

# Users : Physical Capabilities

Chapter 3



To design something for someone, we need to understand the CAPABILITIES and LIMITATIONS of that person.

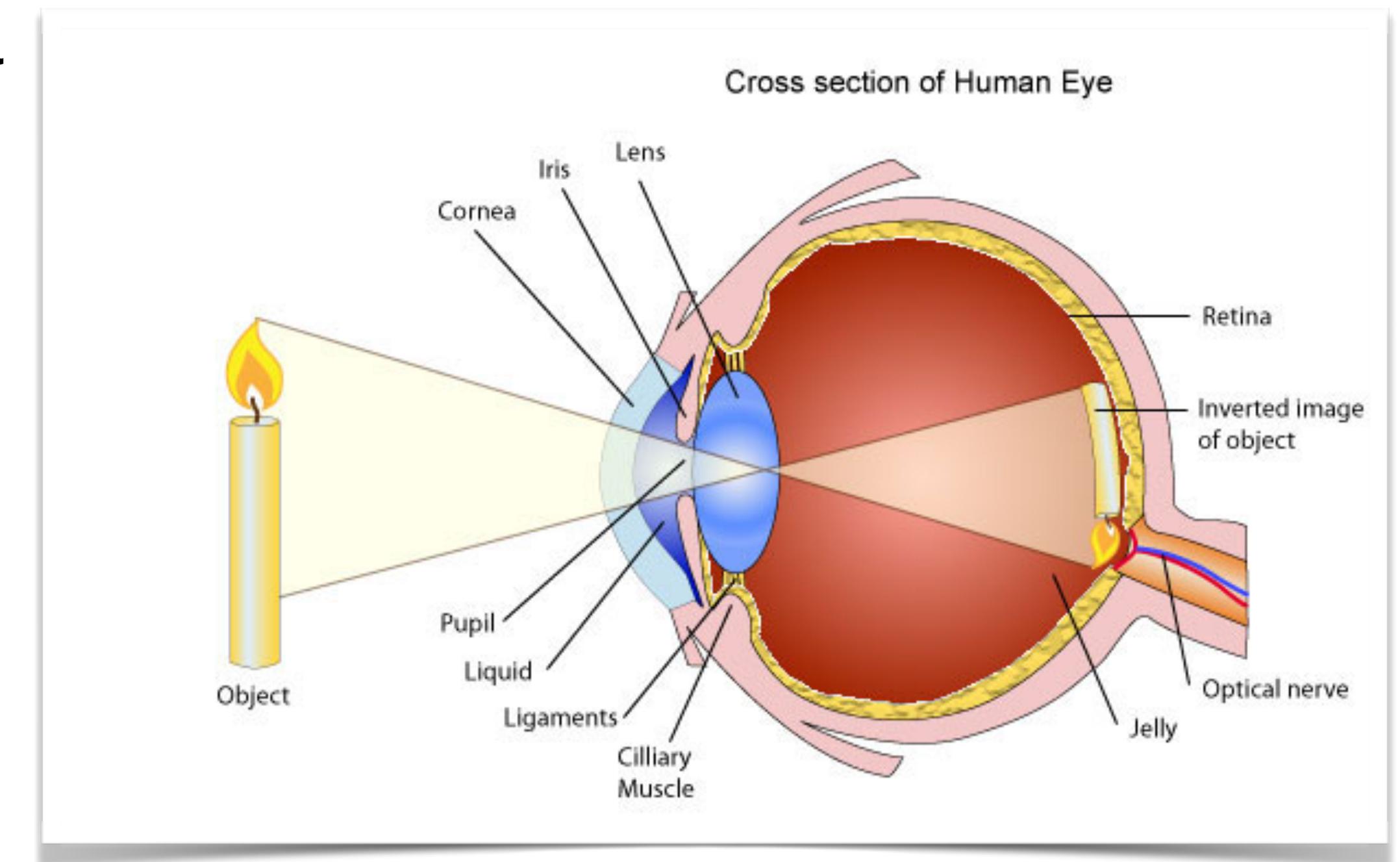


# The User's Physical Capabilities

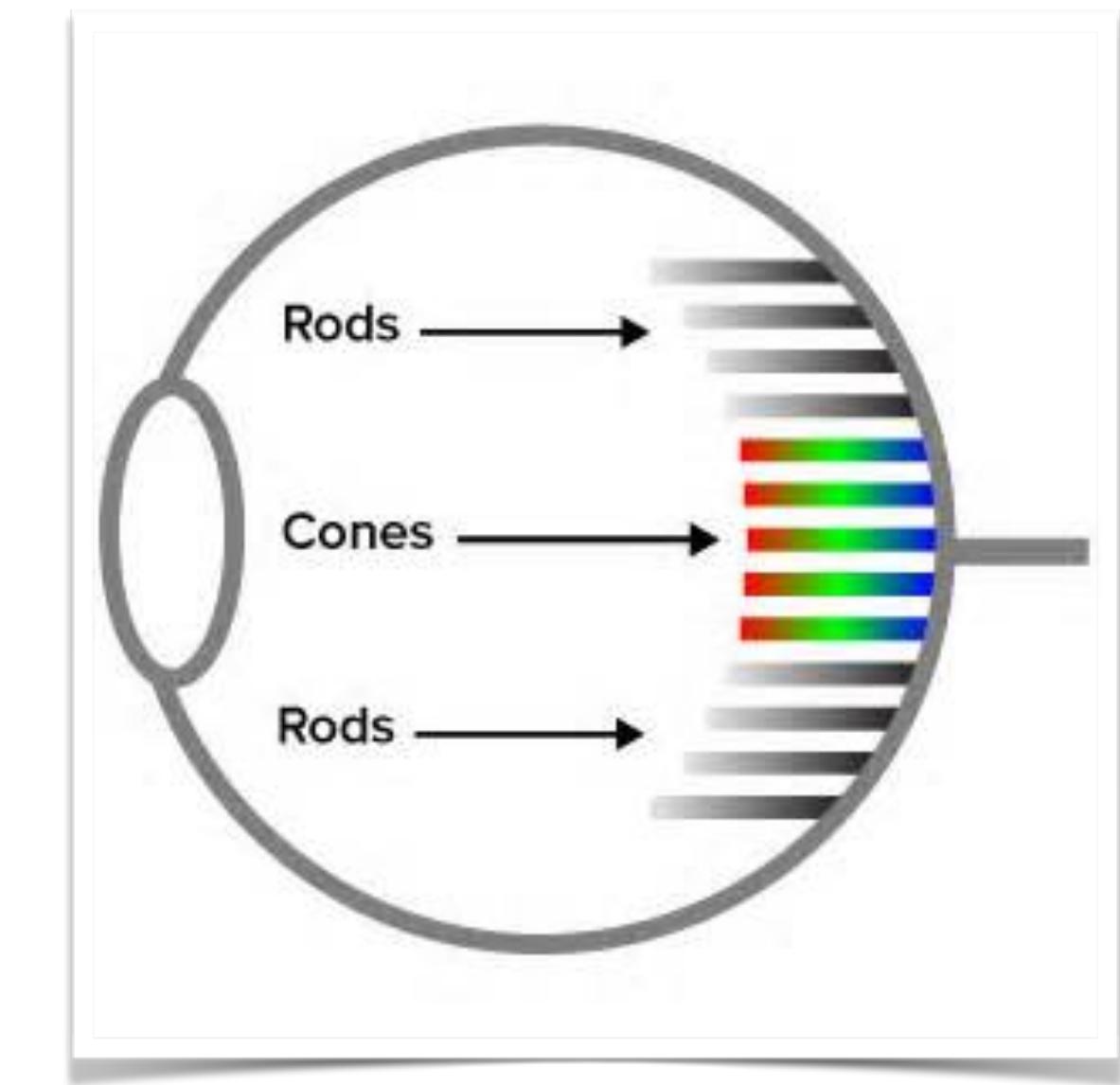
- The user (human) is the one whom computer systems are designed to assist. So , we need to know user (human) capabilities and limitations.
- Humans are limited in their capacity to process information. This has important implications for design
- Information is received and responses given via a number of input and output channels:
  - Visual channel
  - Auditory channel
  - Haptic channel
  - Movement.

# Vision

- mechanism for receiving light and transforming it into electrical energy
- light reflects from objects
- images are focused upside-down on retina

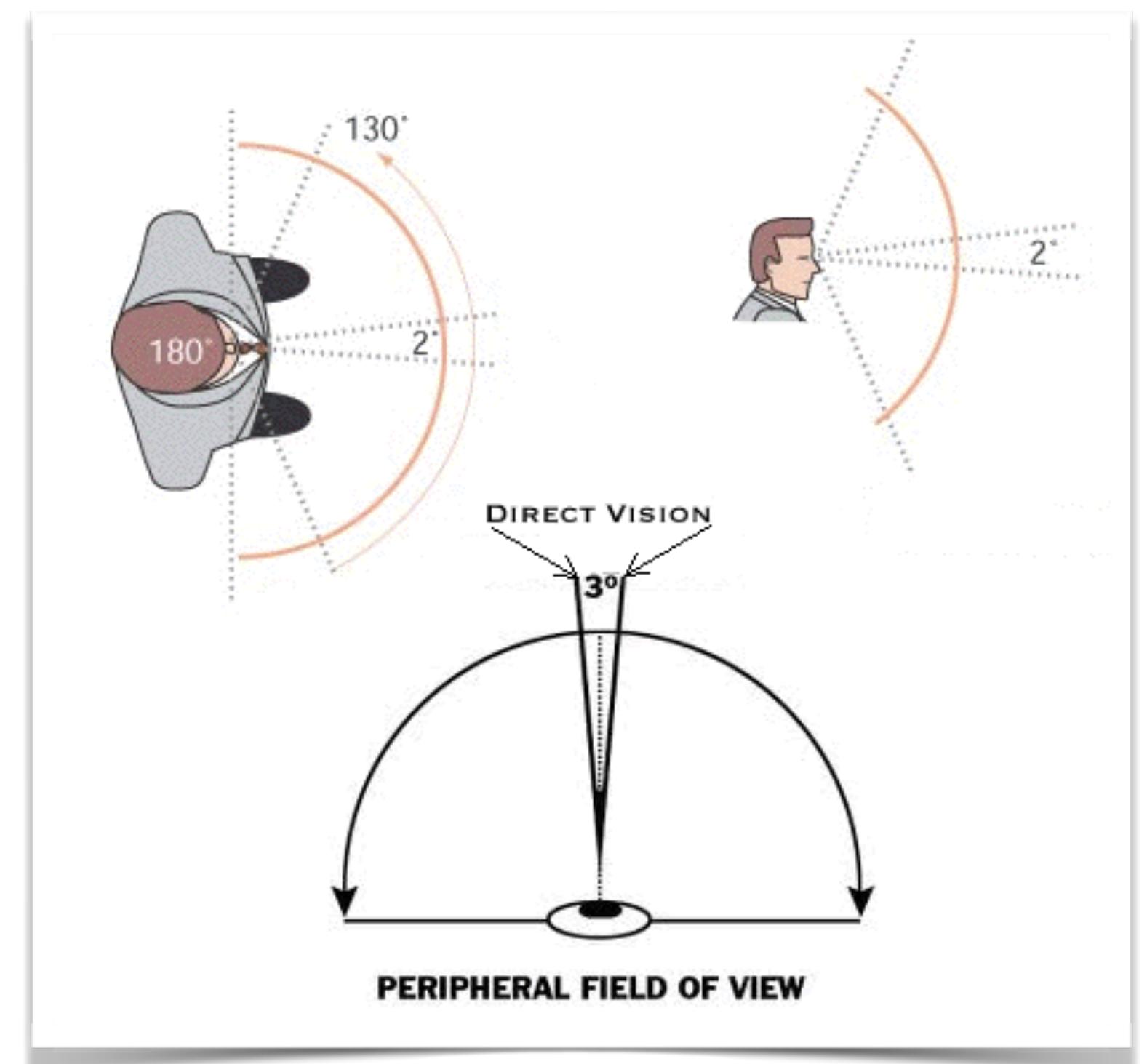


- CONES concentrated at the front of the retina ,and RODS at the SIDES.
- This means that colour detection is good when images are placed in FRONT of the eye.
- The eye is **NOT** sensitive to colour at the periphery. The vision within this area is called a periphery vision.
- Periphery vision –motion sensitive, detail & colour insensitive.



## Peripheral vision

- our peripheral vision is far better at perceiving movement, because we need the ability to identify potential risks quickly.
- Meaning that elements out of central vision do not require detailed colour. If you do need urgent update on sidebar, use motion instead.
- Peripheral animation is distracting. Eg. Animating sidebars zooming in and out.

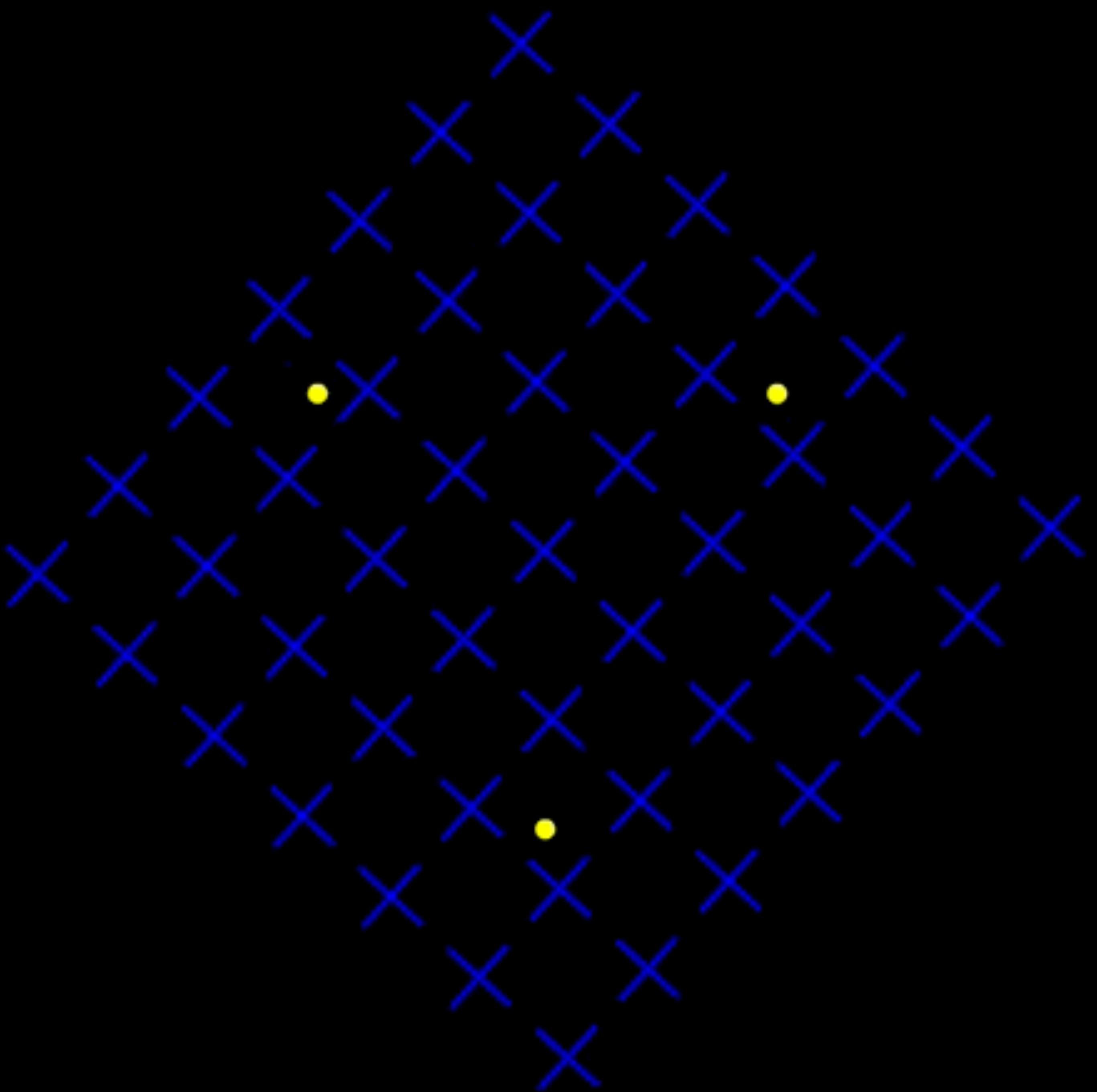




#braingames

Is it true that  
**“Seeing is believing” ?**





Motion-induced blindness



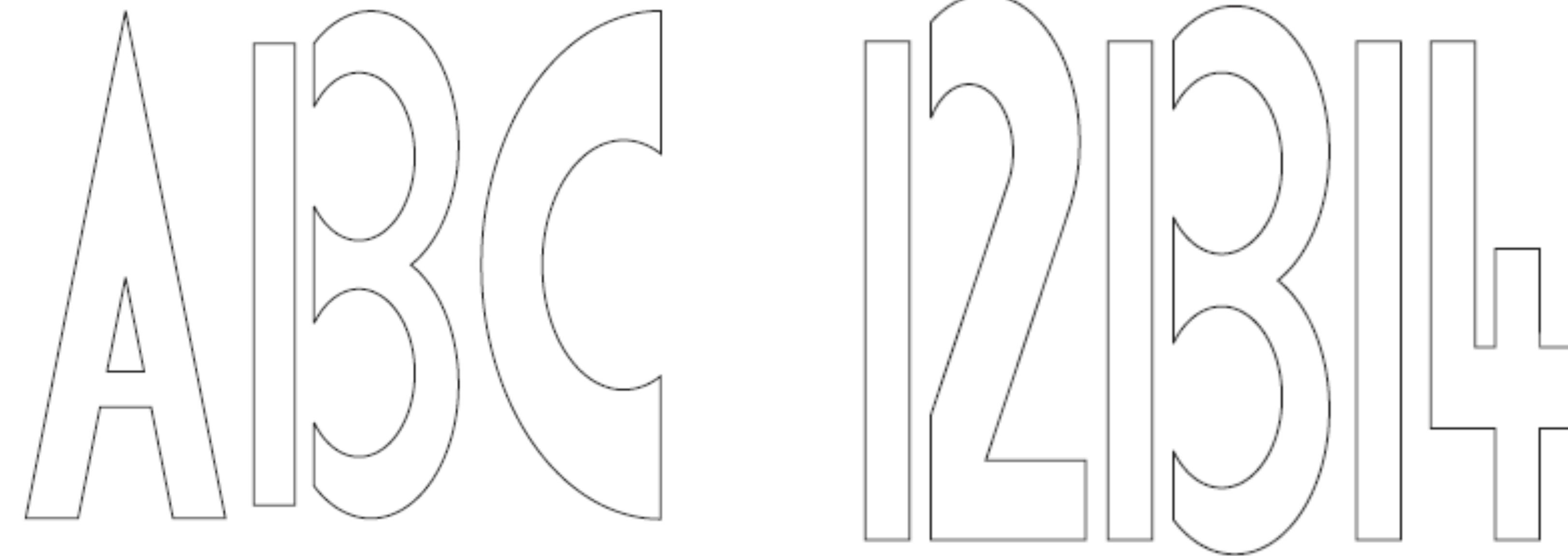
## Colour Illusions

- A small percentage of people are **COLOUR BLIND**
  - 8% male, 1% female (Faulkner, 1998)
- Most common colour blindness = red-green
- A very small % of people have no colour vision at all
- Builders of interfaces need to take this fact into account.

## Interpreting the signal with visual processing

- Context is used to resolve ambiguity

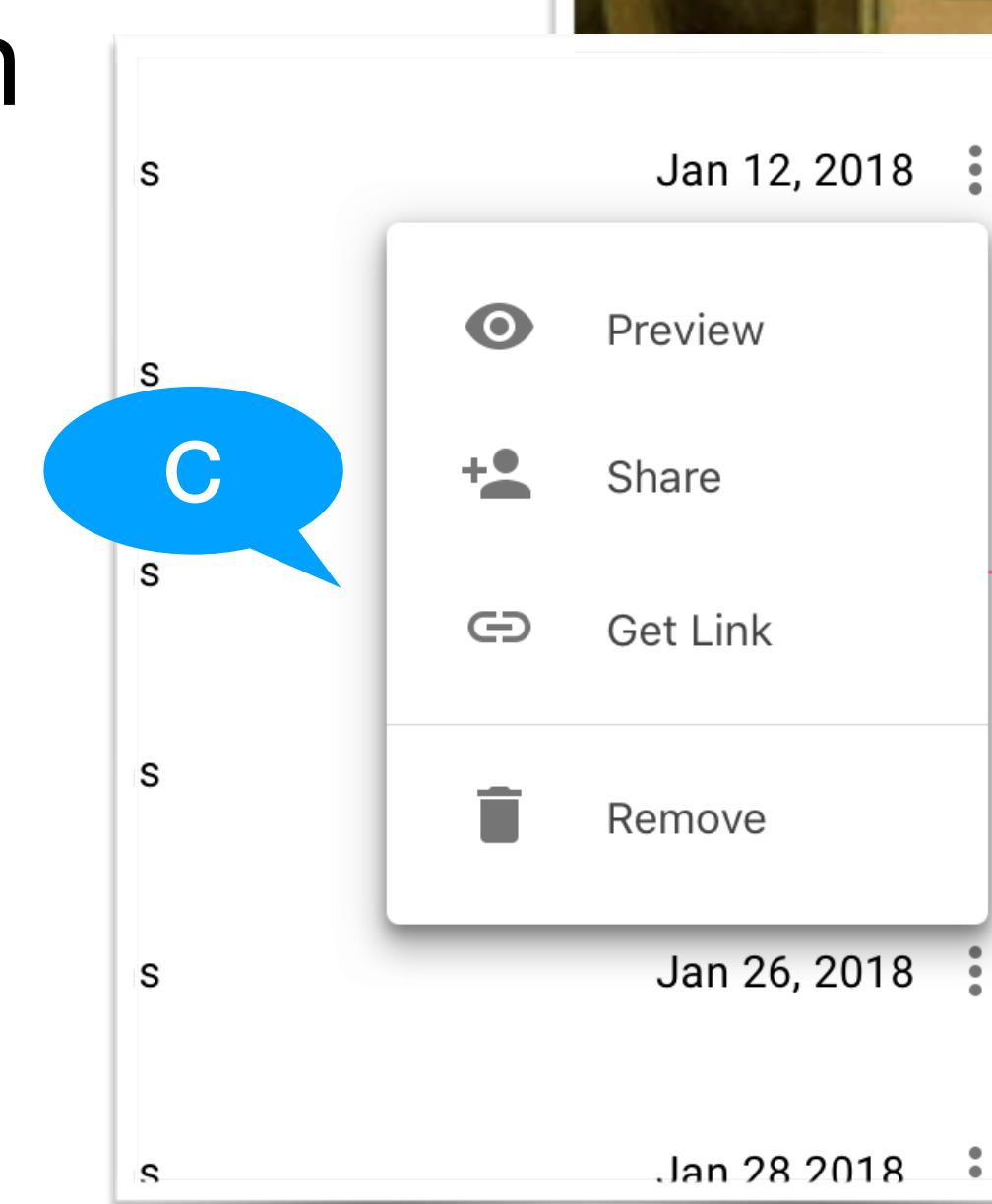
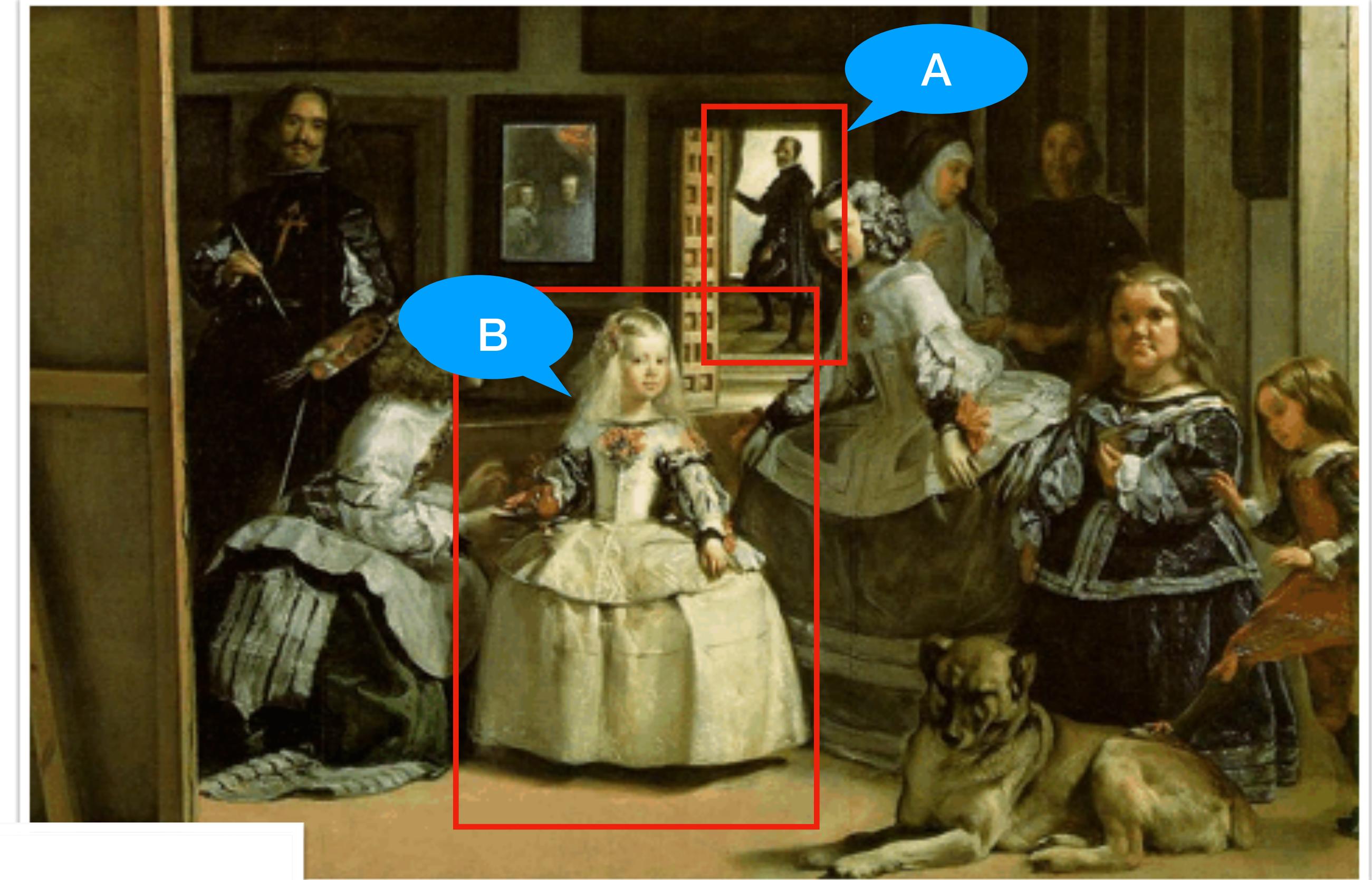




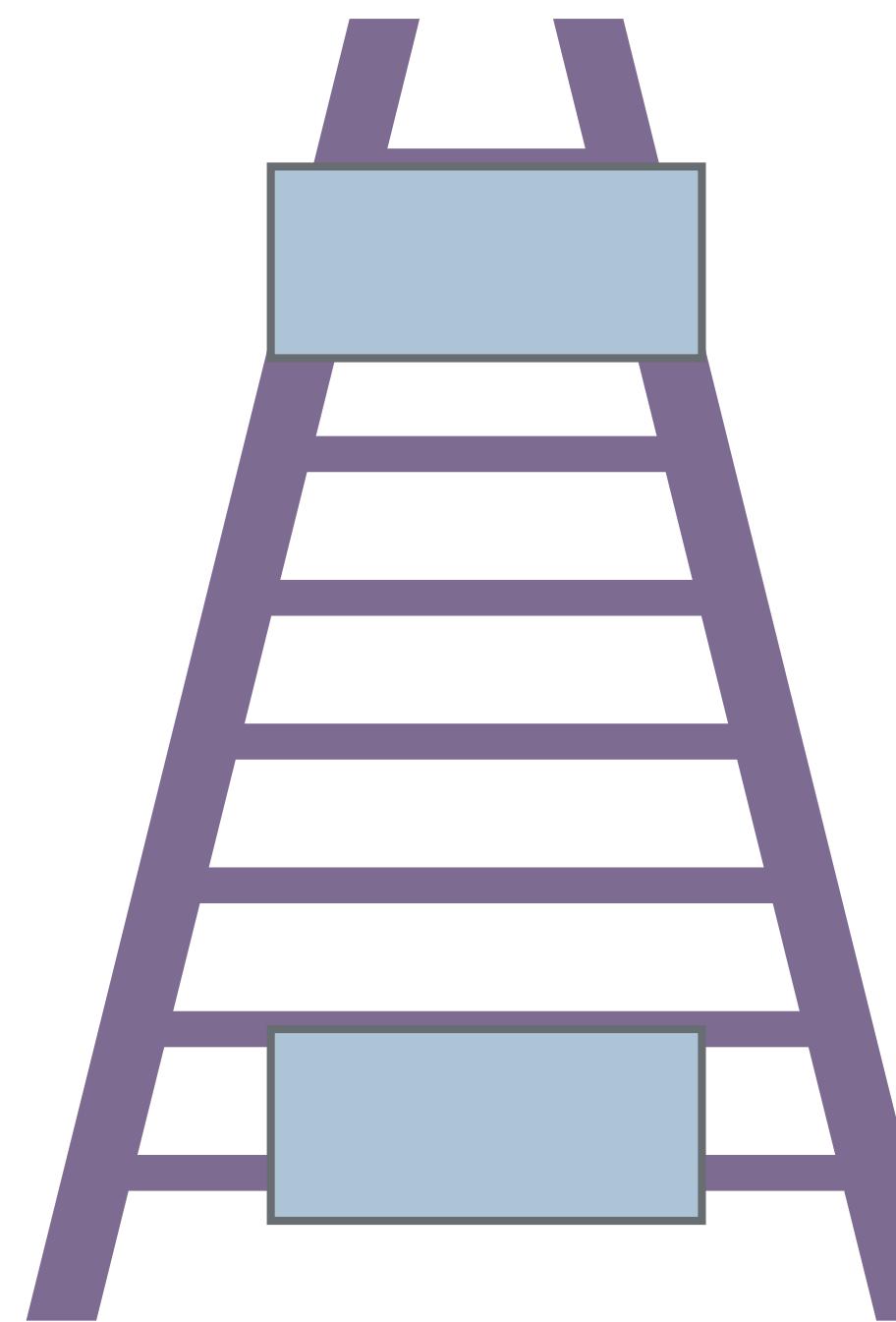
- Context is used to resolve ambiguity

## Size and depth:

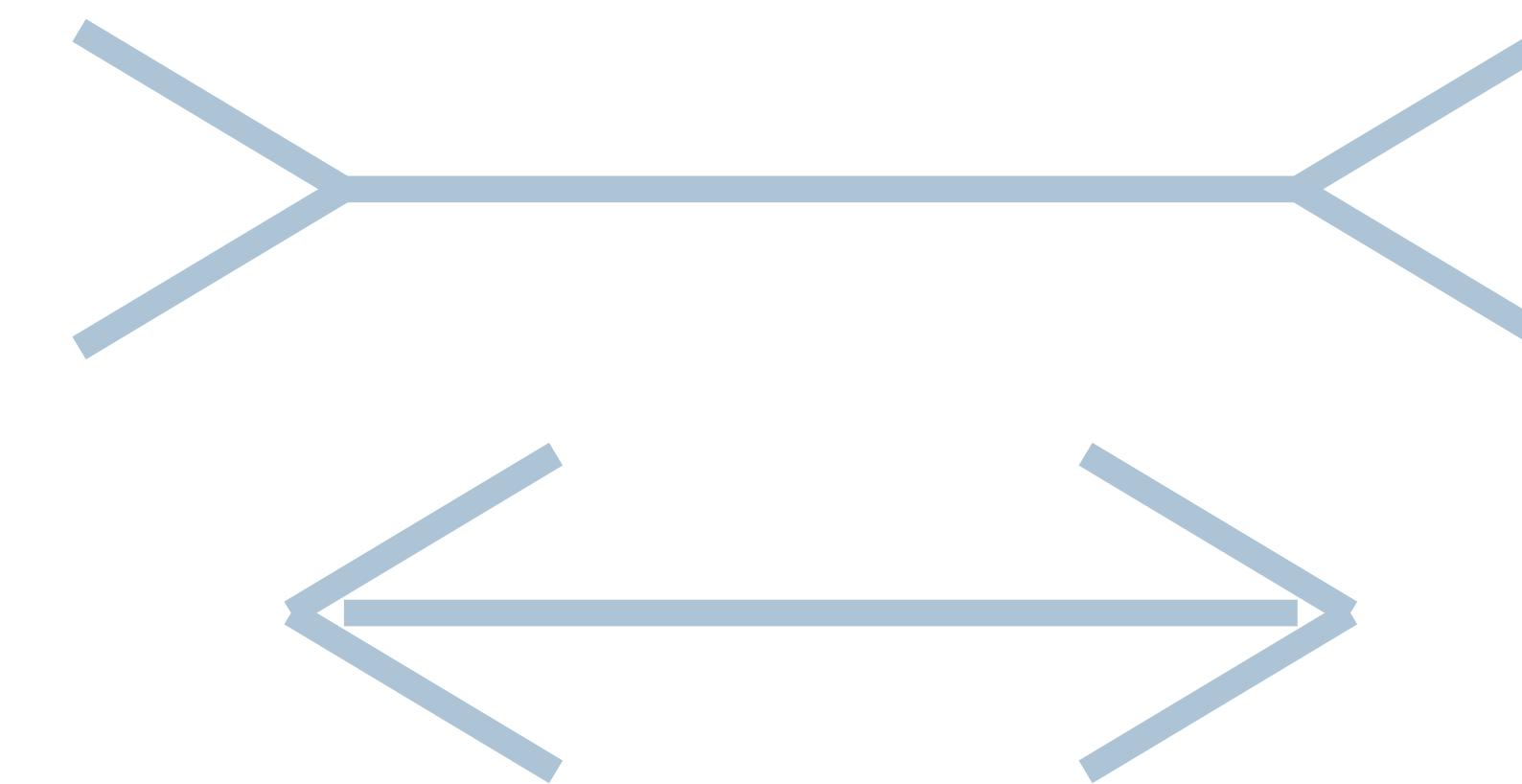
- familiar objects perceived as constant size (law of size constancy), it indicates that our perception of size relies on factors other than the visual angle.
- cues like overlapping help perception of size and depth



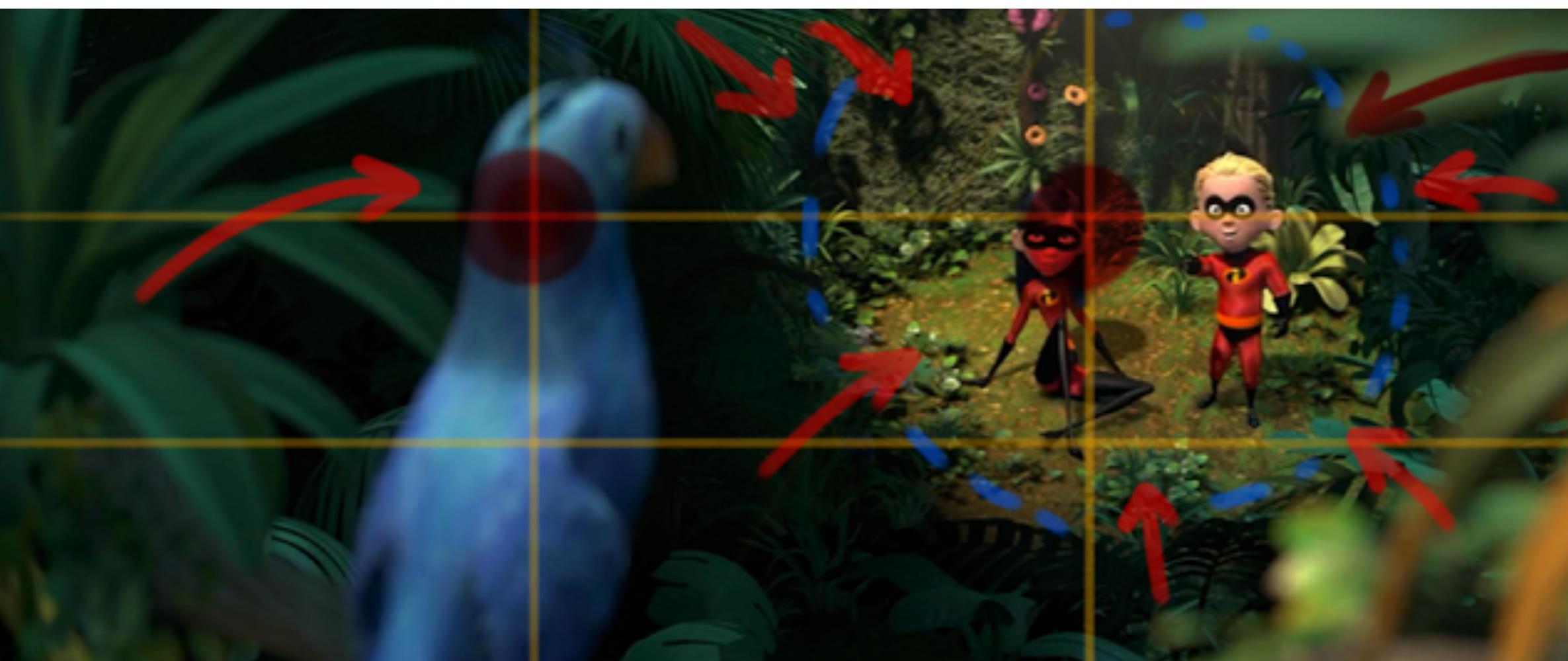
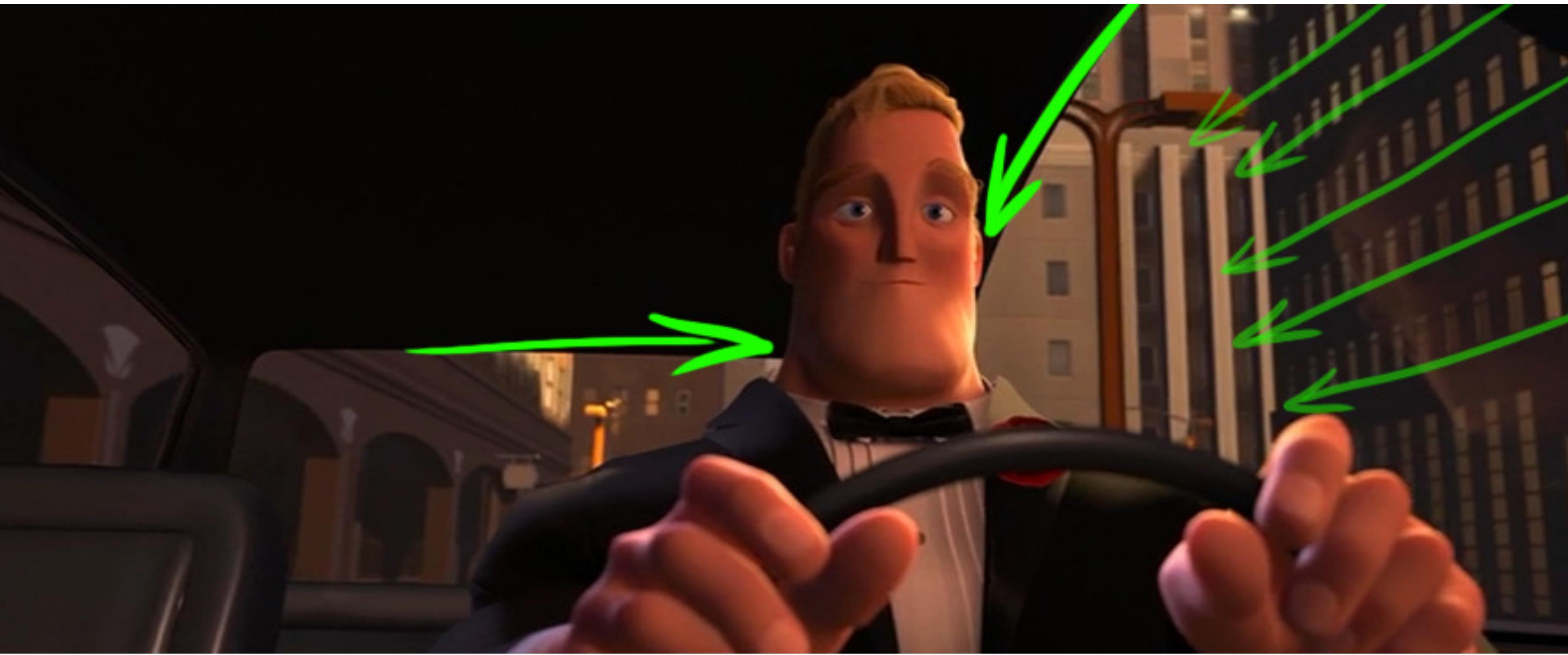
- Optical illusions sometimes occur due to over compensation



the Ponzo illusion



the Muller Lyer illusion



## Reading:

- Several stages:
  - visual pattern perceived
  - decoded using internal representation of language
  - interpreted using knowledge of syntax, operate on phrases or sentences.
- words can be recognized as quickly as single characters, familiar words are recognized using word shape.
- 

**“The qcuik borwn fox jmup oevr the lzay dog”**

SHAPE SHAPE SHAPE SHAPE SHAPE  
SHAPE SHAPE SHAPE SHAPE SHAPE

- Removing the word shape clues (for example, by capitalizing words) will slow down reading speed and accuracy.
- Text in all caps reduces the shape contrast for each word.

# Hearing

Humans can hear frequencies from 20Hz to 15kHz

- Ability to detect the lower and upper frequency ranges deteriorates with age and is also affected by health

Auditory system filters sounds

- can attend to sounds over background noise.
- for example, the cocktail party phenomenon (focus on a single conversation in a noisy room.)

Common usage of sounds:

- As a means to **LOCATE** things
- As a means to provide **FEEDBACK**
- As a means to attract **ATTENTION**

**ATM**

**Telephone**

**Washing machine**

**Air conditioner**

Use sound for **FEEDBACK** and/or attracting **ATTENTION** when:

- The information is **short and simple**
- For alerts and warnings when an **immediate response** is needed
- The visual system is already **overburdened**
- The user is **moving** about from place to place
- Poor illumination makes vision unreliable

**Problem:** sound can be a source of annoyance & distraction

# Haptic

## Touch

- Provides important feedback about environment.
- May be key sense for someone who is visually impaired.
- Some areas more sensitive than others e.g. fingers.

(Keyboard design should give adequate tactile feedback to the user)

- affects comfort and performance.

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# Movement

we need to consider motor control and how the way we move affects our interaction with computers.

- Time taken to respond to stimulus: the amount of time that takes places between when perceive something to respond to it. (detect > process >respond to a stimulus.)
  - reaction time + movement time
- Movement time dependent on age, fitness etc.
- Reaction time - dependent on stimulus type:
  - visual                   ~ 200ms
  - auditory               ~ 150 ms

- Response time limit (system):

0.1 sec: Feels system reacting immediately.

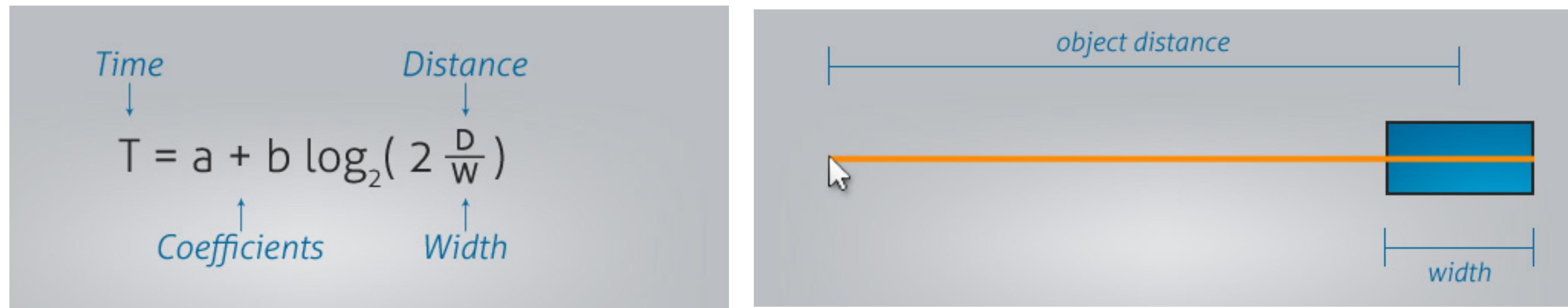
1 sec: Noticing system delay. User still feels being in control.

10sec: Limit for keeping user's attention with system. User feels slow computer respond.

(Nielsen 1993)

# Movement: Fitt's Law

Movement time prediction : Fitt's Law

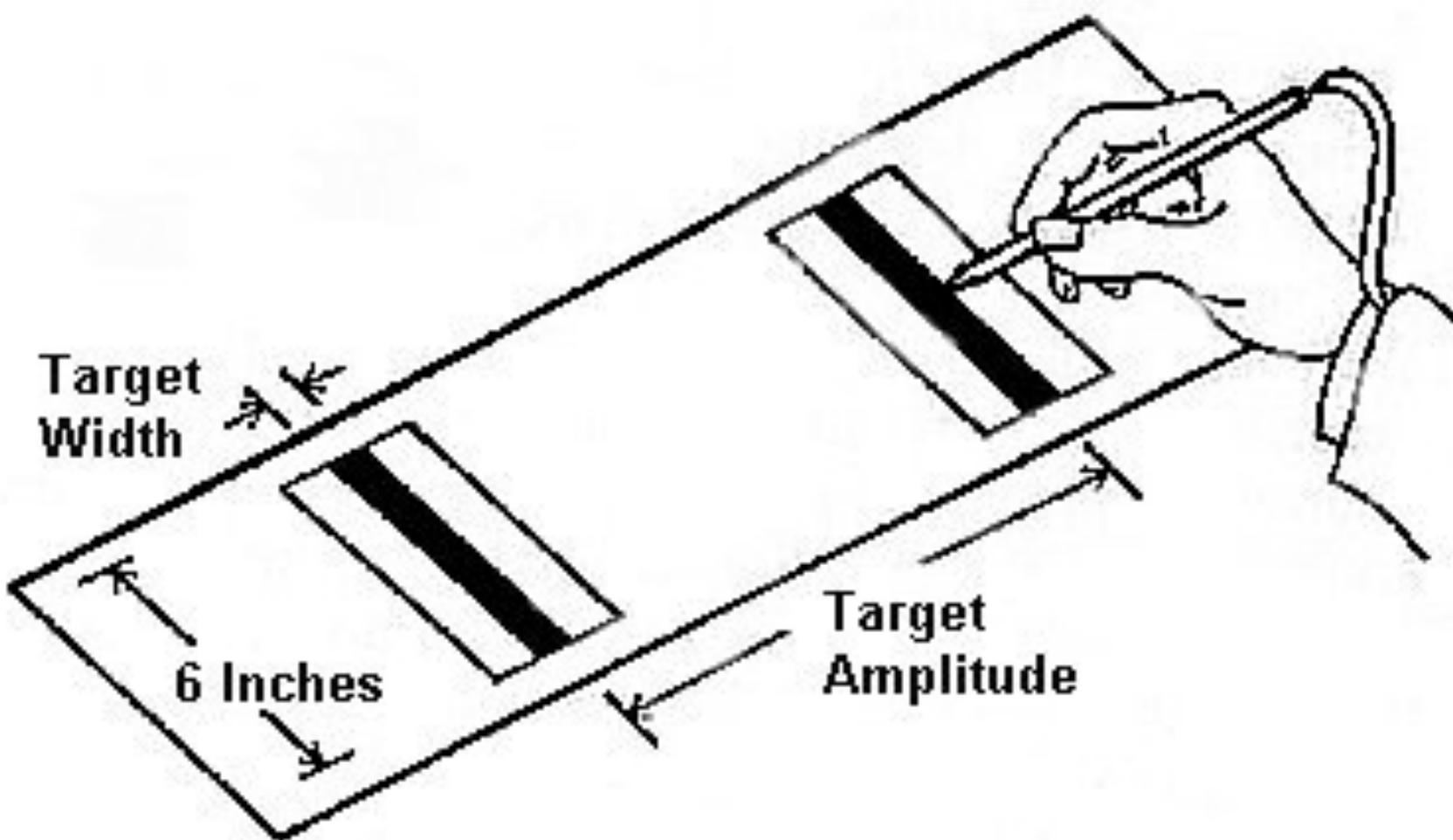


$T$  is the movement time

$a$  and  $b$  are empirically determined constants, that are device dependent.

$D$  is the distance of movement from start to target center

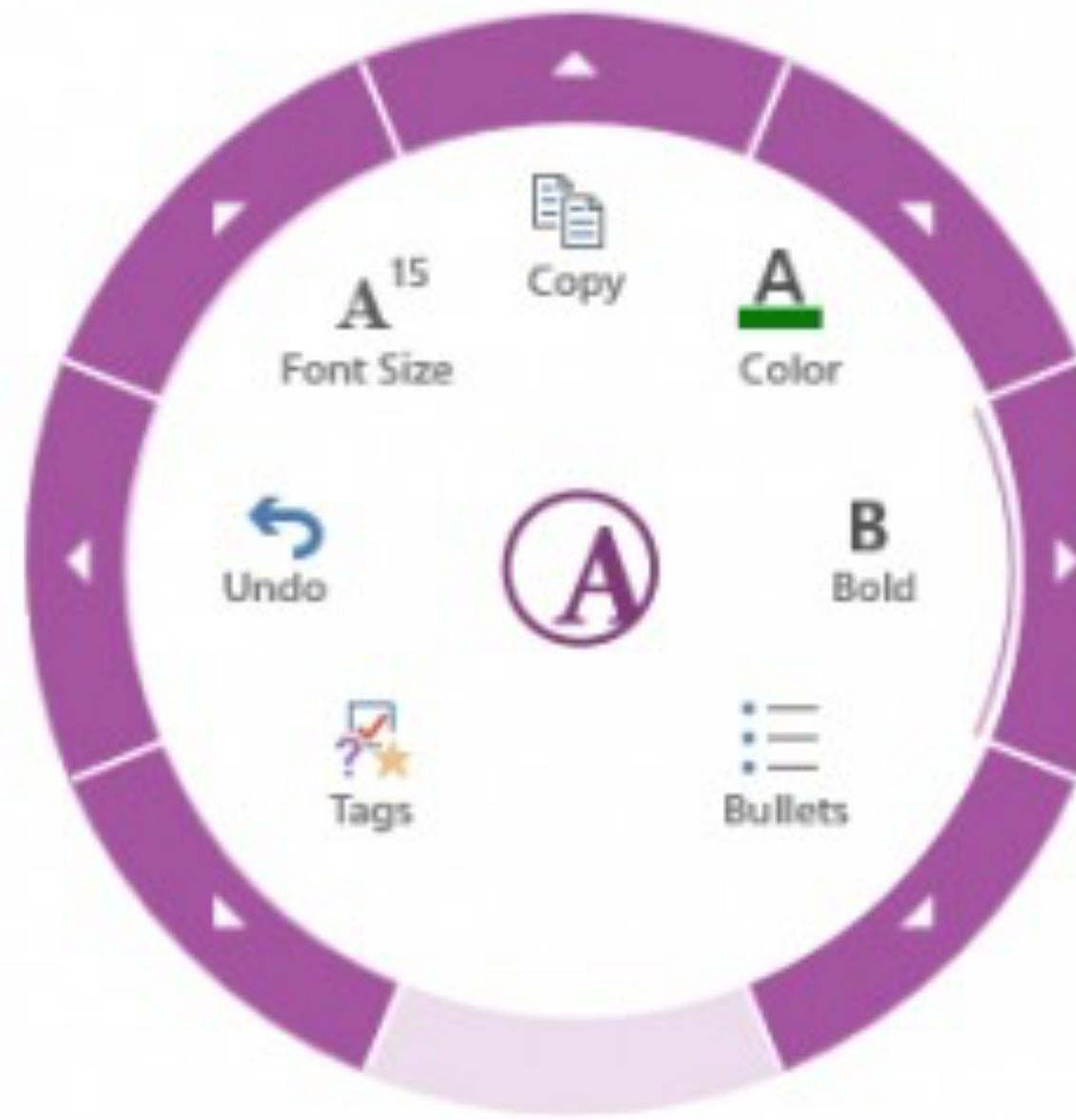
$W$  is the width of the target, which corresponds to accuracy



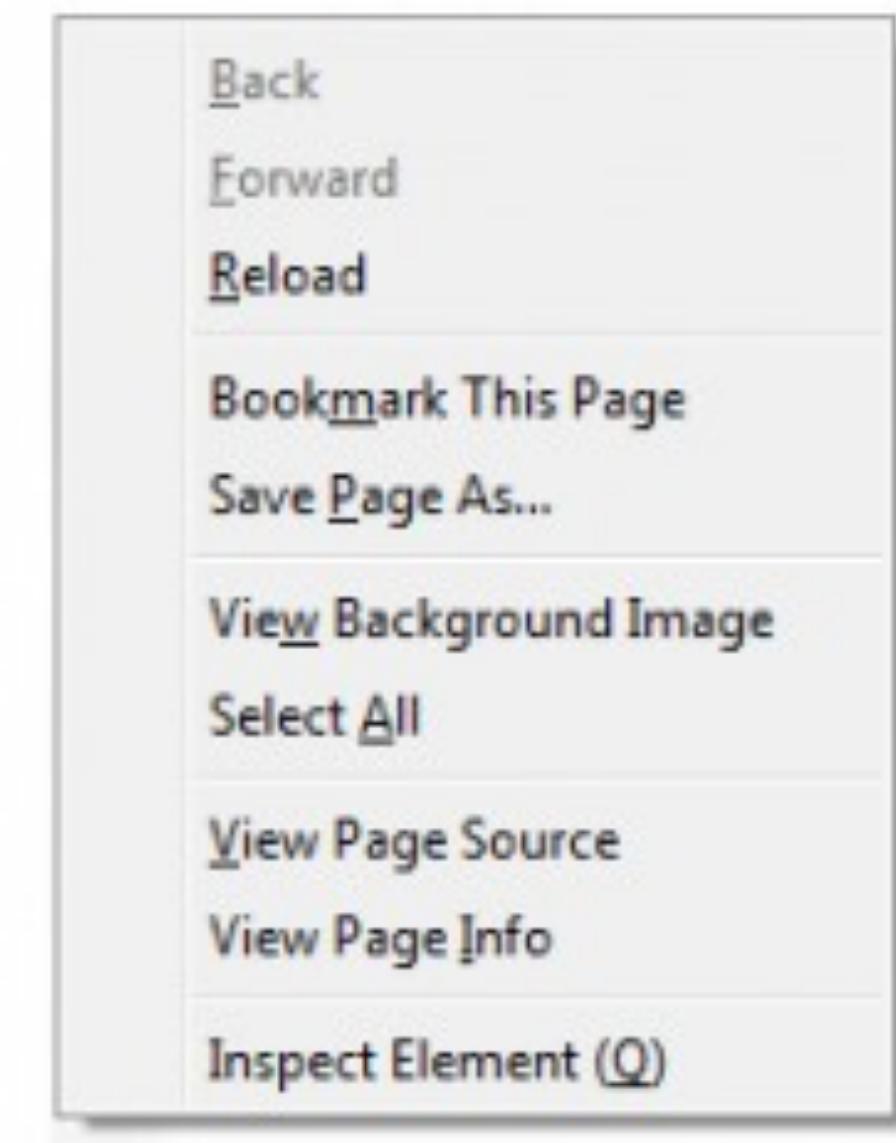
**Fitts' reciprocal tapping paradigm ( Fitts, 1954).**

In the tapping experiments, subjects moved a stylus back and forth between two plates as quickly as possible and tapped the plates at their centers . This experimental arrangement is commonly called the "Fitts' paradigm."

## wheel menu



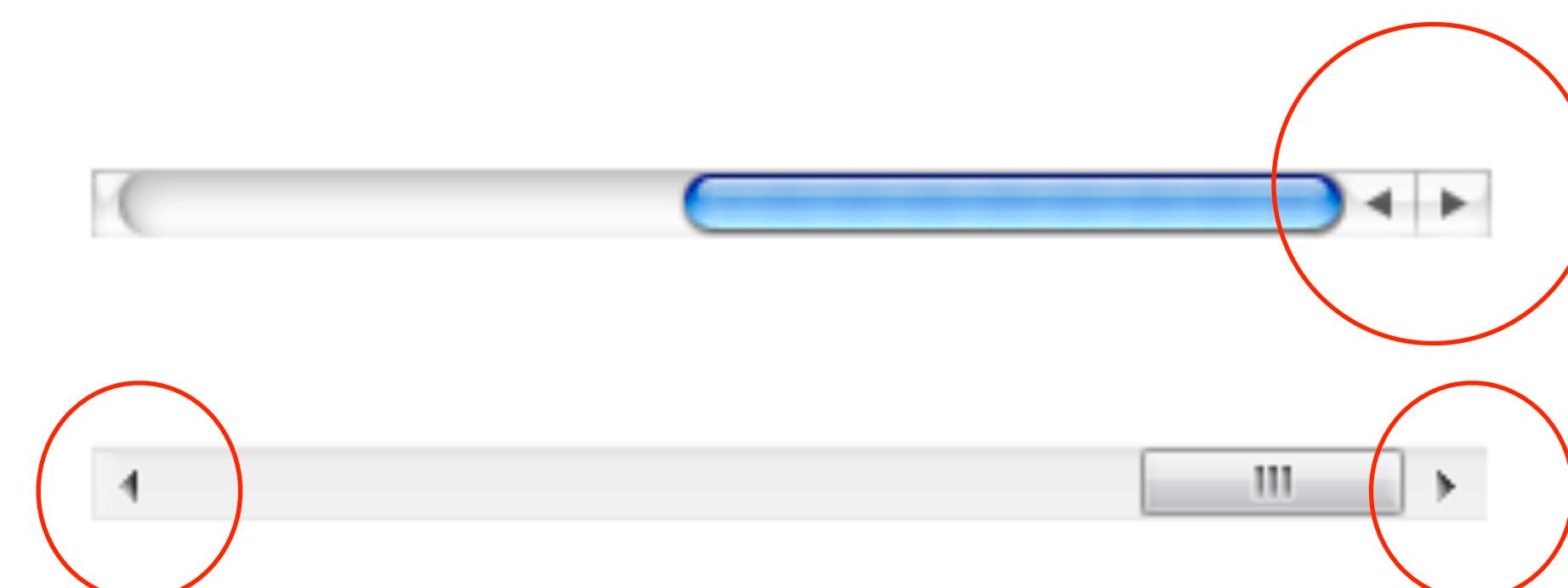
## list menu

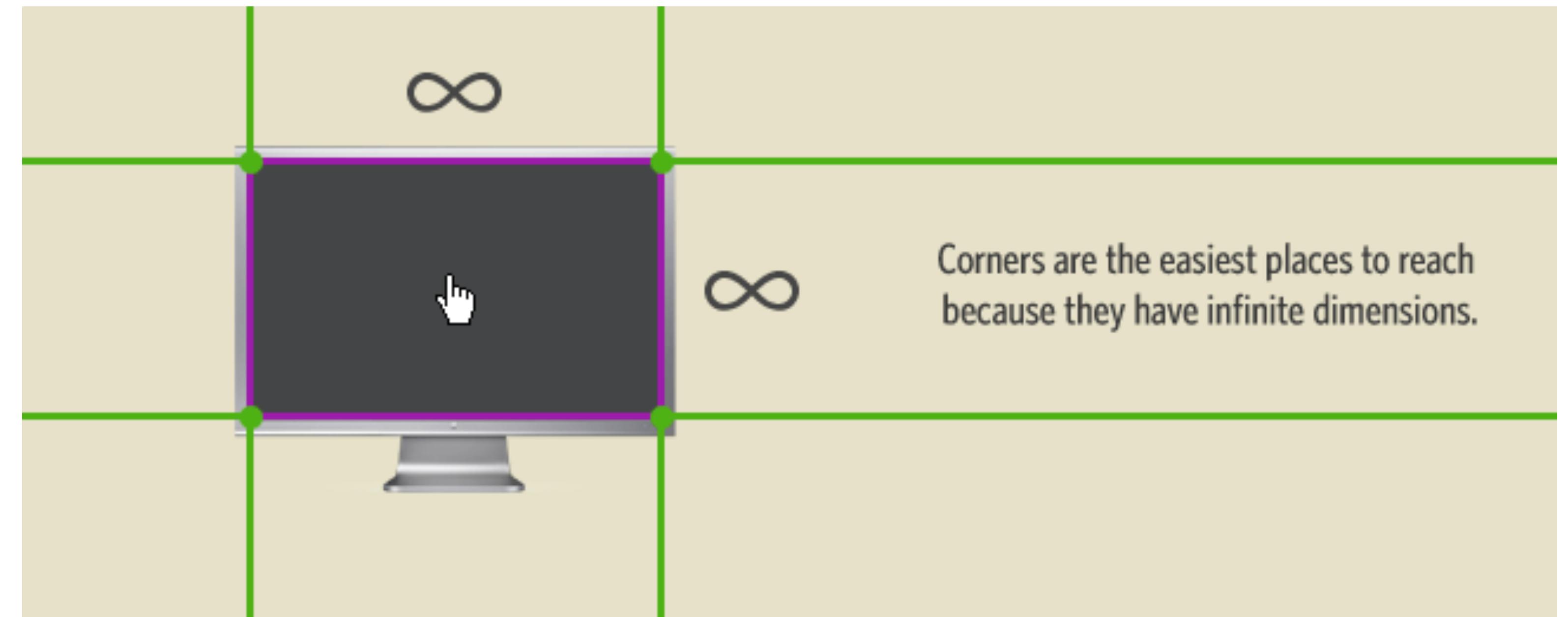
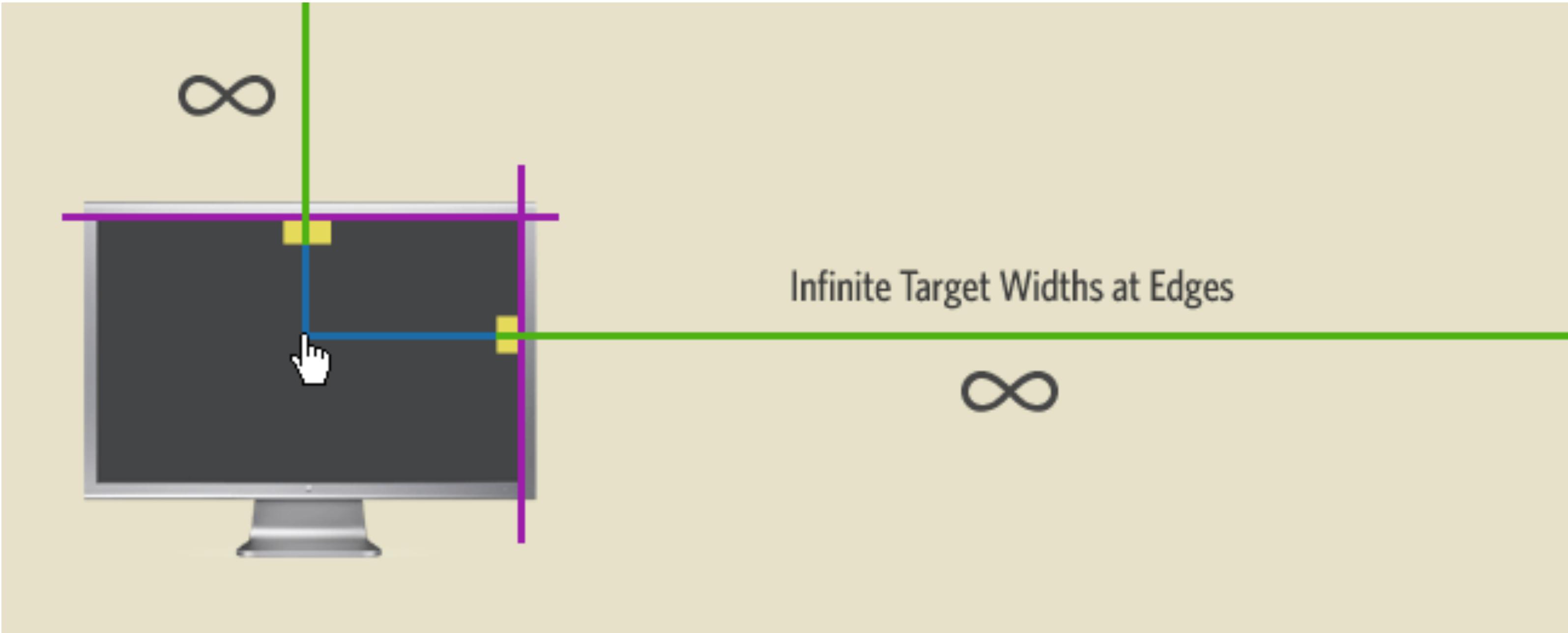


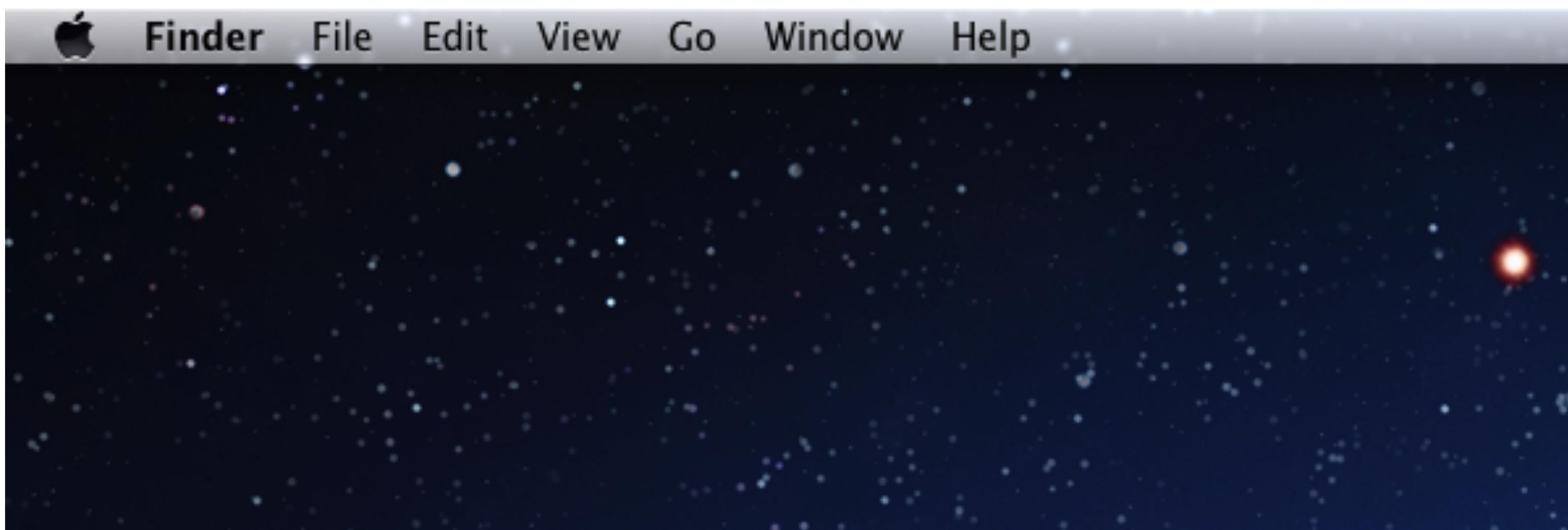
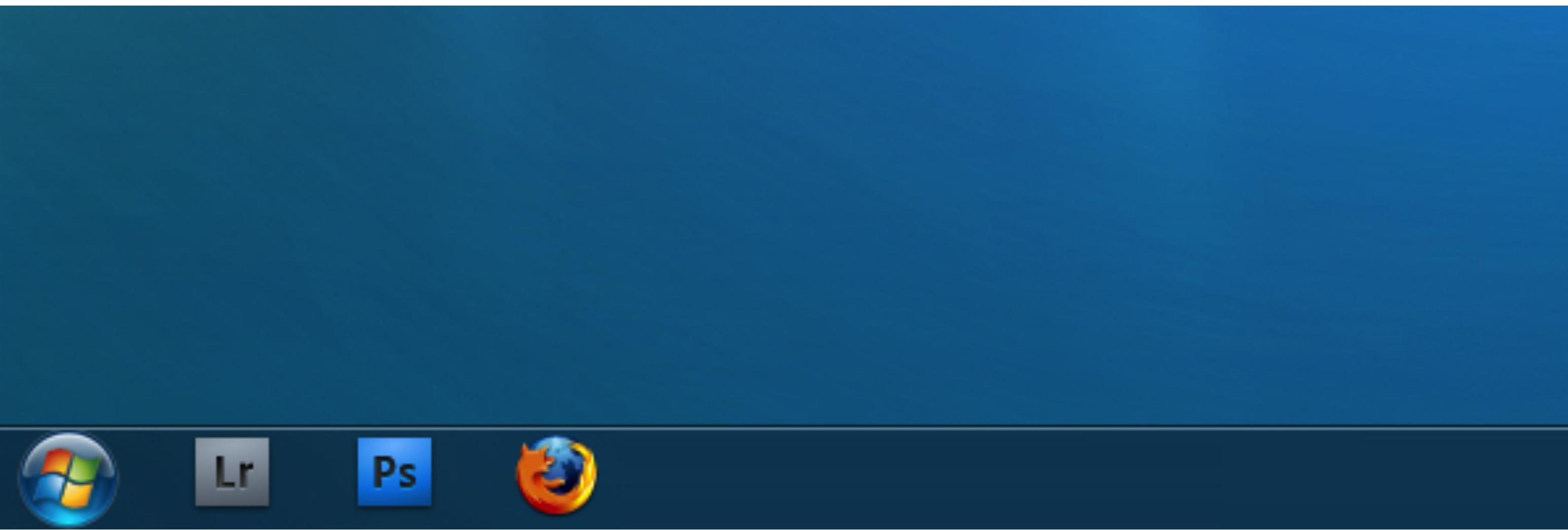
OSX Snow Leopard



Windows







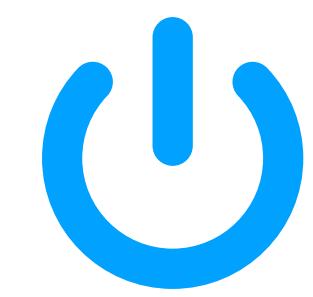
Edge/corners can be considered to have an "infinite" width.

**Do you trust what you are hearing?**





McGurk effect

 **Thank you**