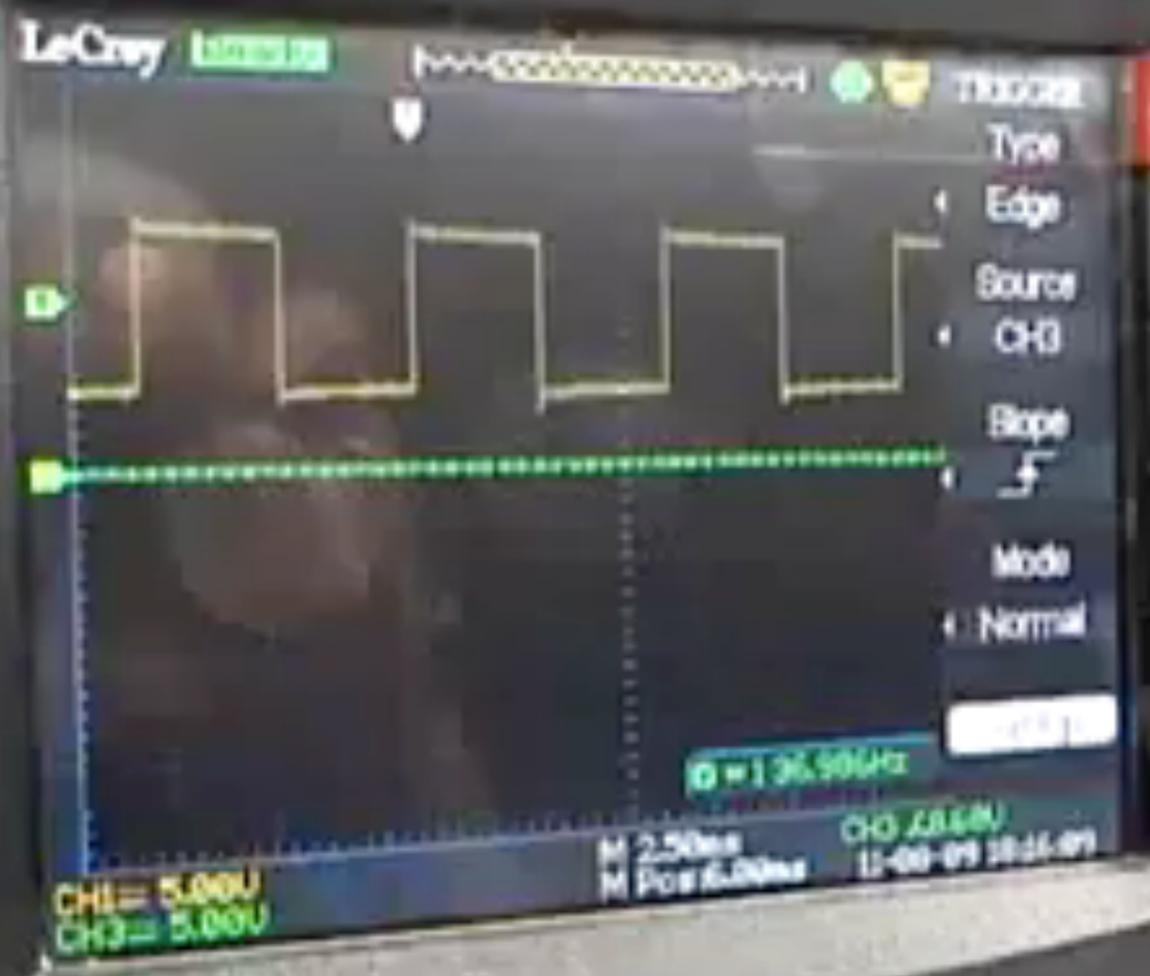


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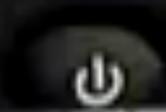


LeCroy WavePro 224 200 MHz Oscilloscope 1 GHz



Control panel of the oscilloscope featuring various knobs, buttons, and connectors.

- Buttons: Run, Stop, Single, Multi, Hold, Trigger, Preset, Help, and other function buttons.
- Knobs: Vertical position, Vertical scale, Horizontal position, Horizontal scale, and other control knobs.
- Connectors: BNC connectors for Channel 1, Channel 2, and other inputs.

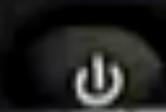


LeCroy WavePro 224 200 MHz Oscilloscope 1 GHz



- Type
- Edge
- Source
- CH0
- Slope
- Mode
- Normal

Control panel of the oscilloscope featuring a grid of buttons, several rotary knobs, and a red emergency stop button. The buttons are arranged in a structured layout, and the knobs are used for adjusting various parameters. The red stop button is located near the top right of the panel.





iPad

Video: <http://tinyurl.com/y8ax6ubq>

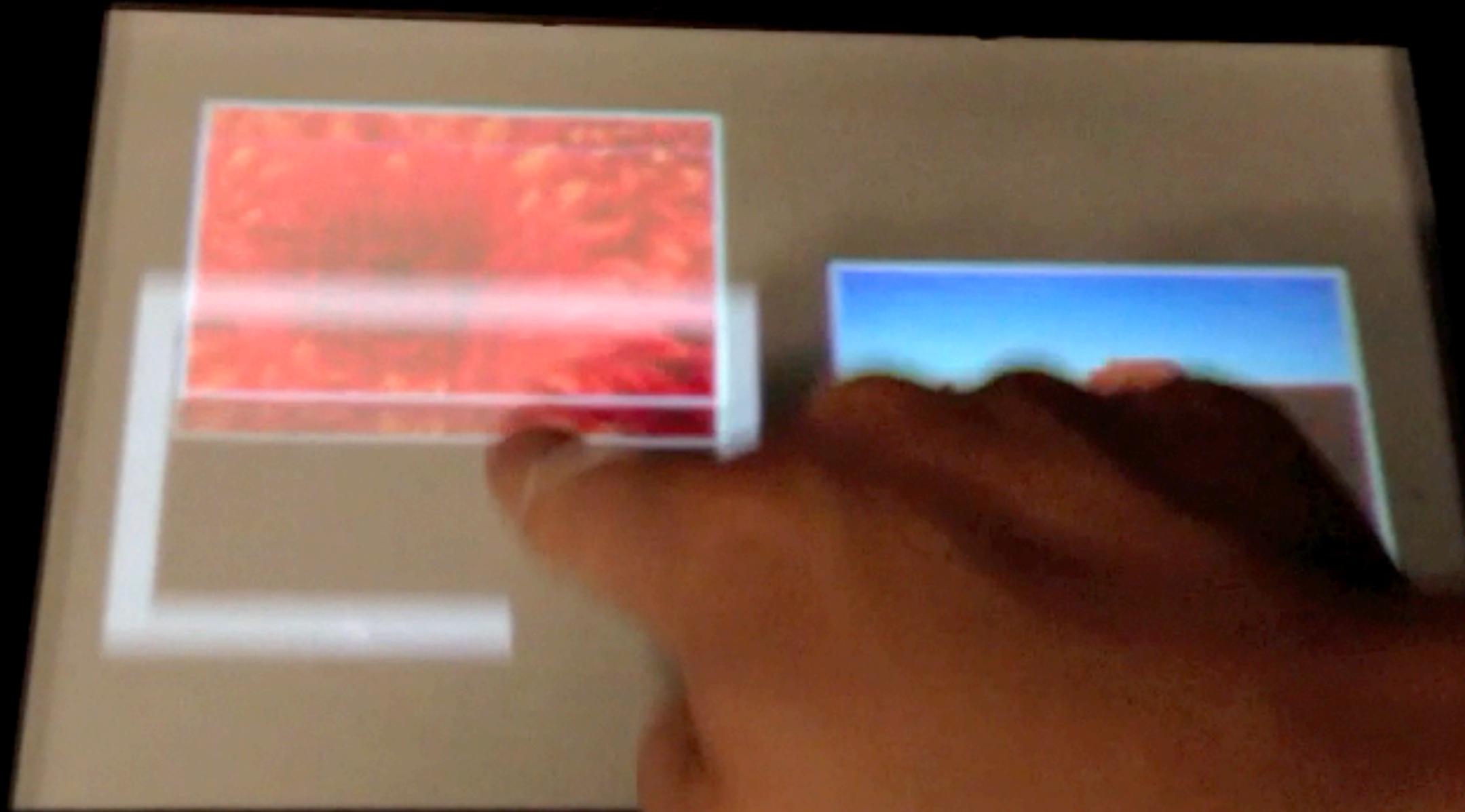
Footage taken at x8 speed



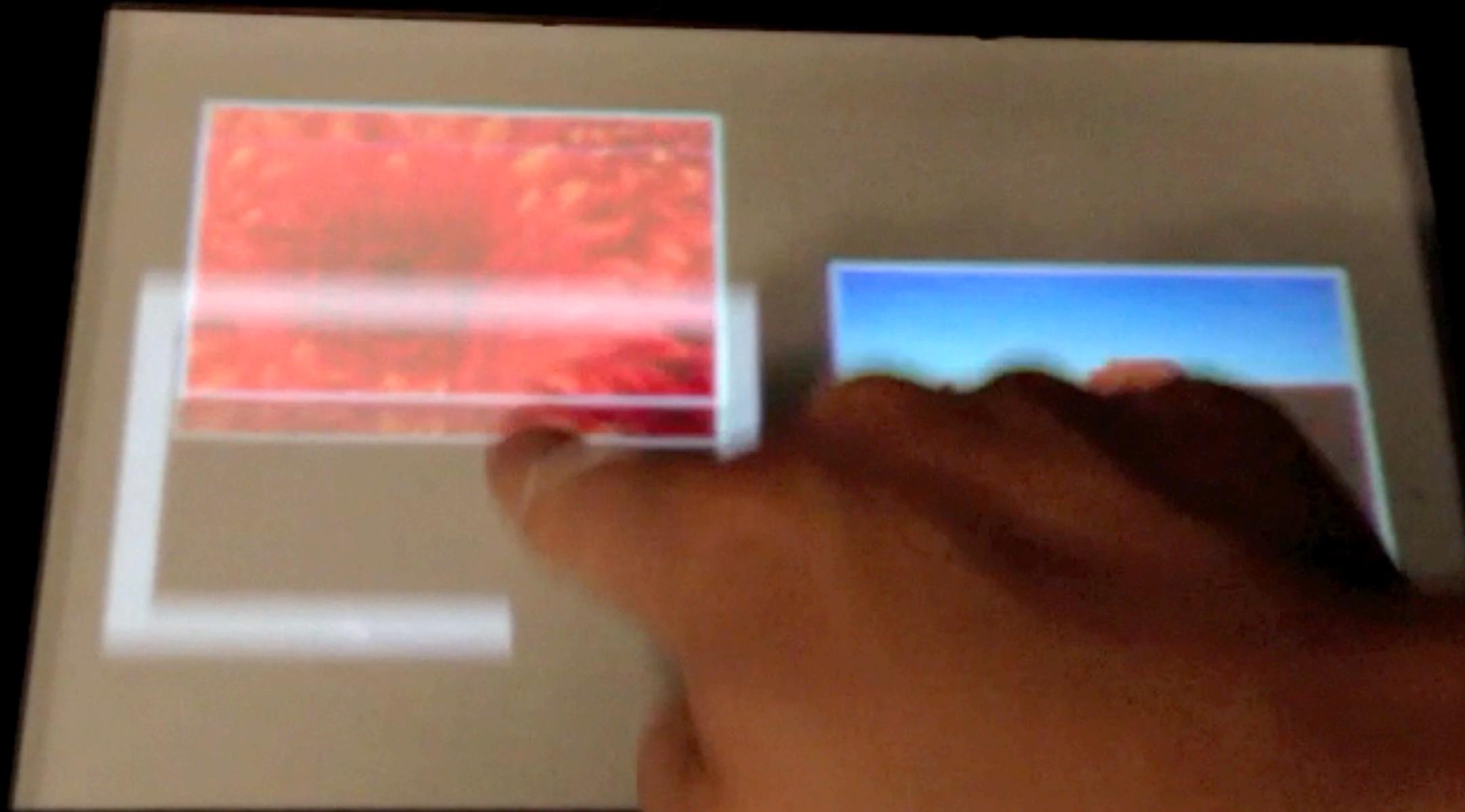
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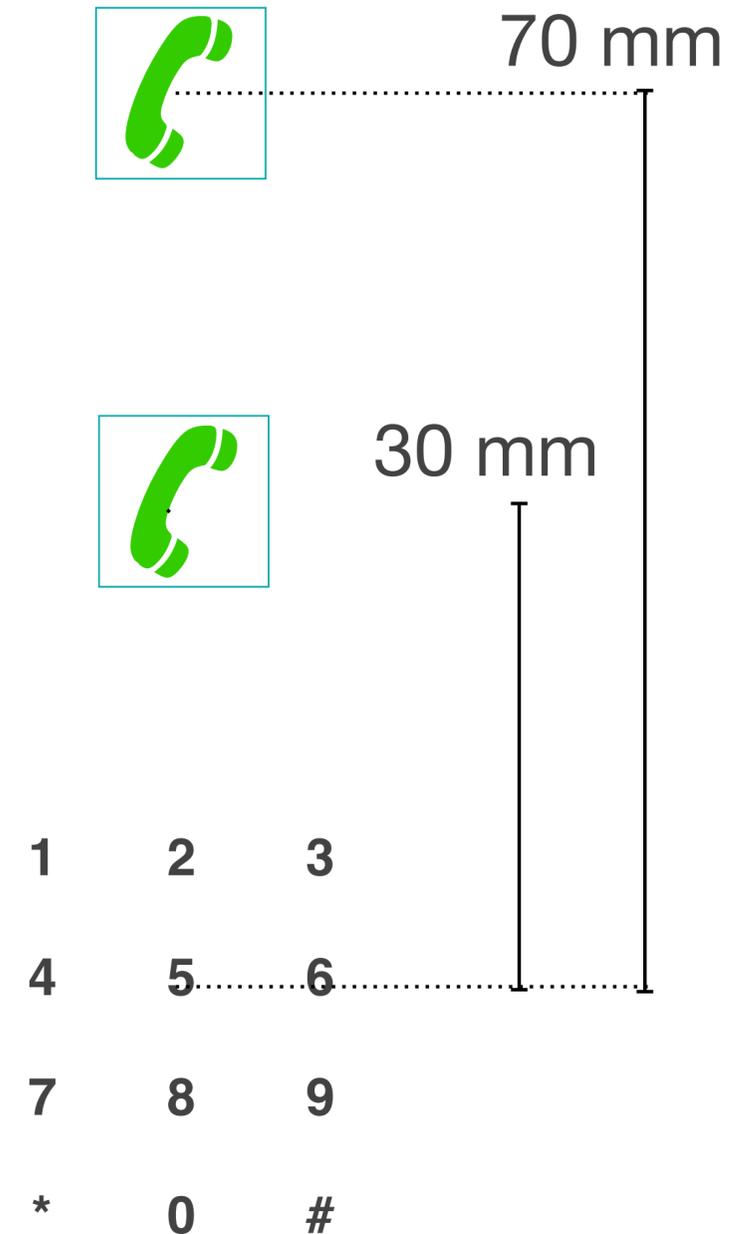
Video: <http://tinyurl.com/y8ax6ubq>

Fitts' Law



In-Class Exercise 2

- How much faster does calling become by moving the “call” button from **70 mm** distance to **30 mm** distance, measured from the middle of the keypad? The size of the call button is **10 x 10 mm**
- Shannon’s formulation: $T_{pos} = a + b \cdot \log_2 \left(\frac{D}{W} + 1 \right)$
- Use **a = 0 ms**, **b = I_M = 100 ms/bit**



Solution

$$T_{pos1} = I_M \cdot \log_2 \left(\frac{D_1}{W} + 1 \right)$$

$$T_{pos2} = I_M \cdot \log_2 \left(\frac{D_2}{W} + 1 \right)$$

$$\begin{aligned} T_{pos1} - T_{pos2} &= I_M \cdot \left(\log_2 \left(\frac{D_1}{W} + 1 \right) - \log_2 \left(\frac{D_2}{W} + 1 \right) \right) \\ &= 100 \frac{ms}{bit} \cdot \left(\log_2 \left(\frac{70}{10} + 1 \right) - \log_2 \left(\frac{30}{10} + 1 \right) \right) \text{ bit} \\ &= 100 \text{ ms} \cdot (\log_2 8 - \log_2 4) \\ &= 100 \text{ ms} \cdot (3 - 2) \\ &= 100 \text{ ms} \end{aligned}$$

⇒ Moving the call button speeds up each call by an average of about 100 ms.

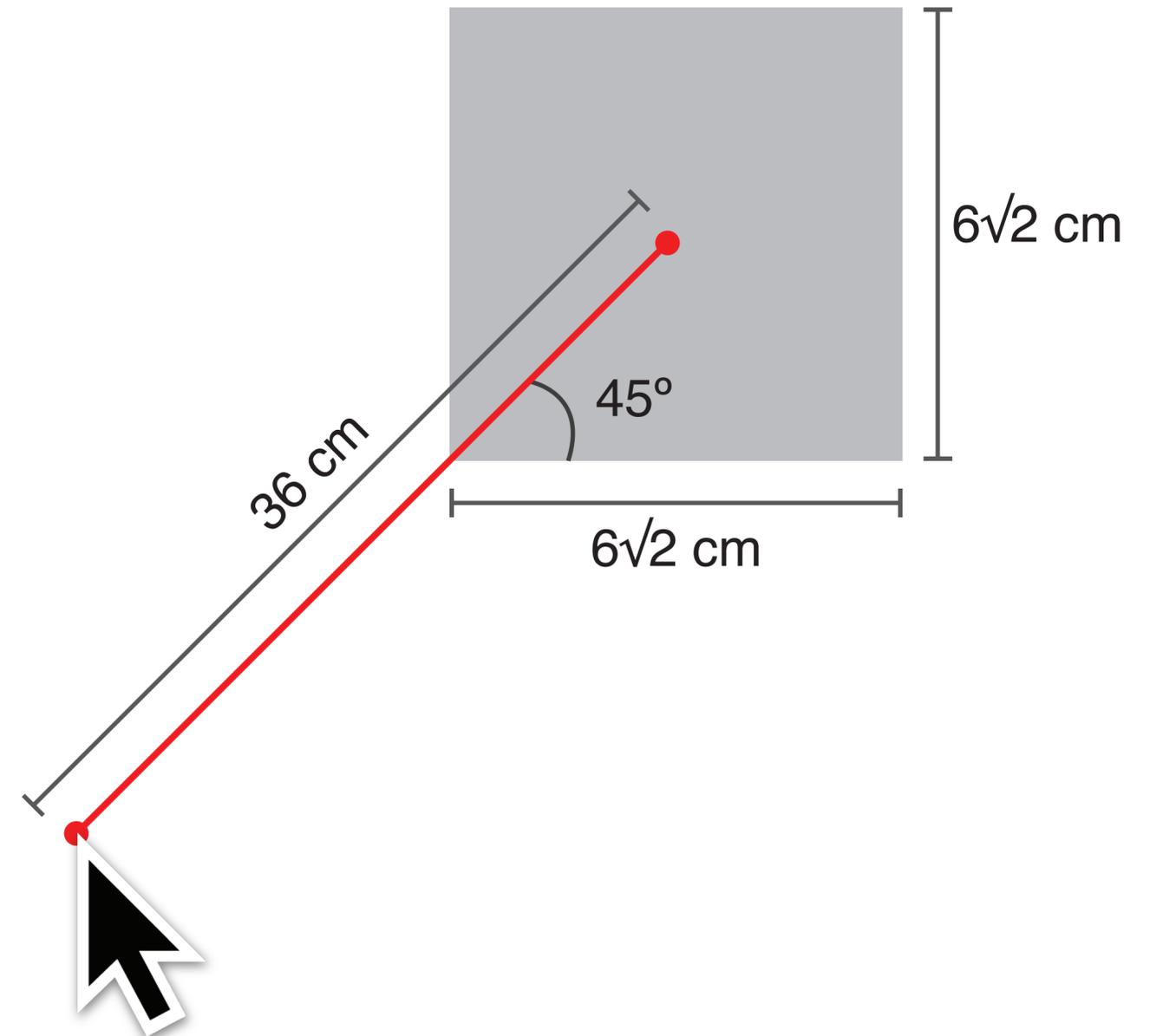
In-Class Exercise 3

- **Task:** Calculate the average time (in *ms*) needed to reach the button.
- You don't need a calculator

$$\text{Shannon's Formula : } T_{\text{pos}} = a + b \cdot \log_2 \left(\frac{D}{W} + 1 \right)$$

$$a = 0 \text{ ms}$$

$$b = I_M = 100 \frac{\text{ms}}{\text{bit}}$$



Solution

Shannon's Formula : $T_{pos} = a + b \cdot \log_2 \left(\frac{D}{W} + 1 \right)$

$$a = 0 \text{ ms}$$

$$b = I_M = 100 \frac{\text{ms}}{\text{bit}}$$

Distance, $D = 36 \text{ cm}$

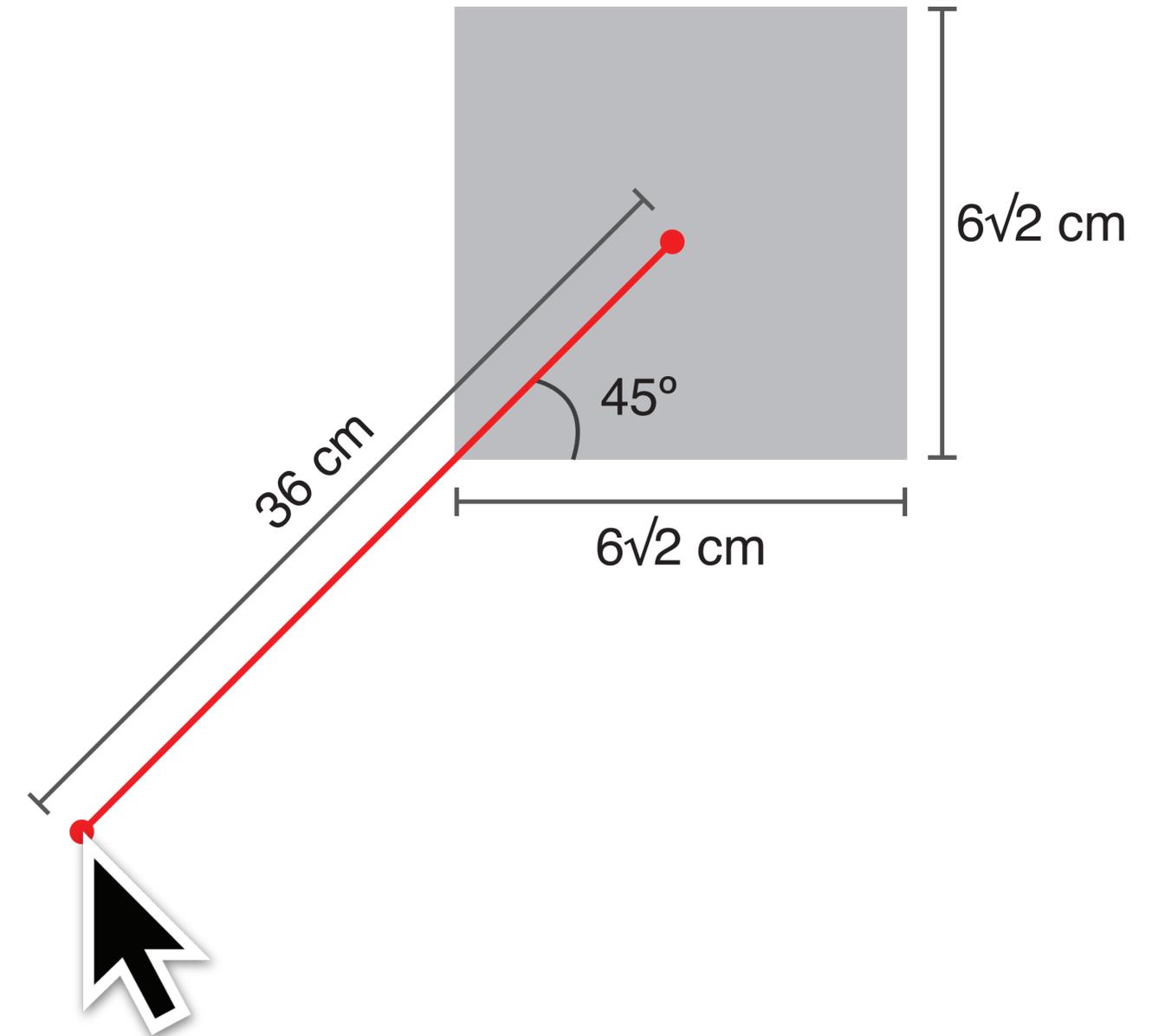
Side of the square, $r = 6\sqrt{2} \text{ cm}$

Target width, $W = \sqrt{r^2 + r^2} \text{ cm}$

$$= r\sqrt{2} \text{ cm}$$

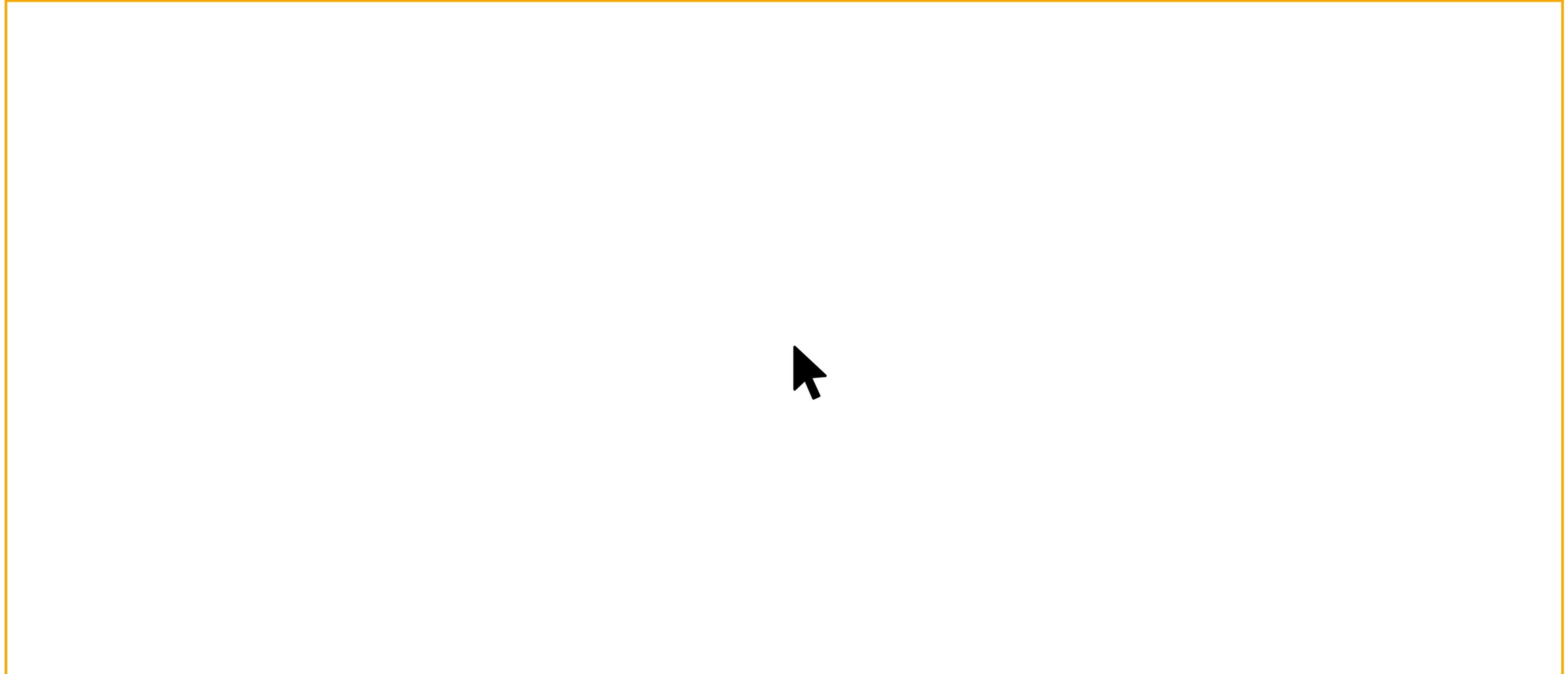
$$= 6\sqrt{2} \cdot \sqrt{2} \text{ cm}$$

$$= 12 \text{ cm}$$

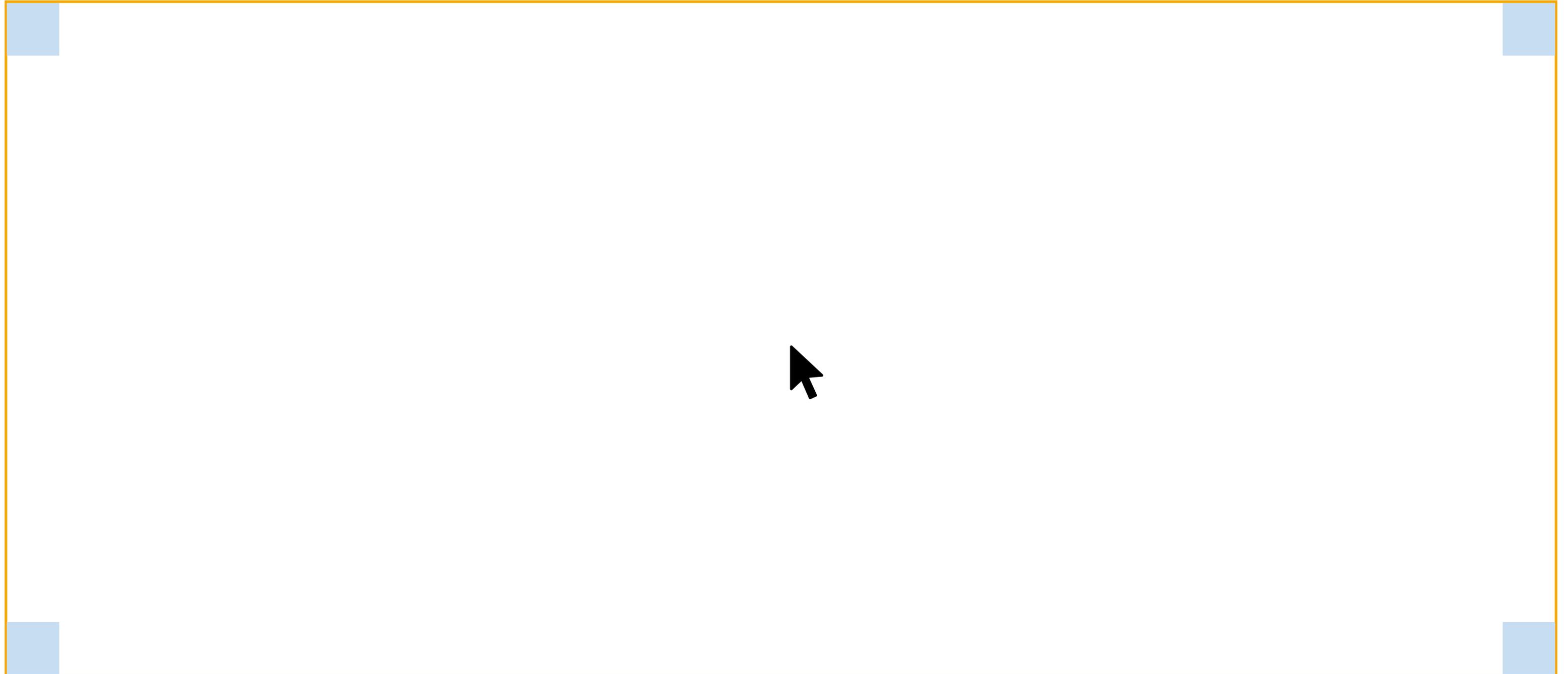


$$T_{pos} = 0 \text{ ms} + 100 \frac{\text{ms}}{\text{bit}} \cdot \log_2 \left(\frac{36}{12} + 1 \right) \text{ bit}$$
$$= 200 \text{ ms}$$

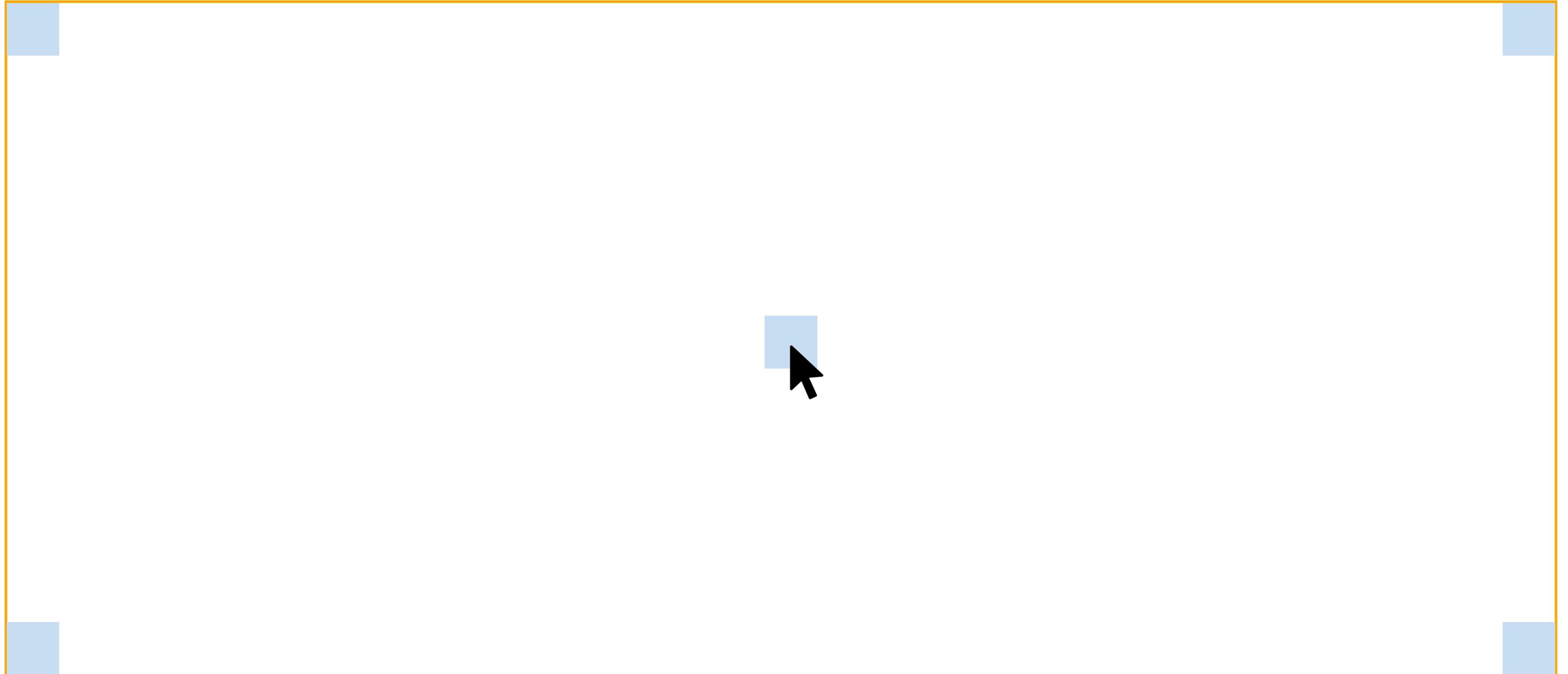
In-Class Exercise #4: Prime Locations for Targets



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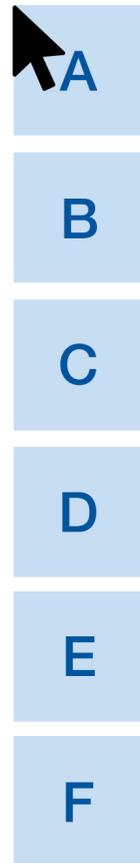
In-Class Exercise #5: Pop-up Menus

- Which of the following pop-up menus lead to a faster selection time?



In-Class Exercise #5: Pop-up Menus

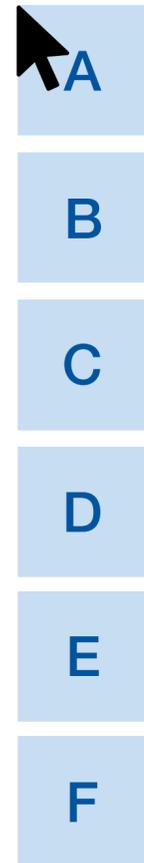
- Which of the following pop-up menus lead to a faster selection time?



Vertical

In-Class Exercise #5: Pop-up Menus

- Which of the following pop-up menus lead to a faster selection time?



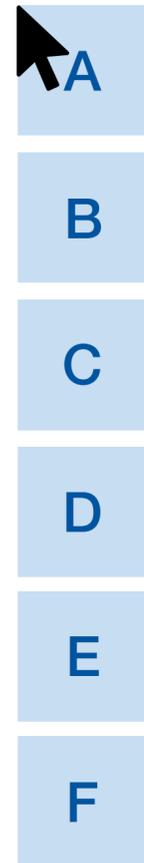
Vertical



Horizontal

In-Class Exercise #5: Pop-up Menus

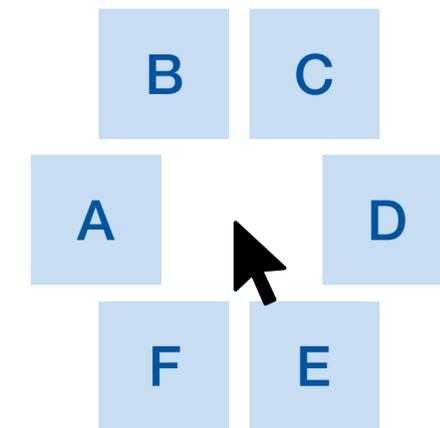
- Which of the following pop-up menus lead to a faster selection time?



Vertical



Horizontal



Radial

Applying Fitts' Law In Interface Design



Applying Fitts' Law In Interface Design

- Move targets closer



expense report ▶

Project page: <http://patrickbaudisch.com/projects/dragandpop/>

Video: <http://tinyurl.com/y74tm8mv>

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Applying Fitts' Law In Interface Design



Applying Fitts' Law In Interface Design

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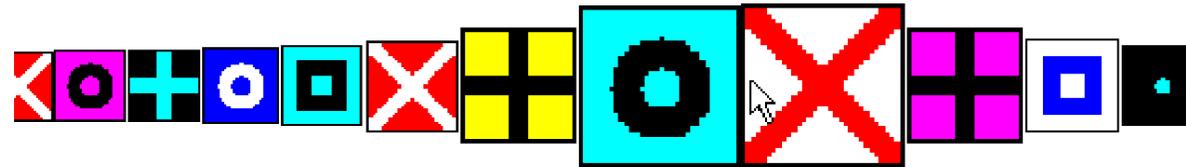
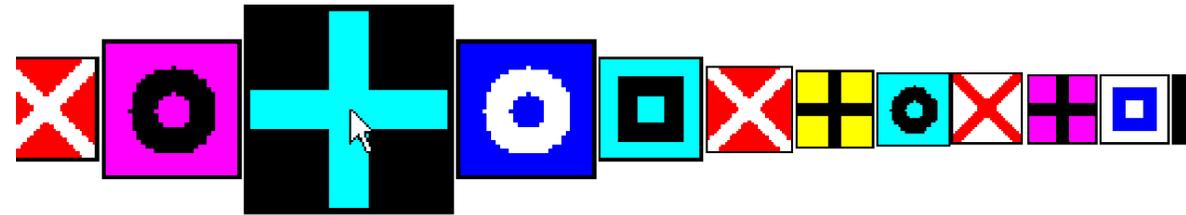


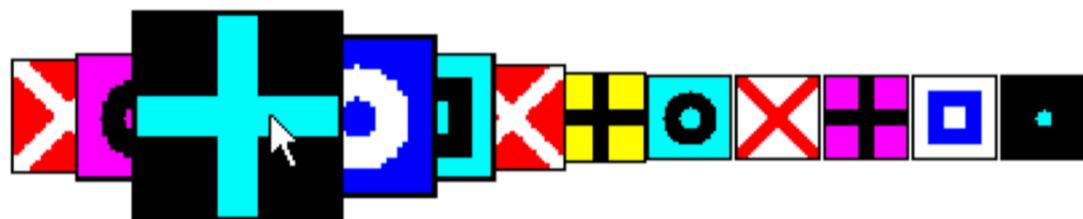
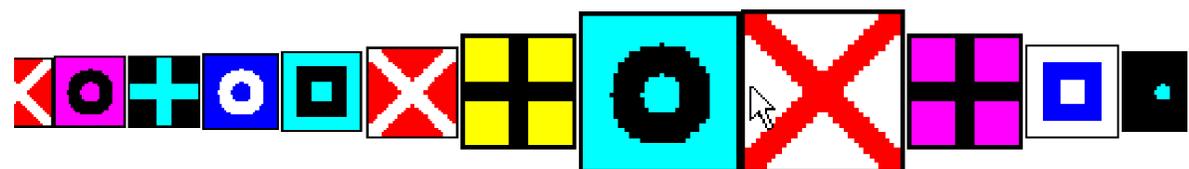
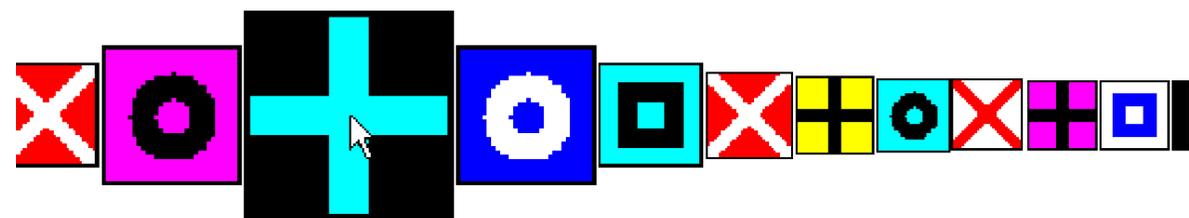
Applying Fitts' Law In Interface Design

- Move targets closer
- Make targets bigger



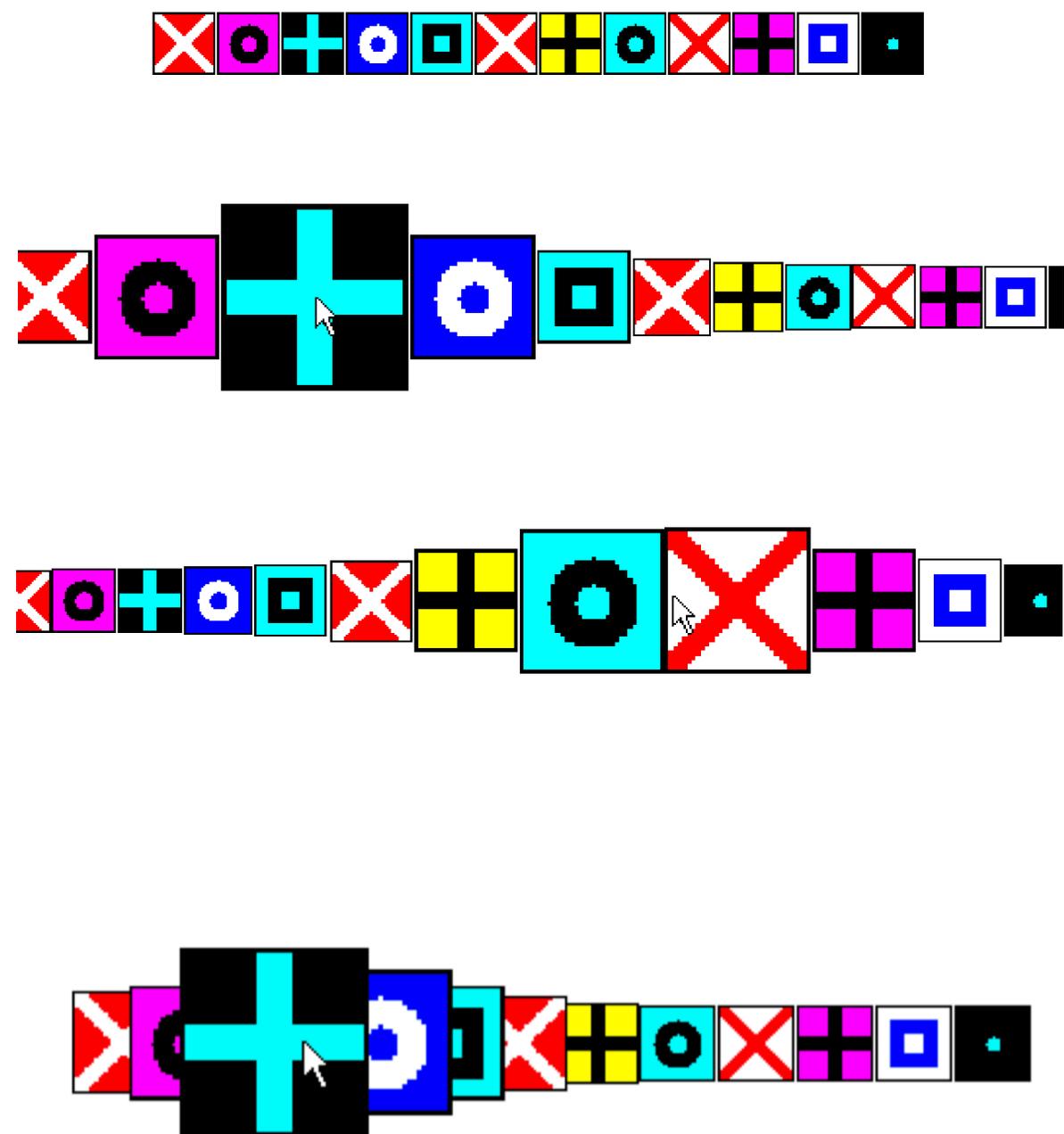




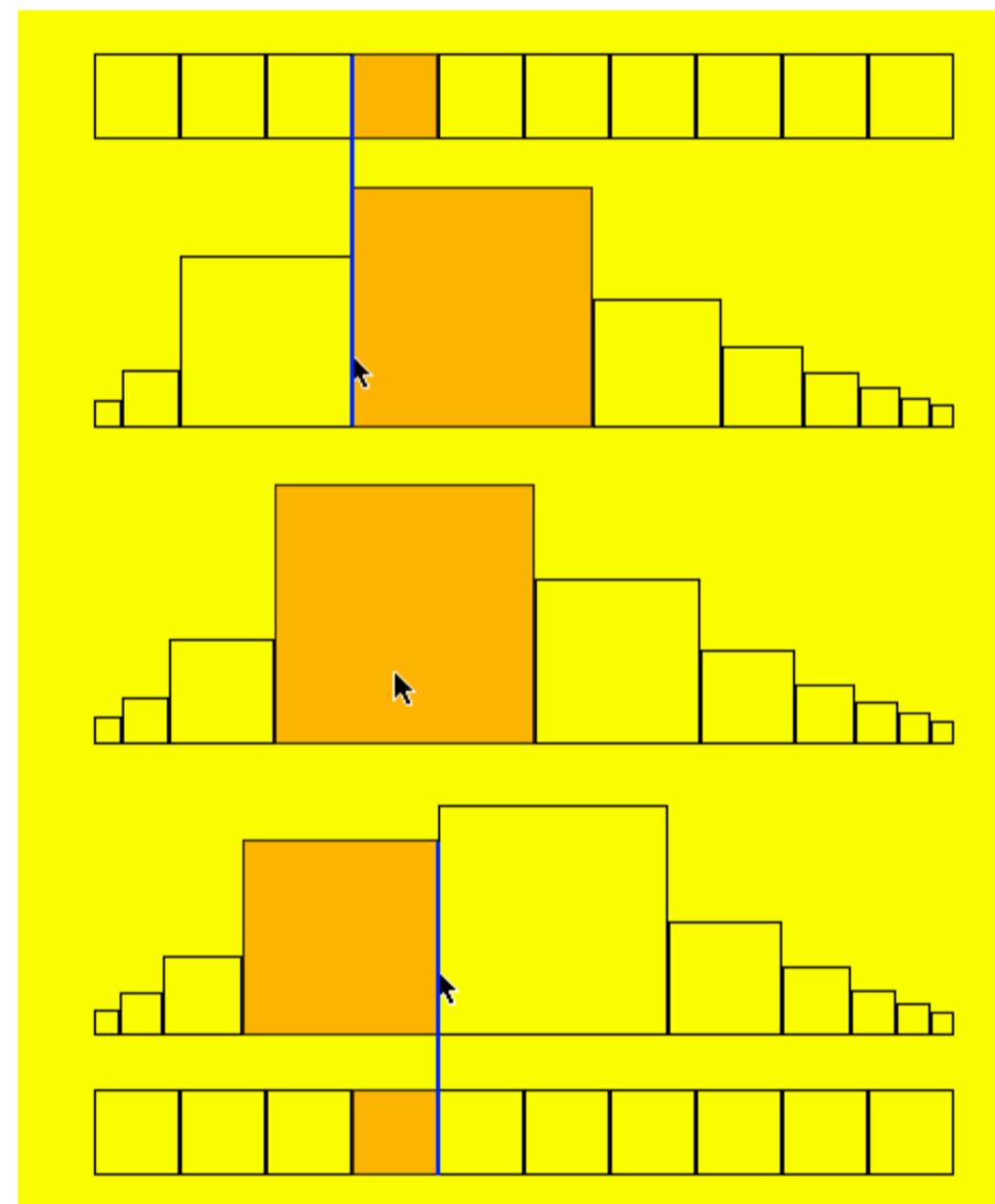


[McGuffin & Balakrishnan, CHI '02]





[McGuffin & Balakrishnan, CHI '02]



[Zhai et al, CHI '03]

Applying Fitts' Law In Interface Design



Applying Fitts' Law In Interface Design

- Move targets closer
- Make targets bigger



Applying Fitts' Law In Interface Design

- Move targets closer
- Make targets bigger
- Cursor acceleration?



Applying Fitts' Law In Interface Design

- Move targets closer
- Make targets bigger
- Cursor acceleration?

For more Fitts' law fun: <https://www.asktog.com/columns/022DesignedToGiveFitts.html>

Assignment I: Fitts' Law

- **Objective:** Learn how to apply Fitts' law in interface design
- Assignment is available online on RWTHmoodle now!
- Deadline: Next **Monday, Oct. 21, 9:00 a.m.**
- Use **RWTHmoodle** to submit (1 submission per group); do not send us your solution via email
- Submissions after deadline will be graded **5.0**
- A few of you will be asked to present your solution during the next lab



Groups for Assignments

- Fixed group size of **three**
- Form groups using RWTHmoodle by **tomorrow (Tue) 1 pm**
- Feel free to talk to classmates at the end of the lab to form groups

Week 2: Gestalt Laws, Information Content, Visibility, Affordances, Signifiers



Perception

- Our brains are wired to make sense of what we perceive.



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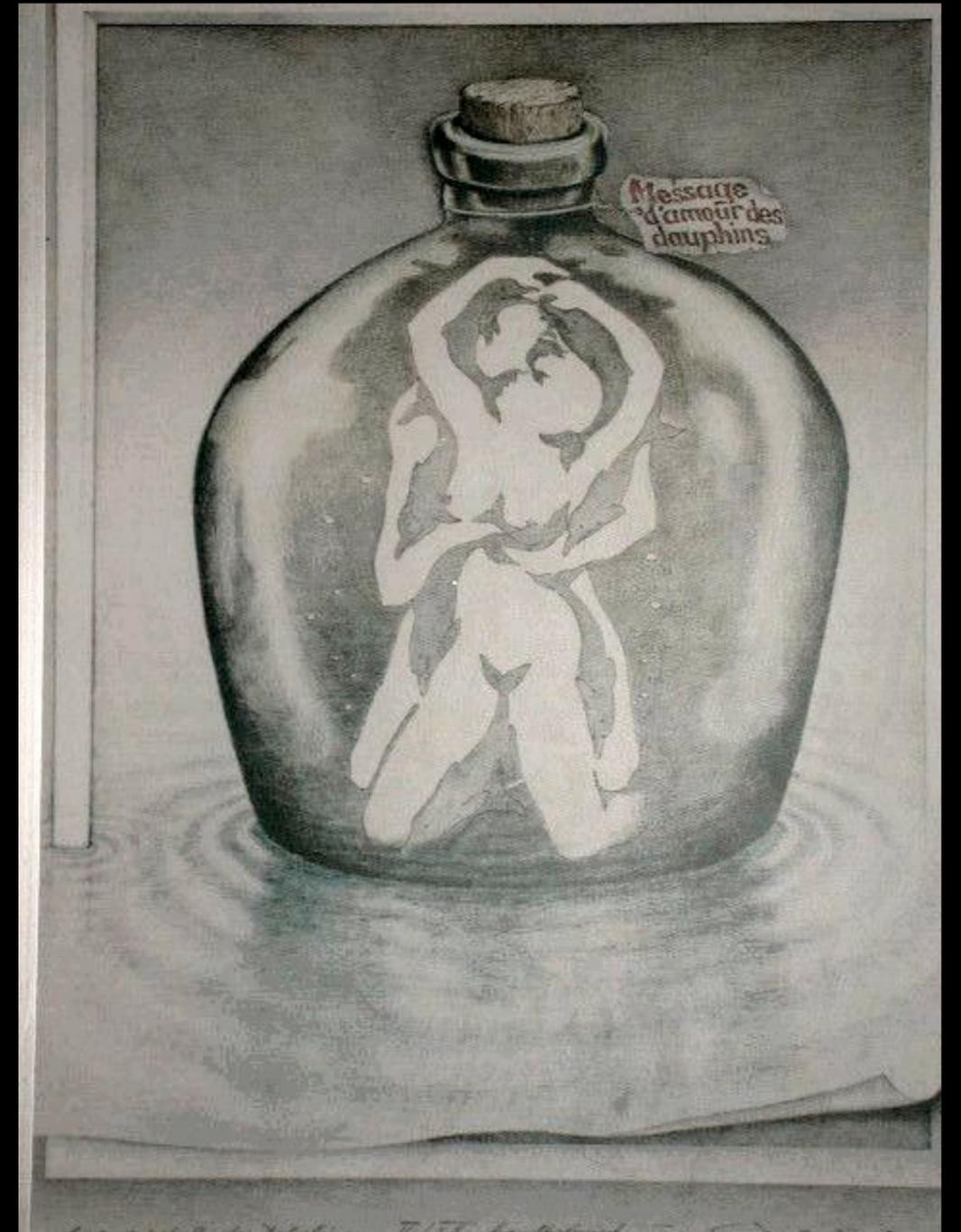












In-Class Experiment





What to Do Next

- **Before Wednesday (Oct. 16)**, complete **at least** task 1 in the first assignment
- **On Wednesday (Oct. 16)**, attend the Studio during your slot (please be min. 5 minutes early!)—you will use the Studio session to work on your group assignment. We will provide feedback to each group, and answer your questions.
 - Slot allocation details will be emailed tomorrow.
- Before **next Monday (Oct. 21)**
 - Finish the first assignment—due **next Monday (Oct. 21), 9 am**
 - Watch the videos for the second week, see **<http://hci.ac/dis>**