HUMAN MODELS

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ANNOUNCEMENTS

Regrade:

- Clerical (missing APK, etc) -> email the grader
- Larger concerns -> Bring printout to my office hours for full regrade of assignment
- All regrades must be completed within two weeks of grade release date

PROG 02-A :: Extension until 11:59pm TODAY!

Emulator Install “Party” in 220 Jacobs after class

Brainstorming NEXT MONDAY! — Required Class

Groups and Group Dynamics

- Assign lead (coordination)
- Setting up times to meet weekly
- Problems ... private piazza post to all instructors

Watches go out next Wed — one per group with $100 check as deposit

PROG 02B OUT

READING RESPONSE

Prompt:

For your first programming project, you are designing a calorie burning conversion app (given an input of the type and amount of exercise, you'll be able to see how many calories you've burned as well as the equivalent amount of another type of exercise). Create a persona that would be useful in the design of PROG 01, and describe a scenario of usage for that app. Use your persona in the scenario. Why is it important to consider personas when designing an application?

READING RESPONSE

Personas are important to anticipate many users' needs and prioritize features according to your targeted audience. Personas also help the designer remove themselves from the process of designing so that there is less self-referential design. By designing towards the goals of one persona or a select few, you don't run into the problem of trying to please everybody.

READING RESPONSE

Persona: Jamie, Newbie Trying to Lose Weight

Activities:

-Goes to the gym every other day
-Meets up with a trainer once a week
-Works from 9AM-5PM at a desk

Attitudes:

-Uses technology casually
-Only started exercising regularly Influencers:
-trainer decides what they do weekly
-gym friends influence the extra exercise they do

Frustrations:

-not sure how to operate new gym equipment
-doesn't know how much exercise is needed per time unit Wish List:
-wishes to be able to customize their exercise regimen Experience Goals:
-to not spend too much money
-to stay on track
-to be motivated
-to be interested
-to enjoy working out

End Goals:

-to lose weight (50 lbs)
-to be more healthy

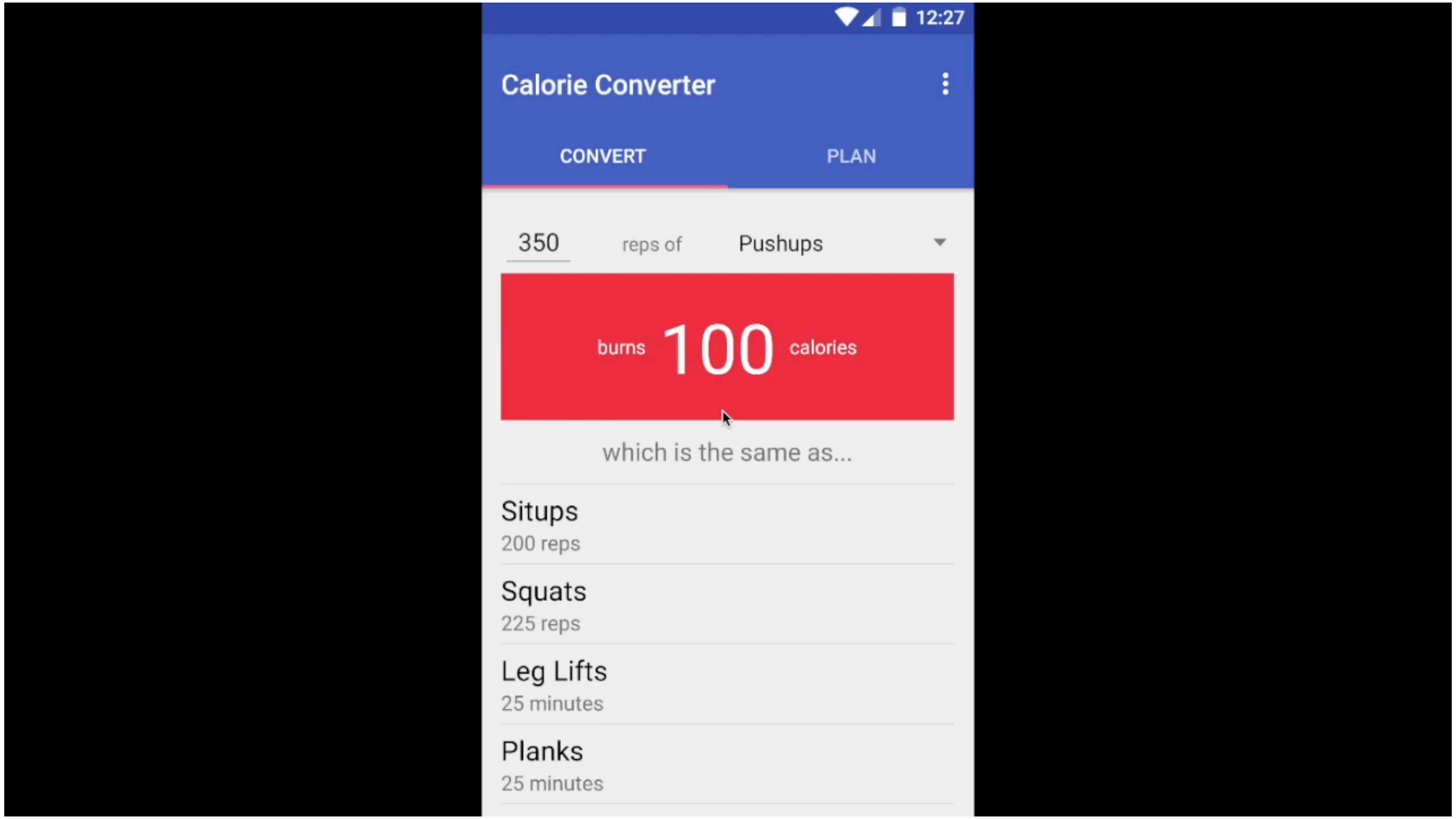
Life Goals:

-to live longer
-to find a life partner
-to be respected and looked upon favorably

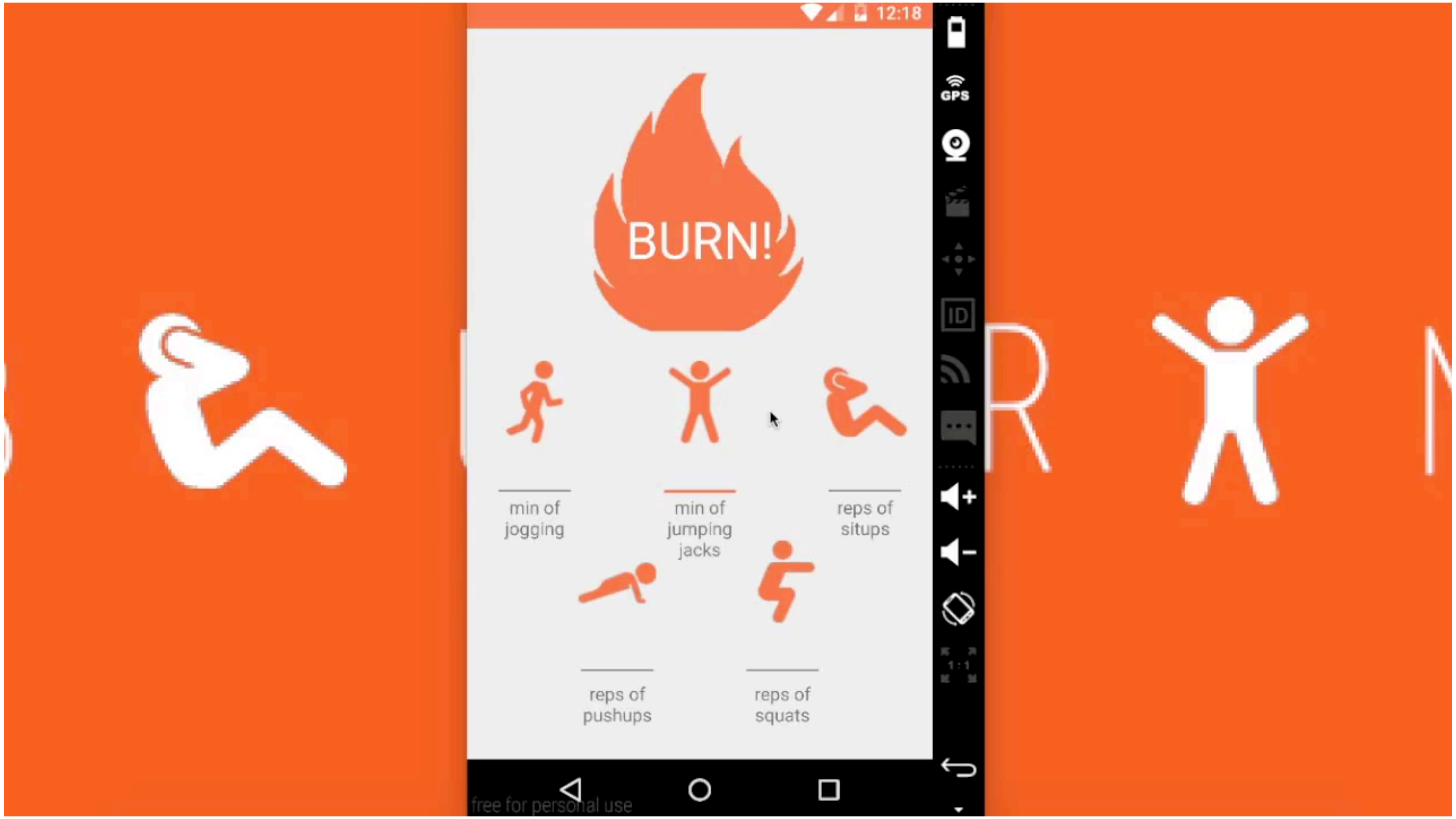
READING RESPONSE

Scenario: Jamie has just begun exercising regularly. They decide to add an extra workout day to their week just this once. They spontaneously come to the local gym in the neighborhood. Without the guidance of their trainer, Jamie looks around at the gym and notices a lot of people performing a variety of exercises. Not wanting to repeat any exercises from their prescribed workout regimen, Jamie searches online for a set of exercises. Mid-routine Jamie finds that the next set requires a piece of gym equipment that is already being used. Jamie quickly uses their phone (and the xerrcise app) while running on the treadmill to convert the calorie burn of the next set into a different activity.

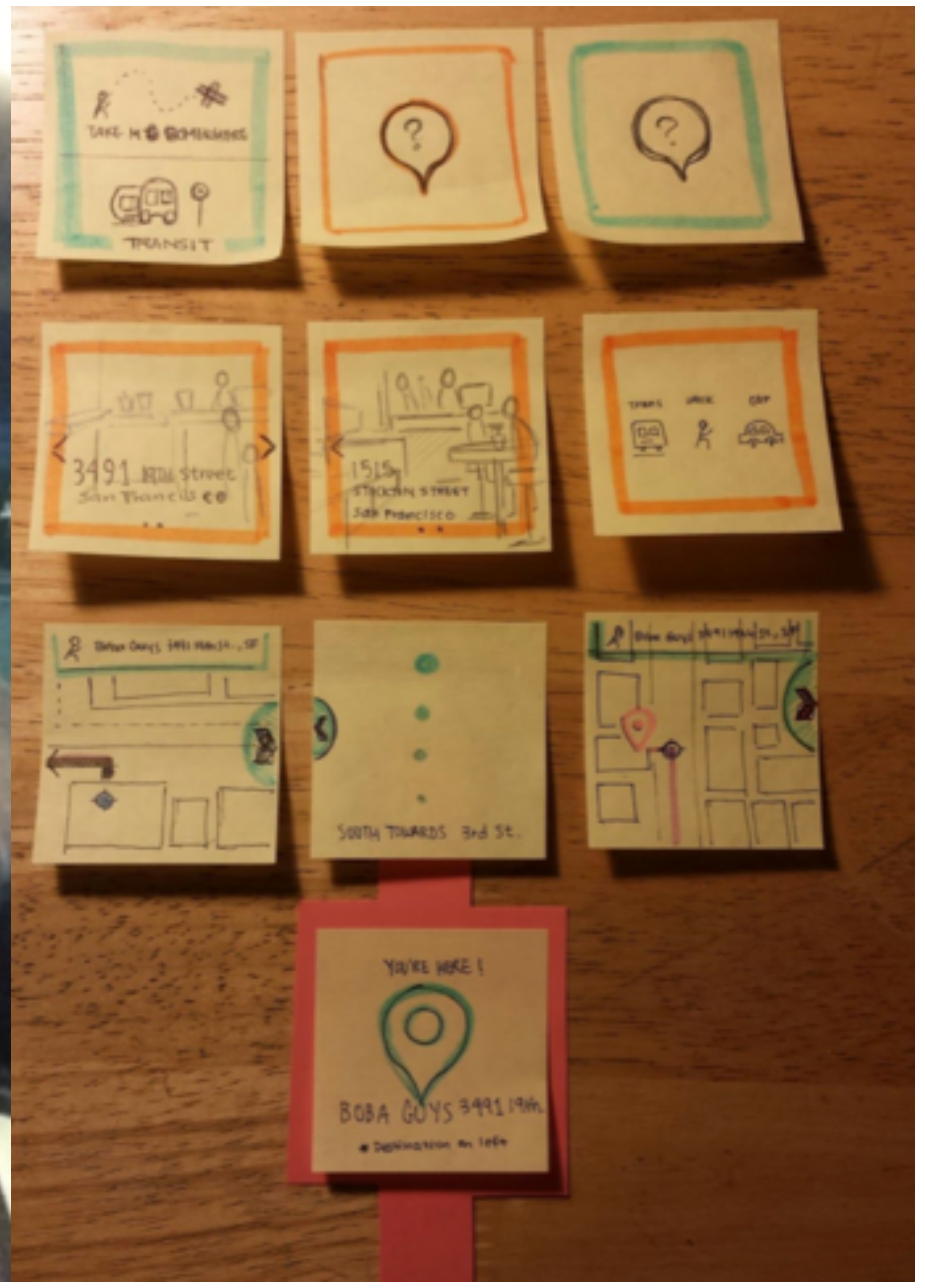
PROG 01: JOEL GRAYCAR



PROG 01: MAYA ANGELICA HERNANDEZ



DESIGN 01



WHY MODEL HUMAN PERFORMANCE?

WHY MODEL HUMAN PERFORMANCE?

To predict impact of new technology/interface

Apply model to predict effectiveness

We could build a simulator to evaluate user interface designs

HUMAN INFO PROCESSOR

Processors:

- Perceptual
- Cognitive
- Motor

Memory:

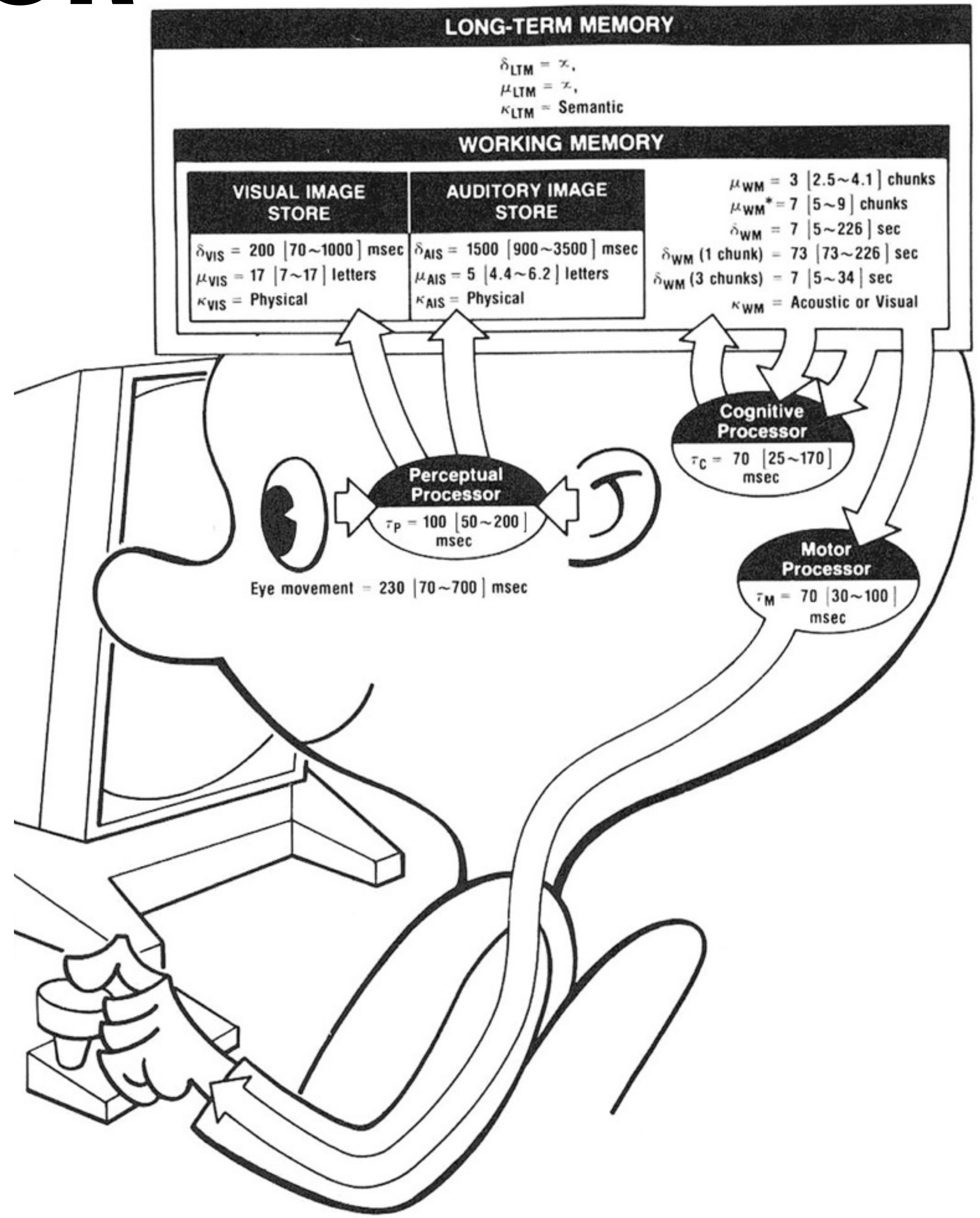
- Working memory
- Long-term memory

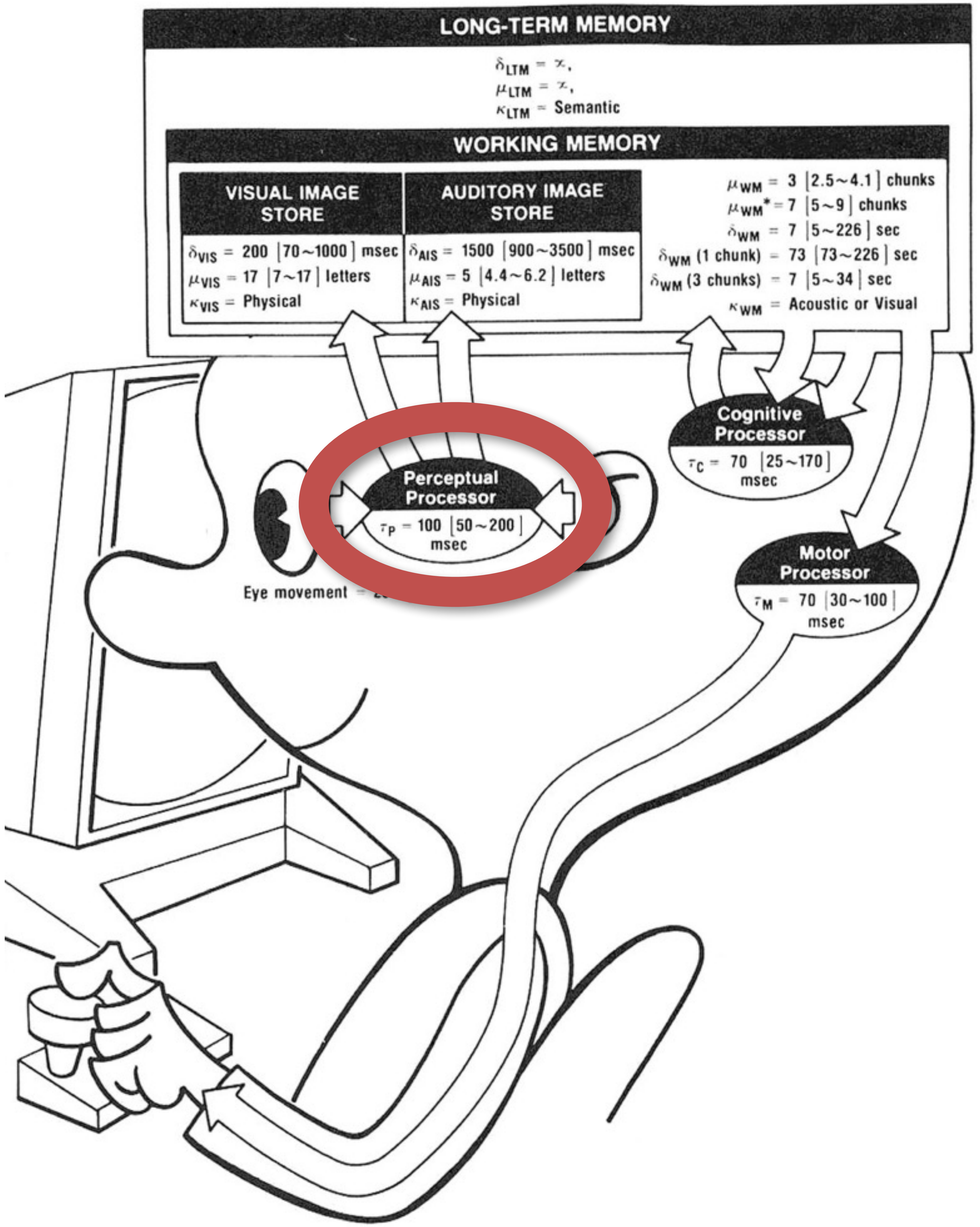
Unified model

Probably inaccurate

Predicts performance well

Very influential





LONG-TERM MEMORY
$\delta_{LTM} = \infty$,
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κ_{LTM} = Semantic
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VISUAL IMAGE STORE
δ_{VIS} = 200 [70~1000] msec
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Perceptual Processor
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Motor Processor
τ_M = 70 [30~100] msec
Eye movement

PERCEPTUAL PROCESSOR

Physical store from our senses: sight, sound, touch, ...

Code directly based on sense used

Visual, audio, haptic, ... features

Selective

Spatial

Pre-attentive: color, direction...

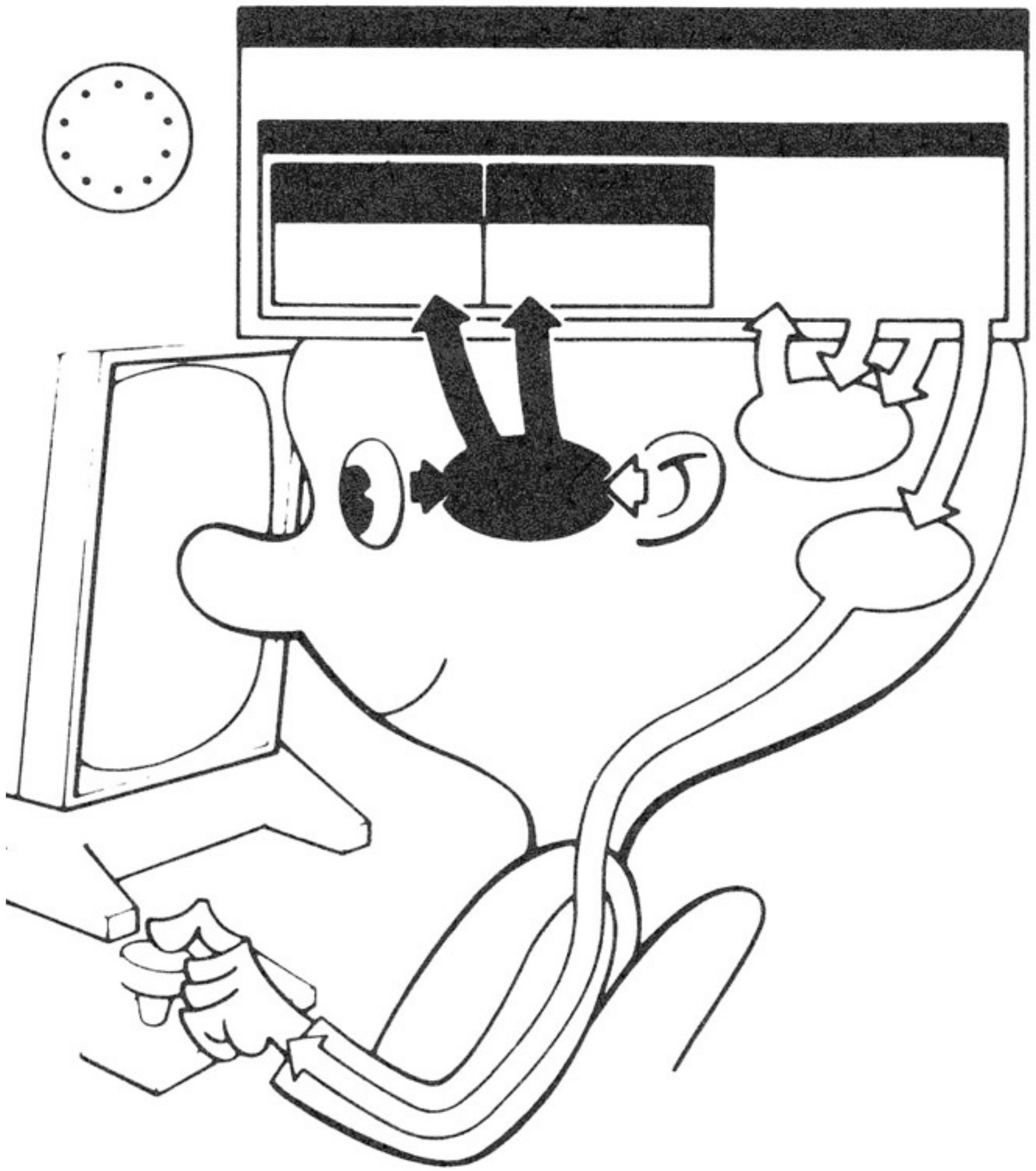
Capacity of visual store

Example: 17 letters

Decay time for working memory: 200ms

Recoded for transfer to working memory

Progressive: 10ms/letter



PRE-ATTENTIVE

Typically, tasks that can be performed on large multi-element displays in less than 200 to 250 milliseconds are considered preattentive.

HOW MANY 3'S

1281768756138976546984506985604982826762
9809858458224509856458945098450980943585
9091030209905959595772564675050678904567
8845789809821677654876364908560912949686

HOW MANY 3'S

5690859068509681389765469845069856082826
2112091820981209812098465969091030209902
5395959577256445689075469675050678904567
8189457636466950440598681240360912949686

HOW MANY 3'S

1281768756138976546984506985604982826762
9809858458224509856458945098450980943585
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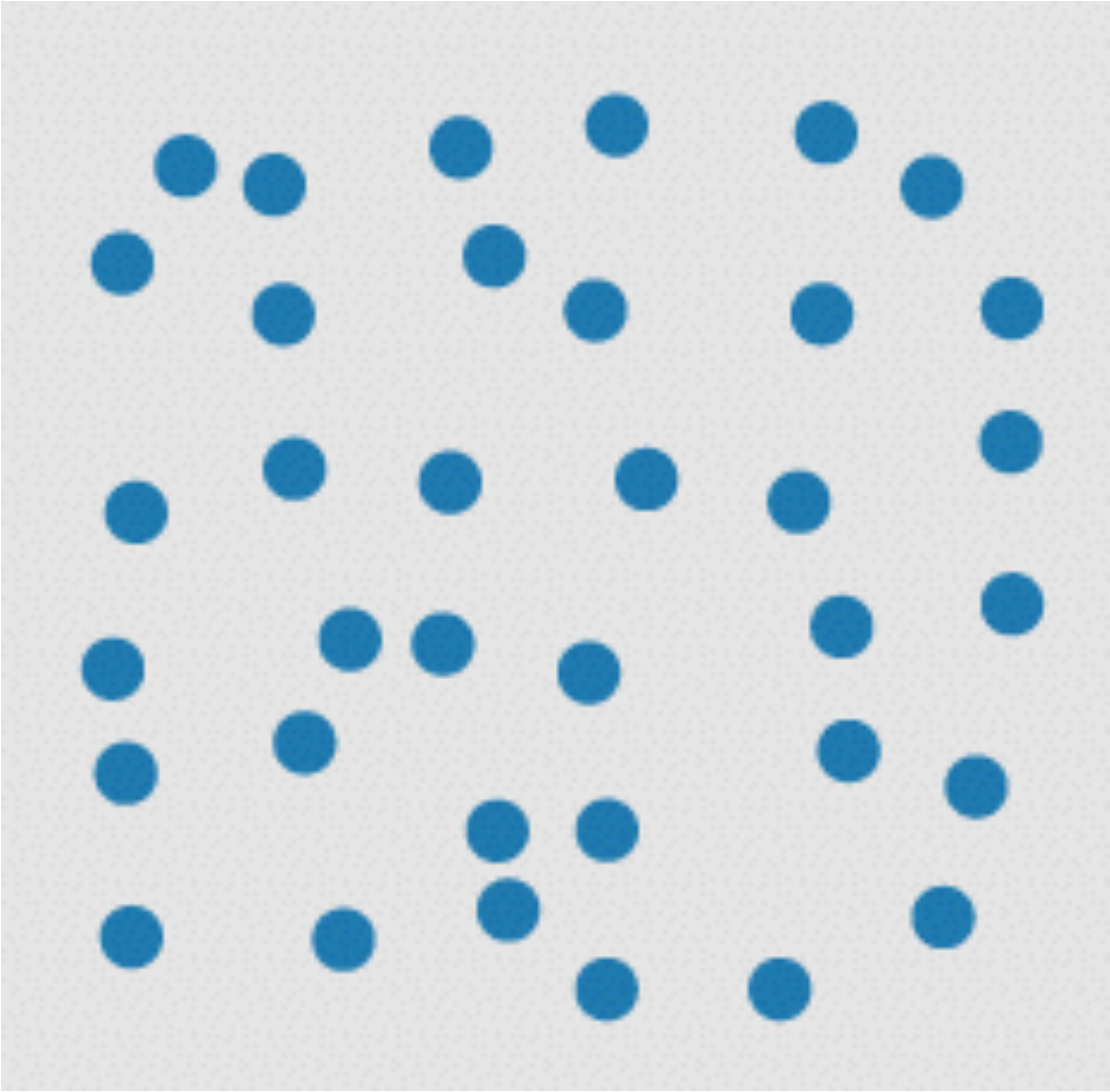
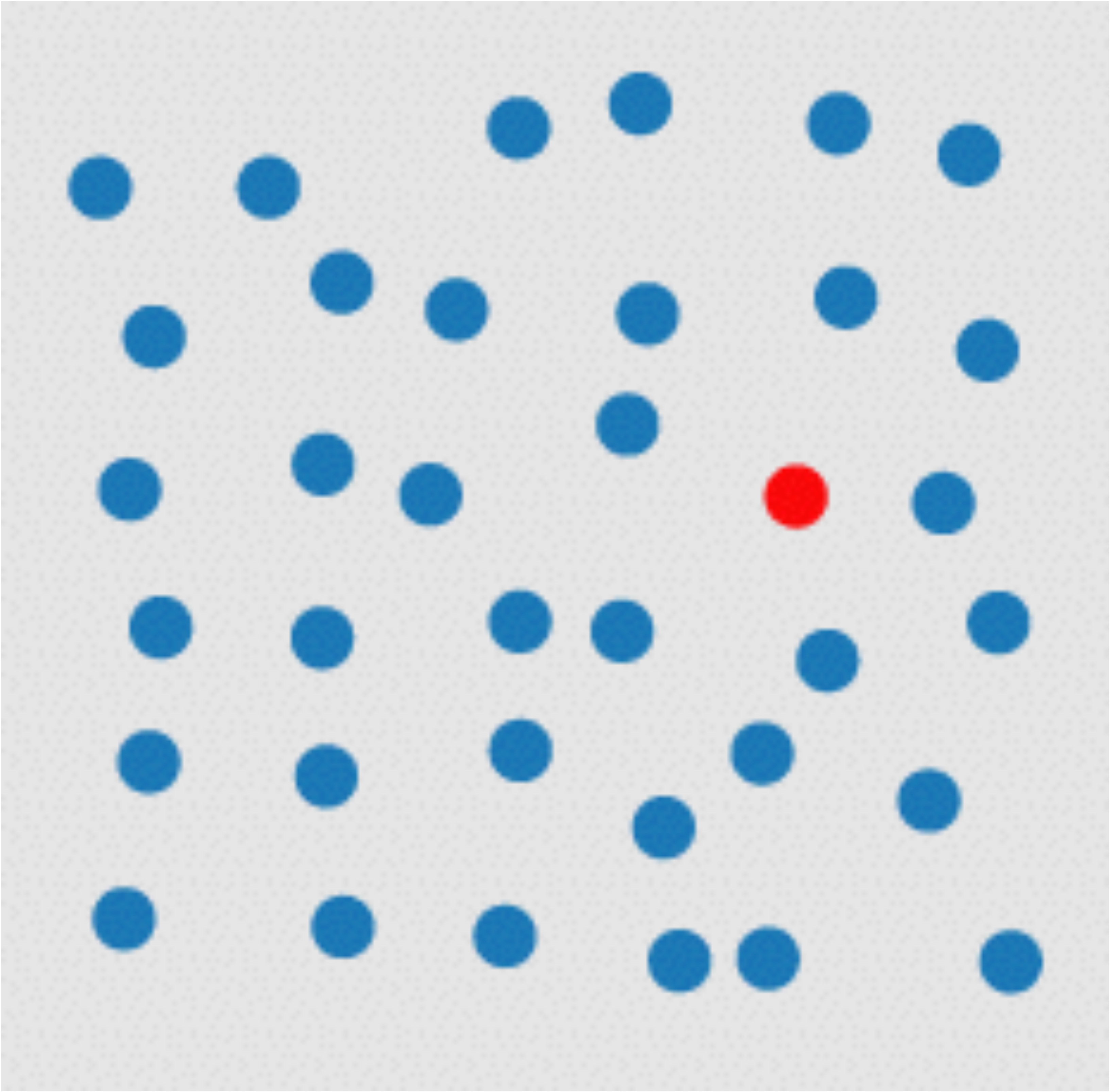
8845789809821677654876364908560912949686

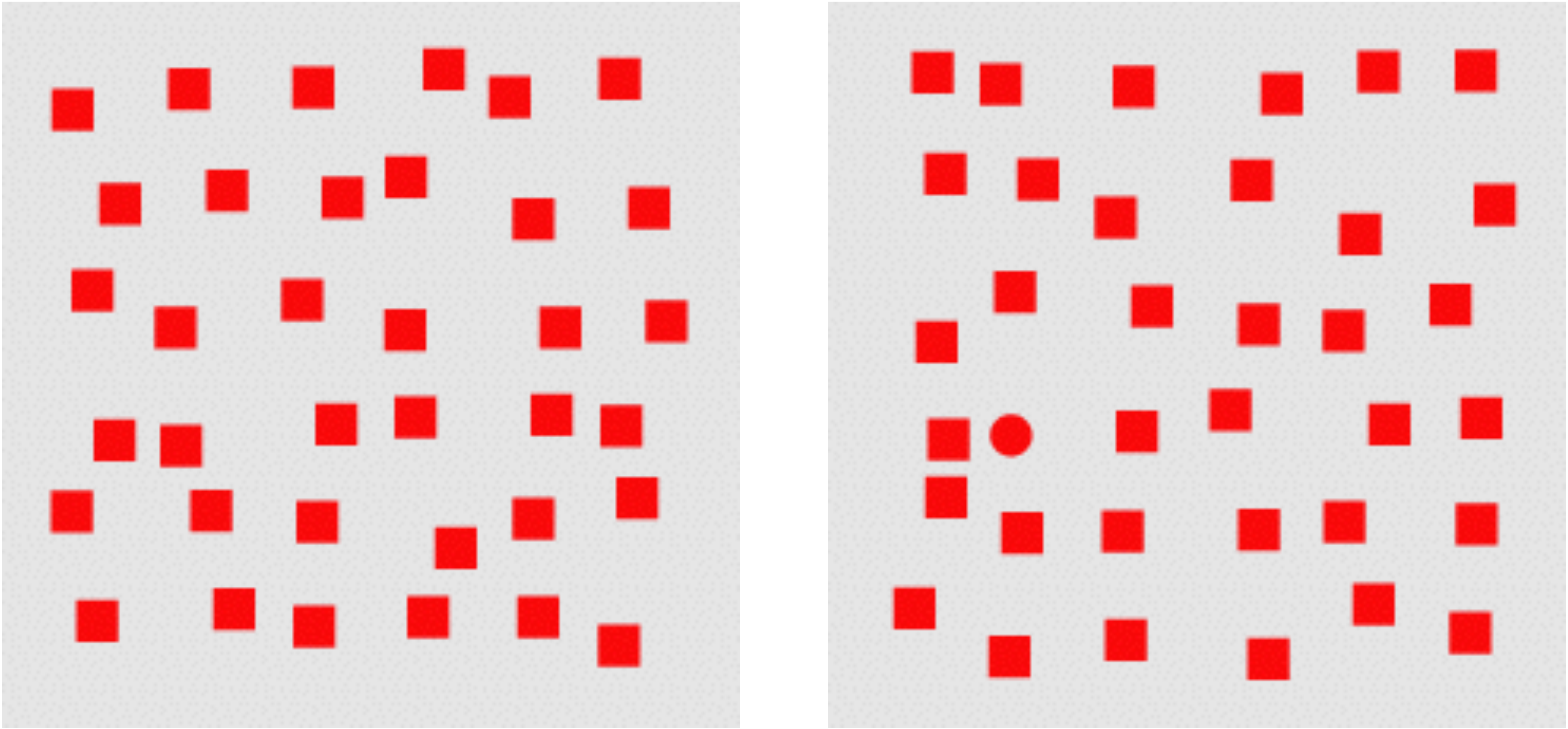
VISUAL POP-OUT: COLOR

http://www.csc.ncsu.edu/faculty/healey/PP/index.html





VISUAL POP-OUT: SHAPE



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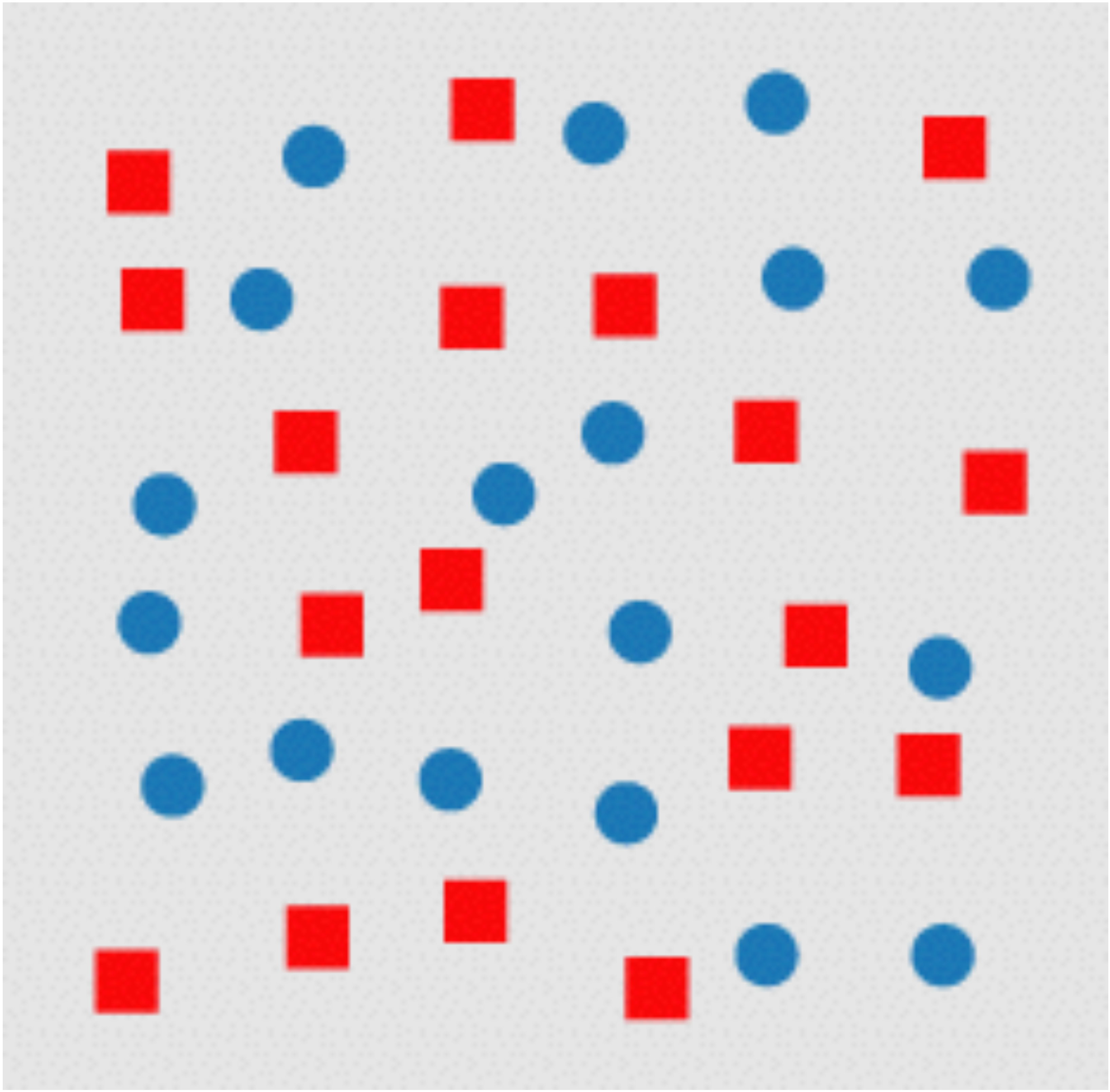
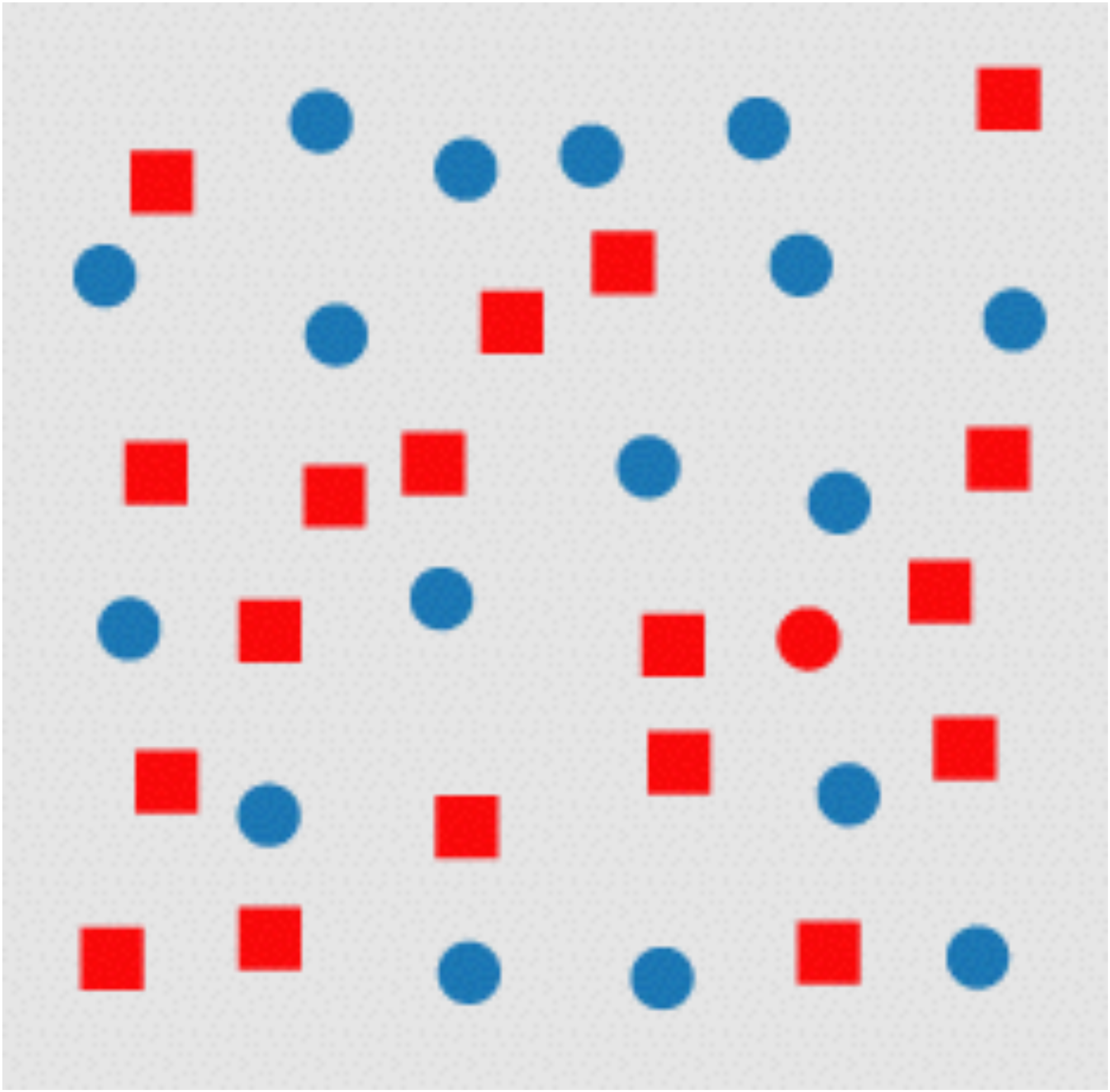
FEATURE CONJUNCTIONS





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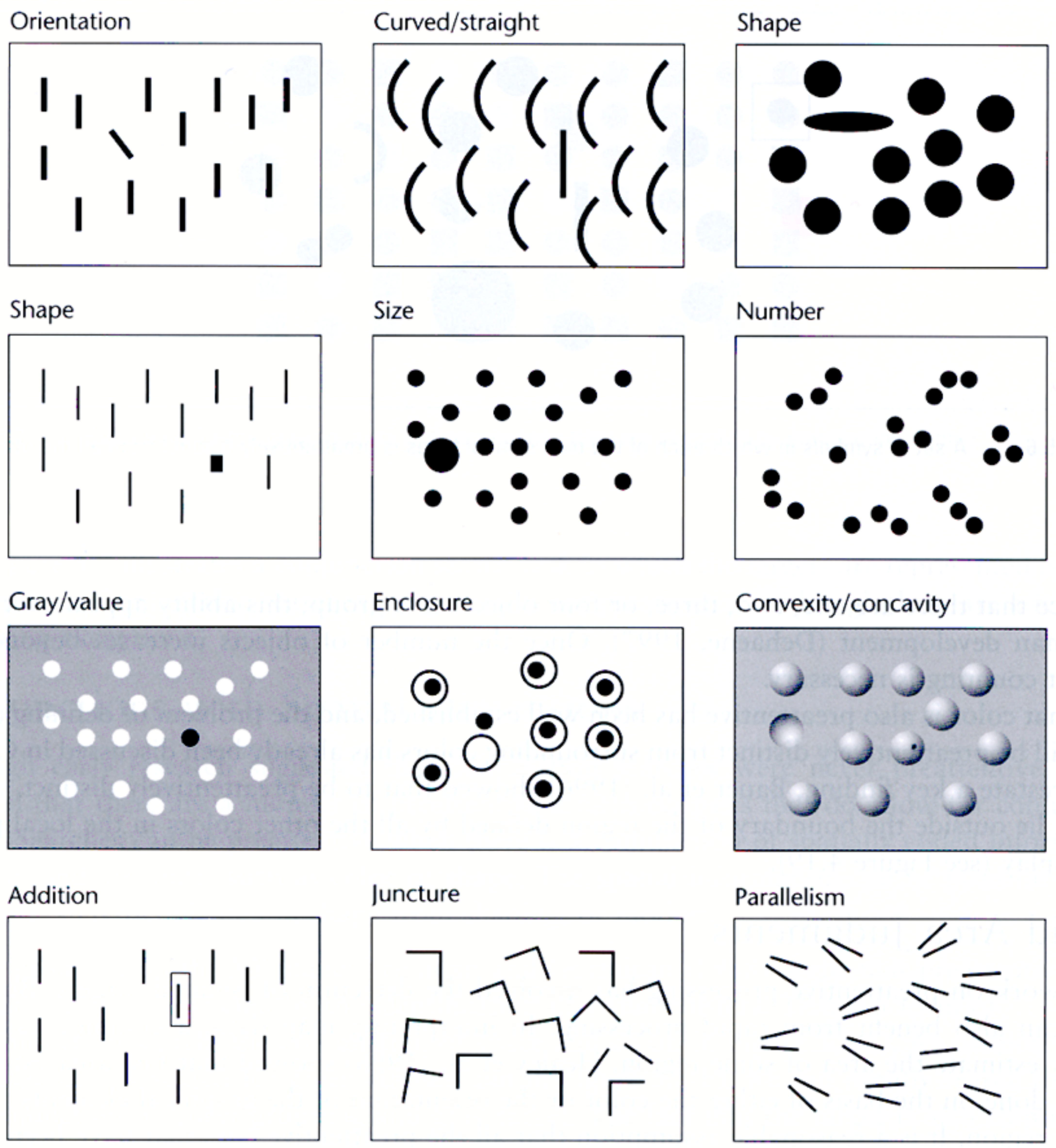
PRE-ATTENTIVE FEATURES



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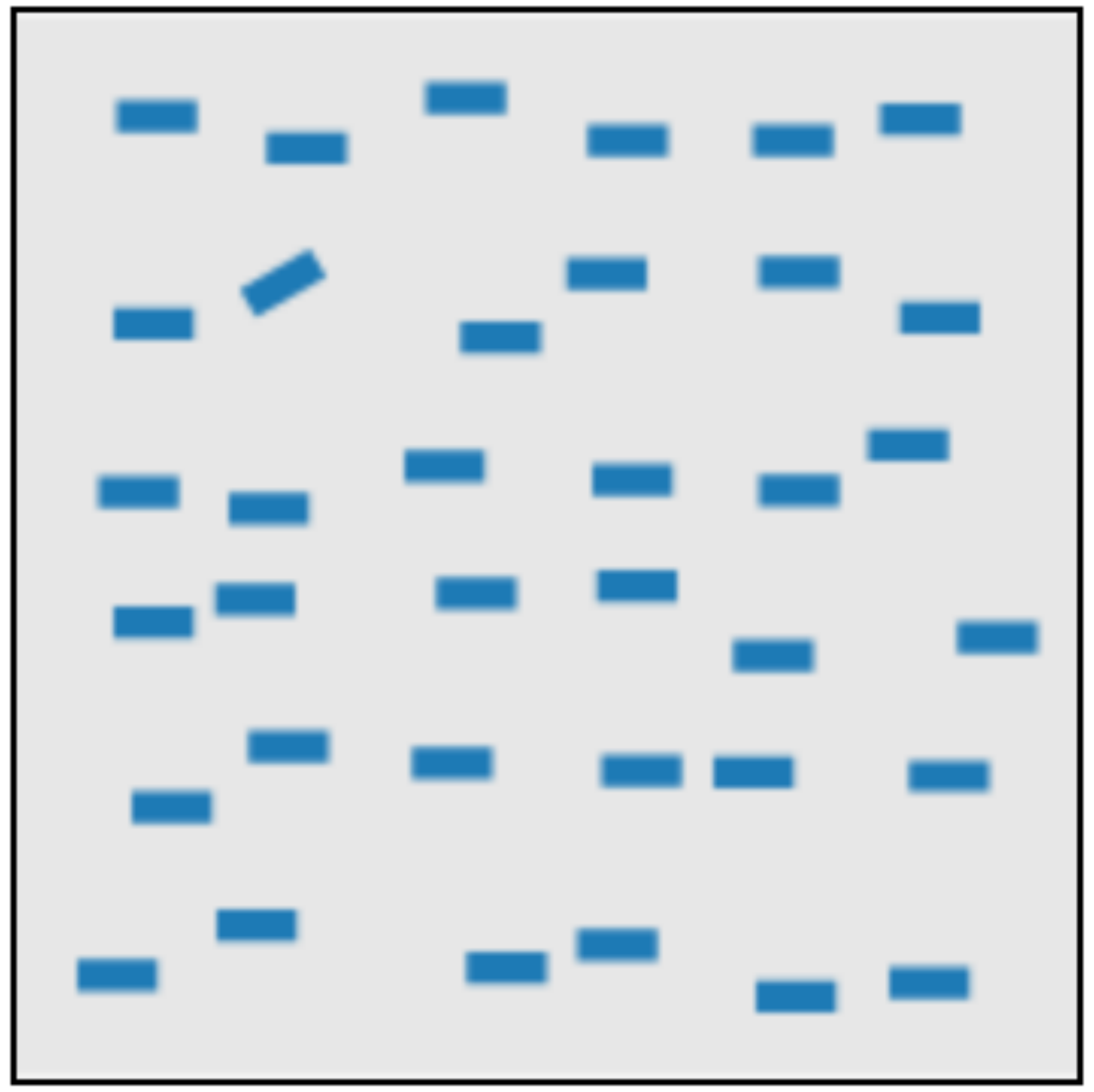
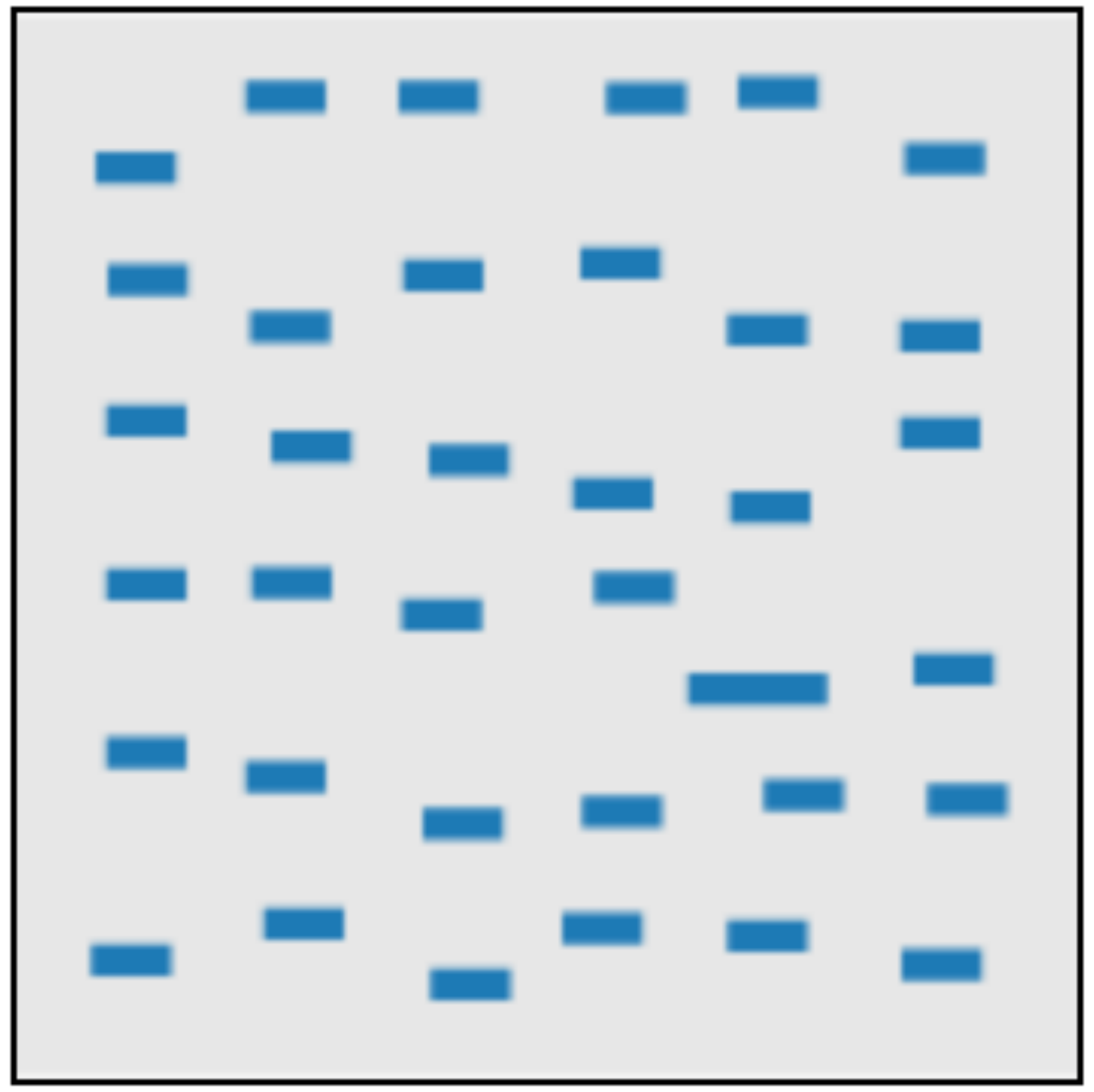
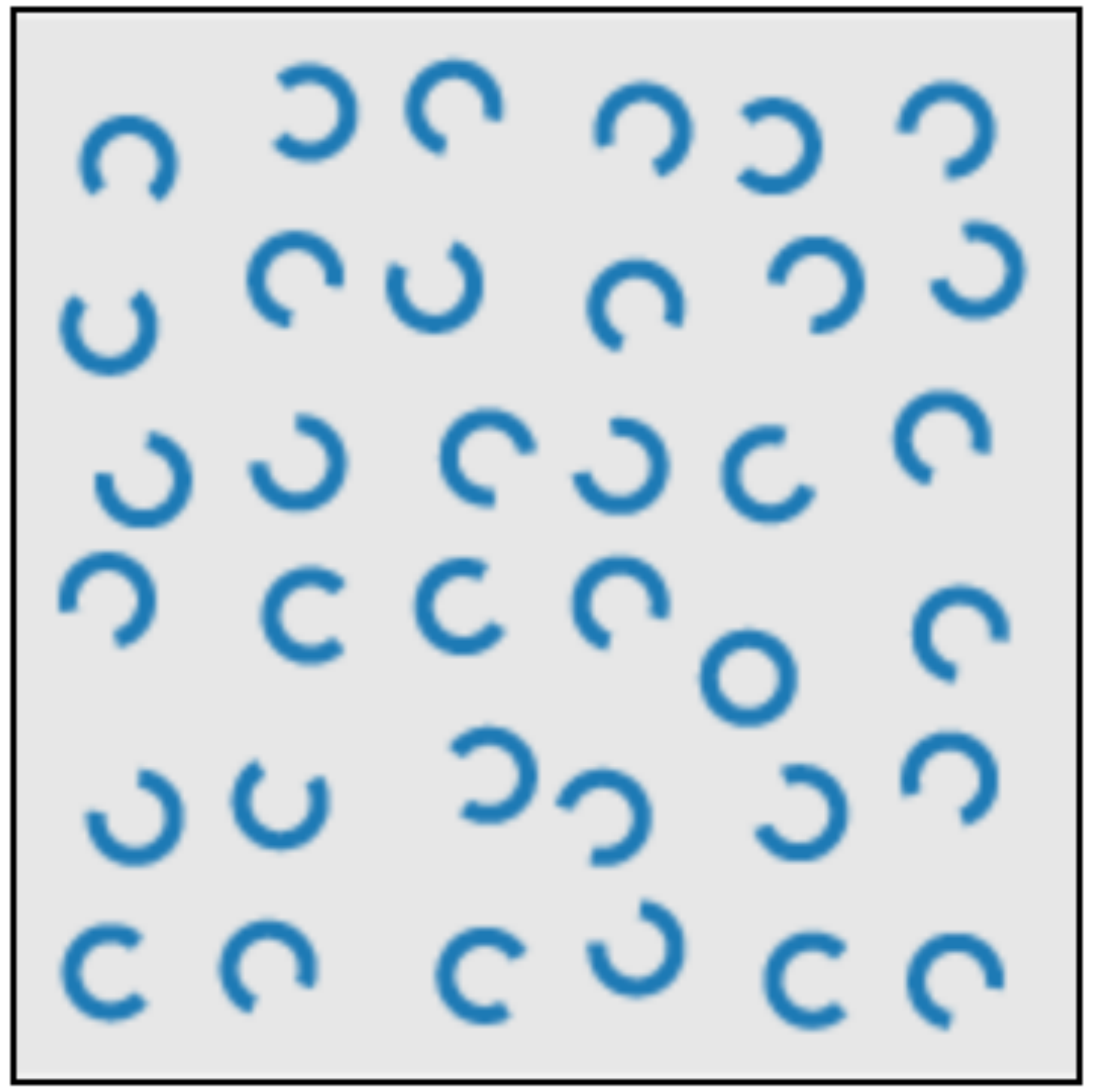


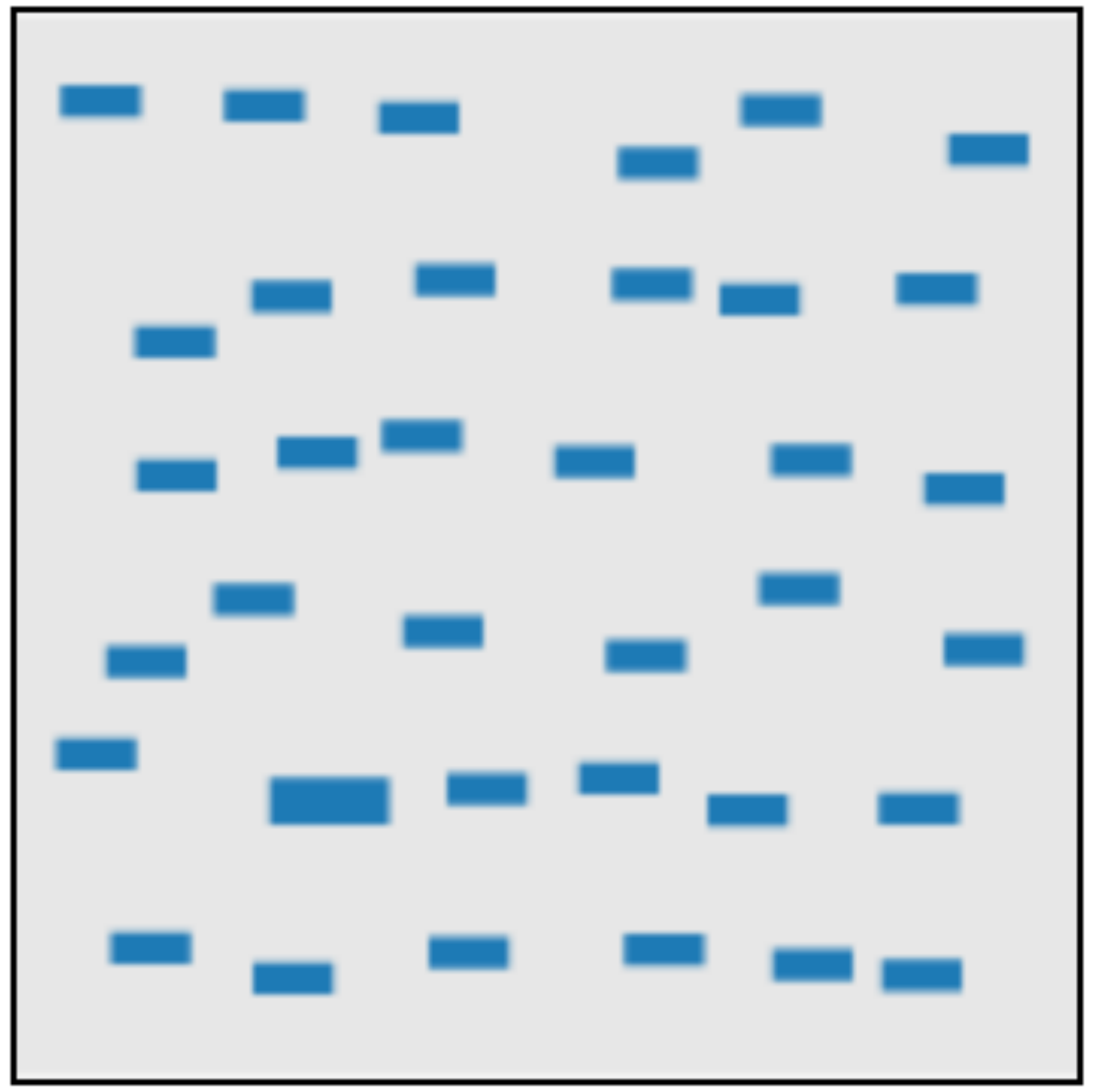
line (blob) orientation



length, width

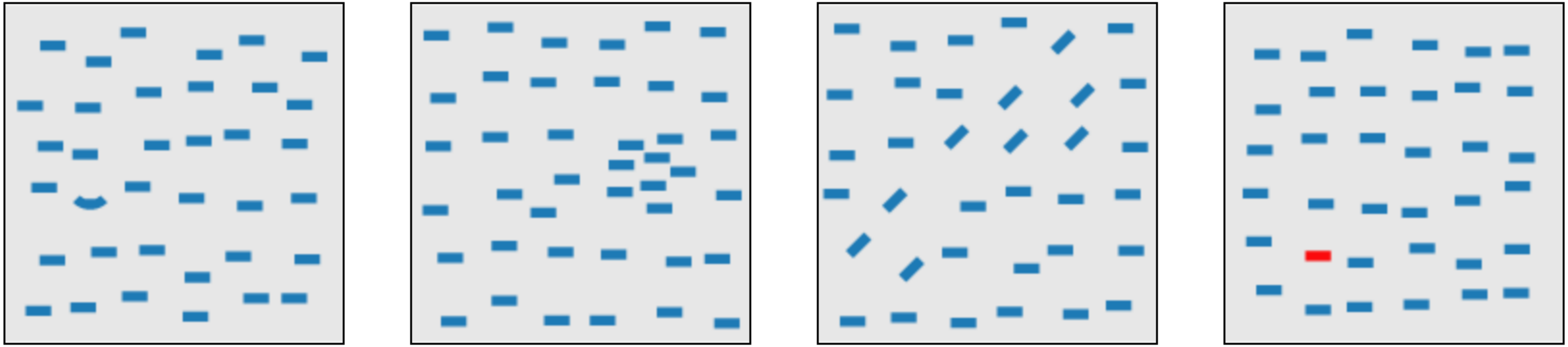


closure



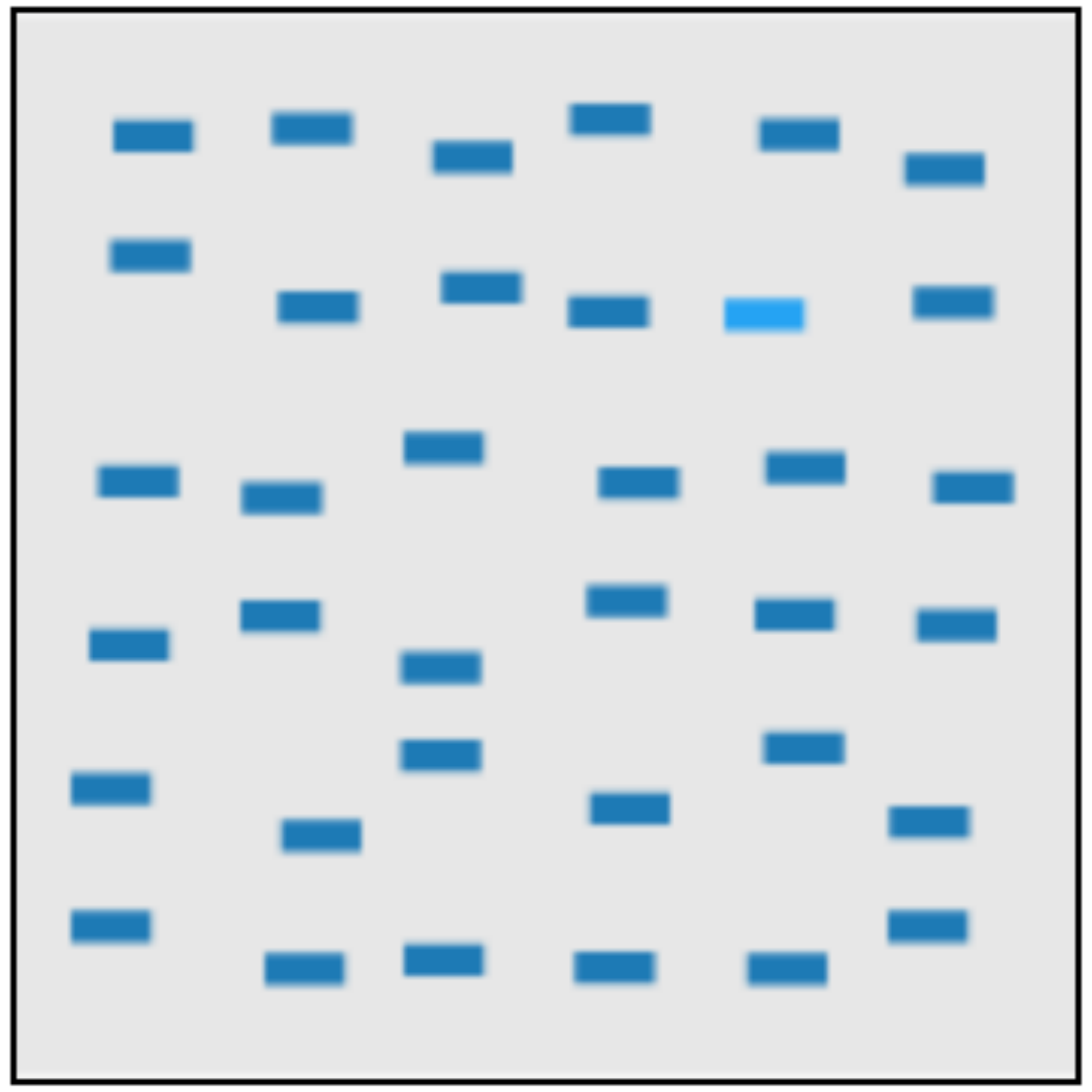
size

PRE-ATTENTIVE FEATURES

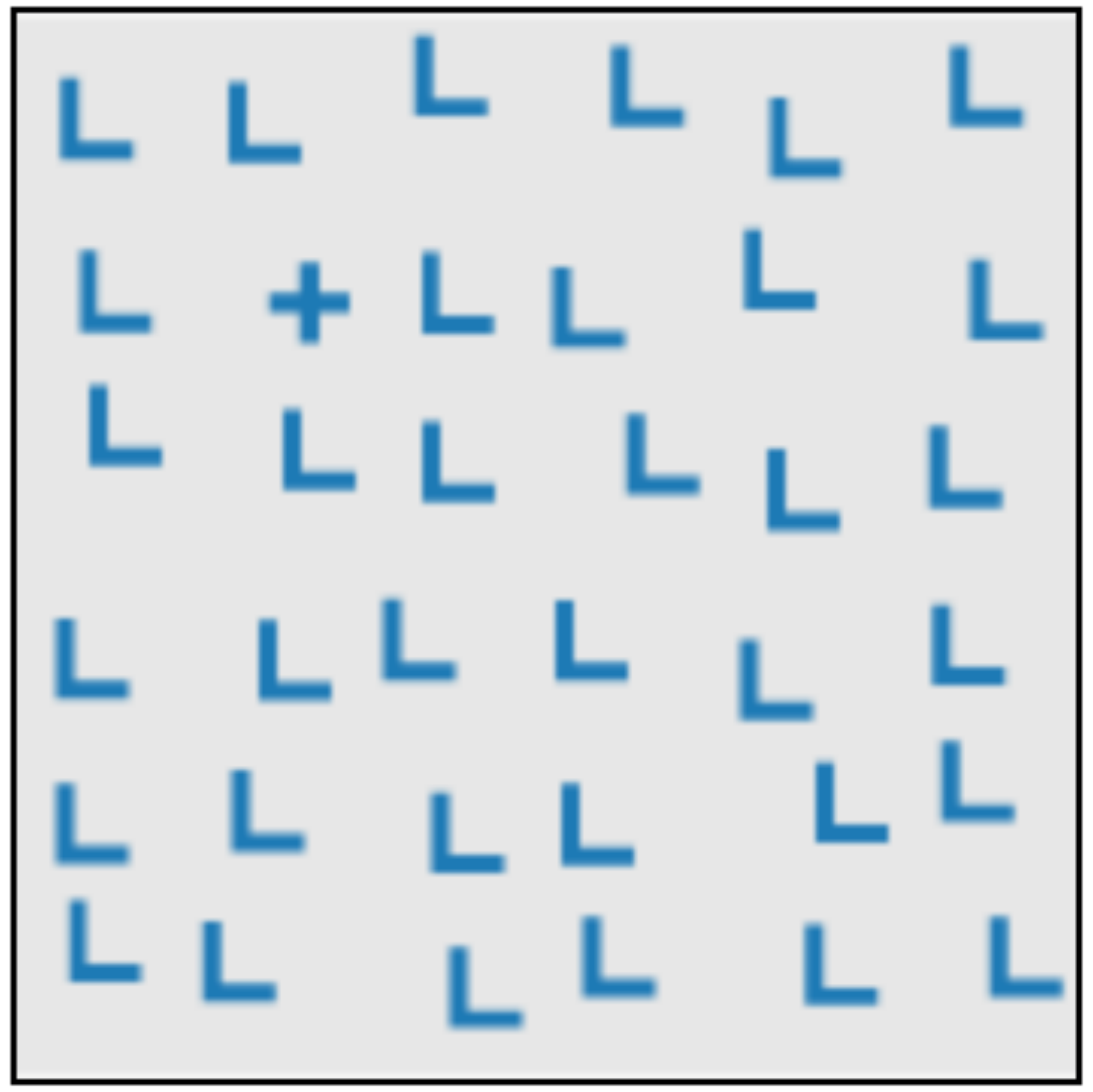


curvature | density, contrast | number, estimation | colour (hue)

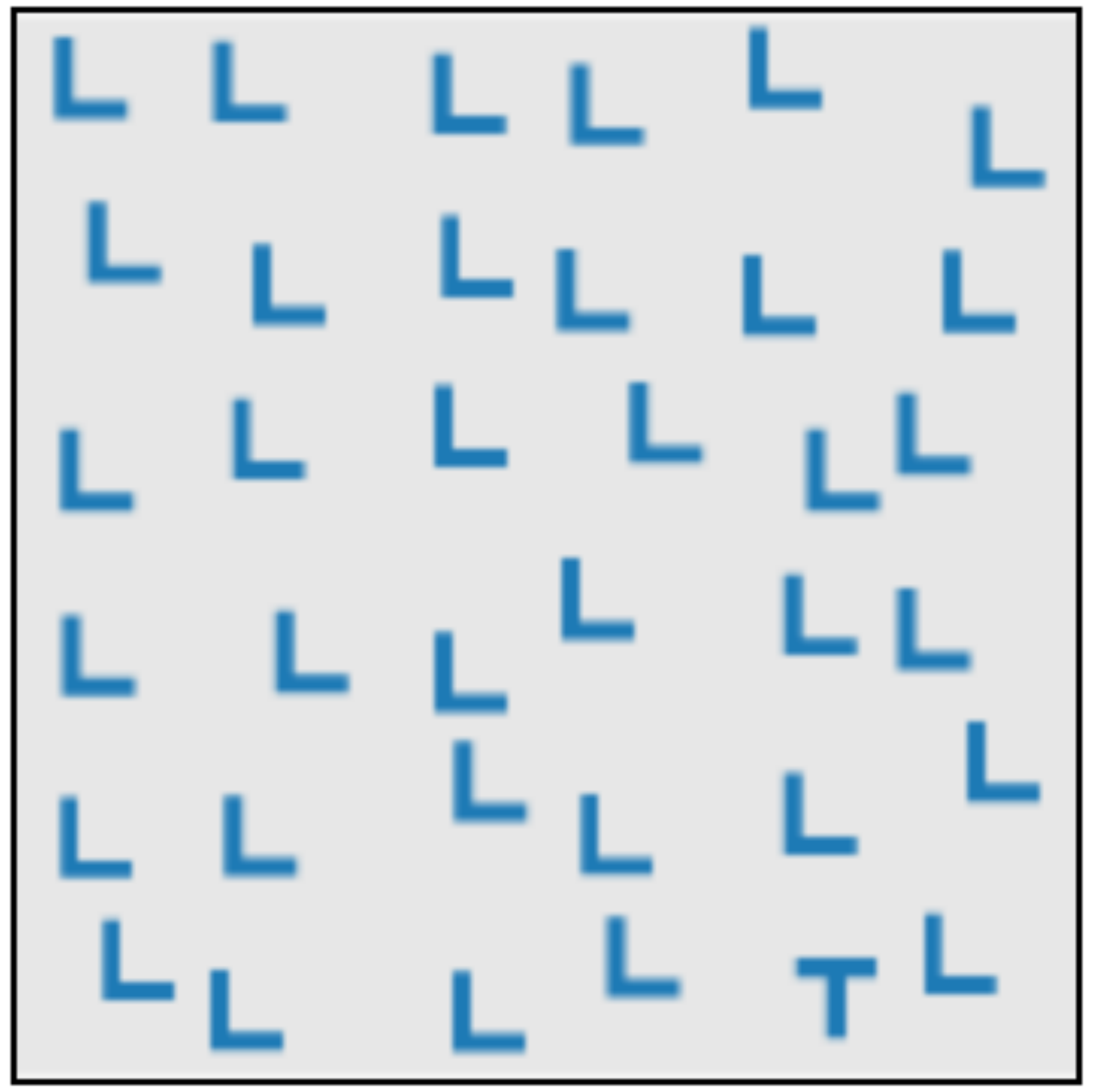
PRE-ATTENTIVE FEATURES



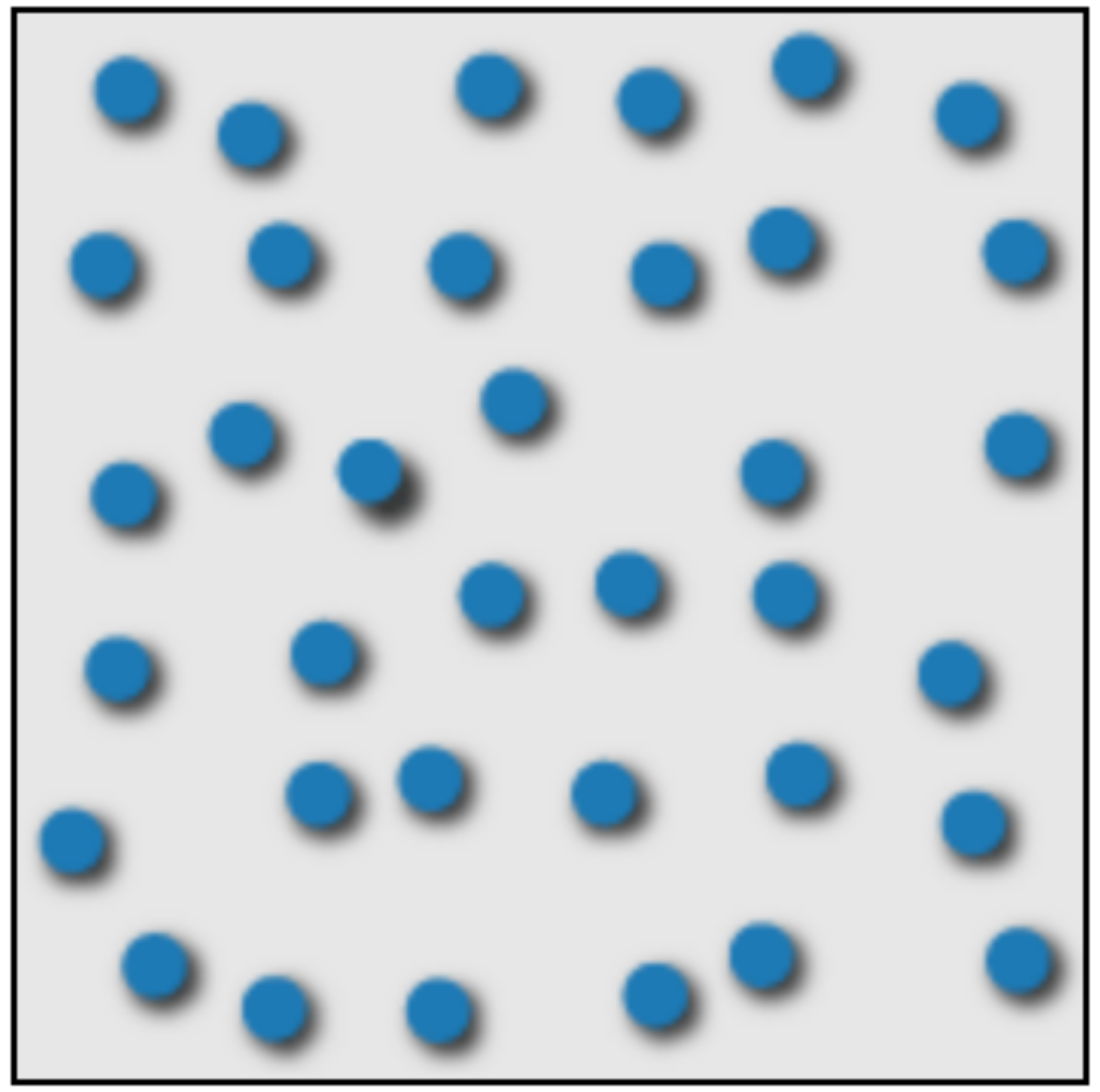
intensity, binocular lustre



intersection



terminators



3D depth cues

http://www.csc.ncsu.edu/faculty/healey/PP/

CHANGE BLINDNESS

Change blindness is a surprising perceptual phenomenon that occurs when a change in a visual stimulus is introduced and the observer does not notice it. For example, observers often fail to notice major differences introduced into an image while it flickers off and on again.

Instructions

Count how many times the players wearing white pass the basketball.

SELECTIVE ATTENTION

Selective attention is simply the act of focusing on a particular object for a period of time while simultaneously ignoring irrelevant information that is also occurring. This occurs on a daily basis and can be seen in basically any of your interactions. Because it is impossible to give attention to every stimulus in our environment, we use selective attention to select what stimuli are important as events occur.

PERCEPTUAL PROCESSOR

Cycle time

Quantum experience: 100ms

Percept fusion

Frame rate necessary for movies to look continuous?

time for 1 frame < Tp (100 msec) -> 10 frame/sec.

Max. morse code rate can be similarly calculated

Perceptual causality

Two distinct stimuli can fuse if the first event appears to *cause* the other

Events must occur in the same cycle

Michotte demonstration 1. What do you see? Most observers report that the red ball **hit** the blue ball. The blue ball moved "**because** the red ball hit it." Thus, the red ball is perceived to "**cause**" the blue ball to move, even though the balls are nothing more than color disks on your screen that move according to a program.

http://cogweb.ucla.edu/Discourse/Narrative/Heider_45.html

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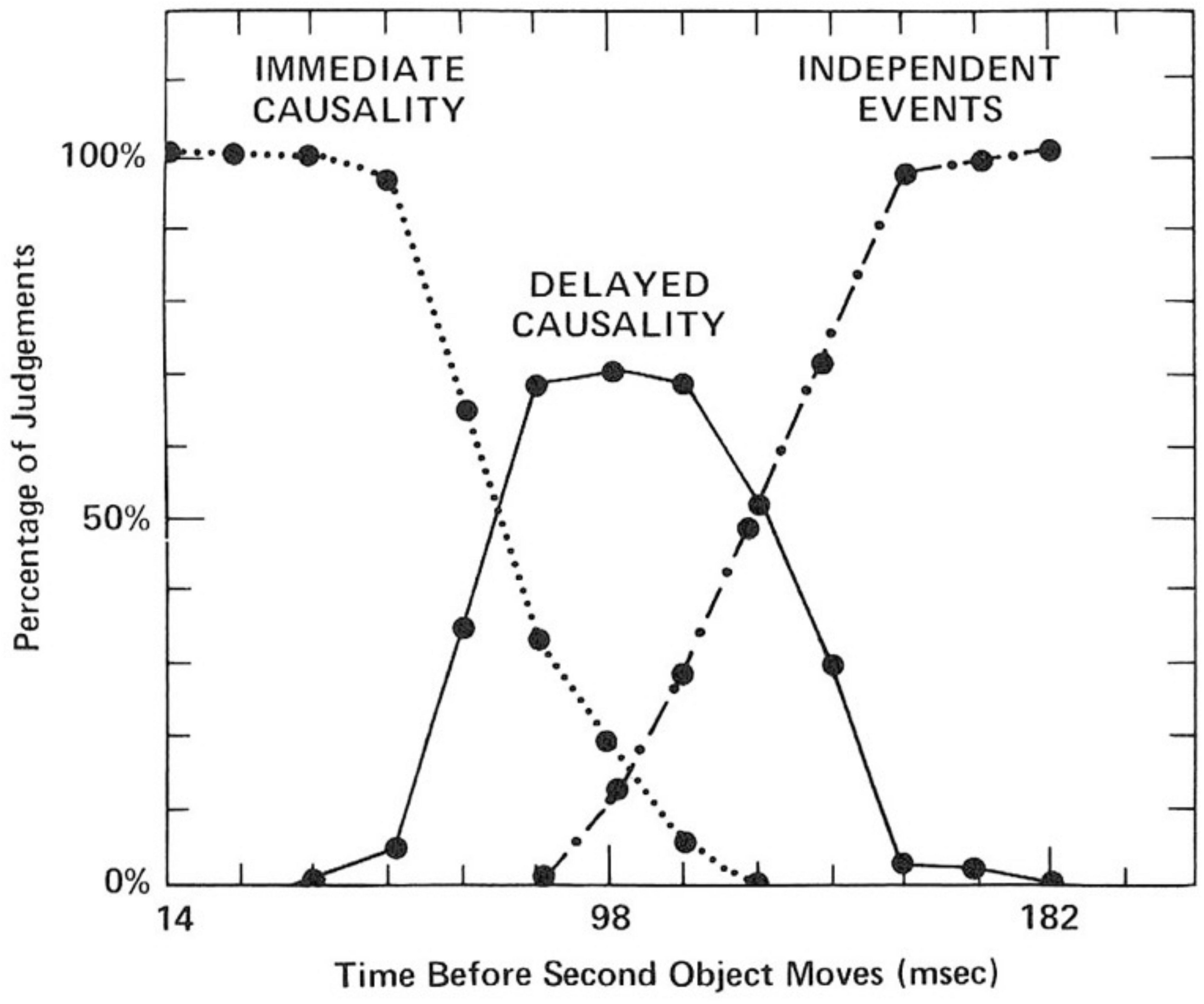


WORKING MEMORY

Access in chunks

Task dependent construct

7 ±2 (Miller)

Decay

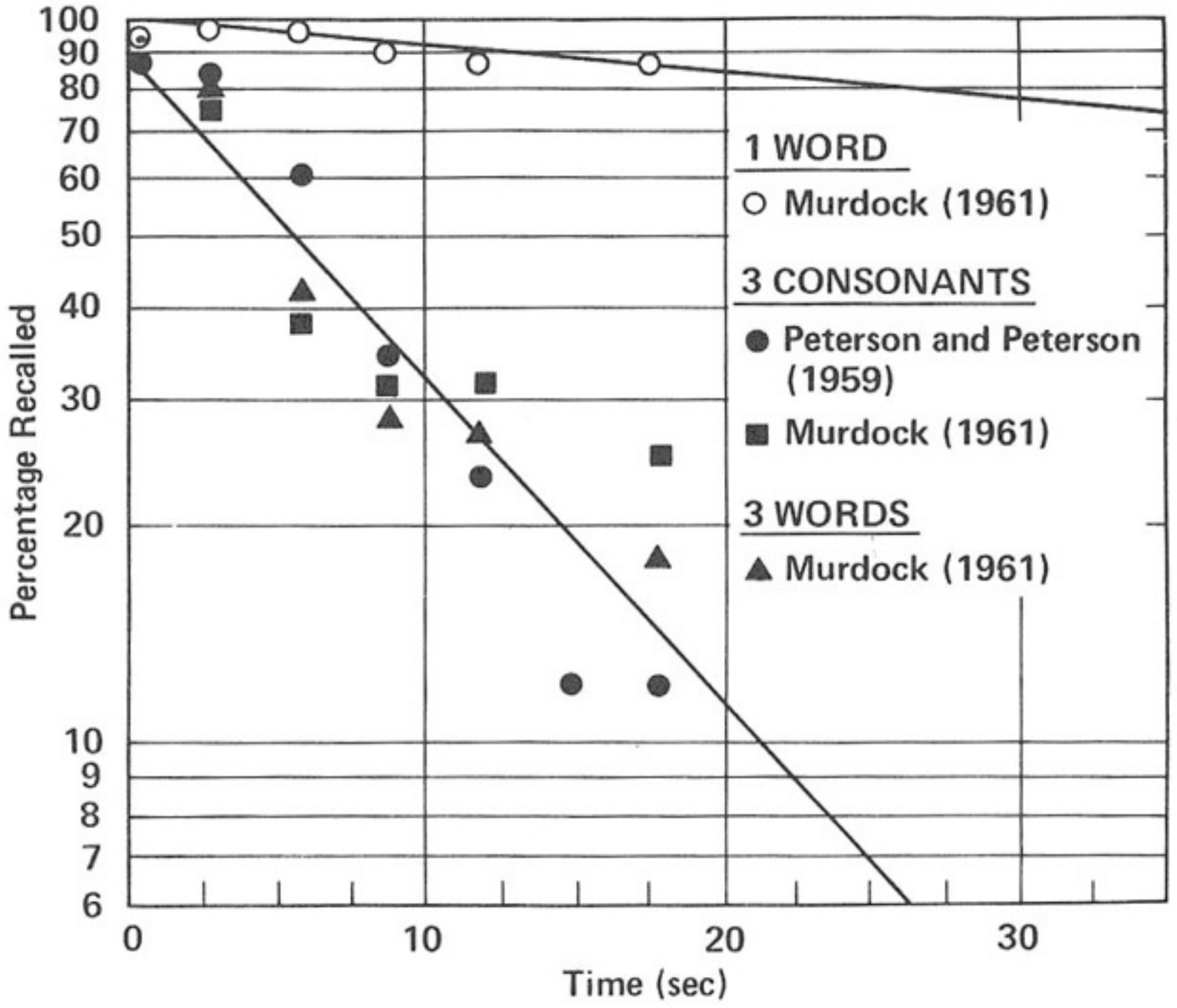
Content dependant

1 chunk 73 sec

3 chunks 7 sec

Attention span

Interruptions > decay time



LONG TERM MEMORY

Very large capacity

Semantic encoding

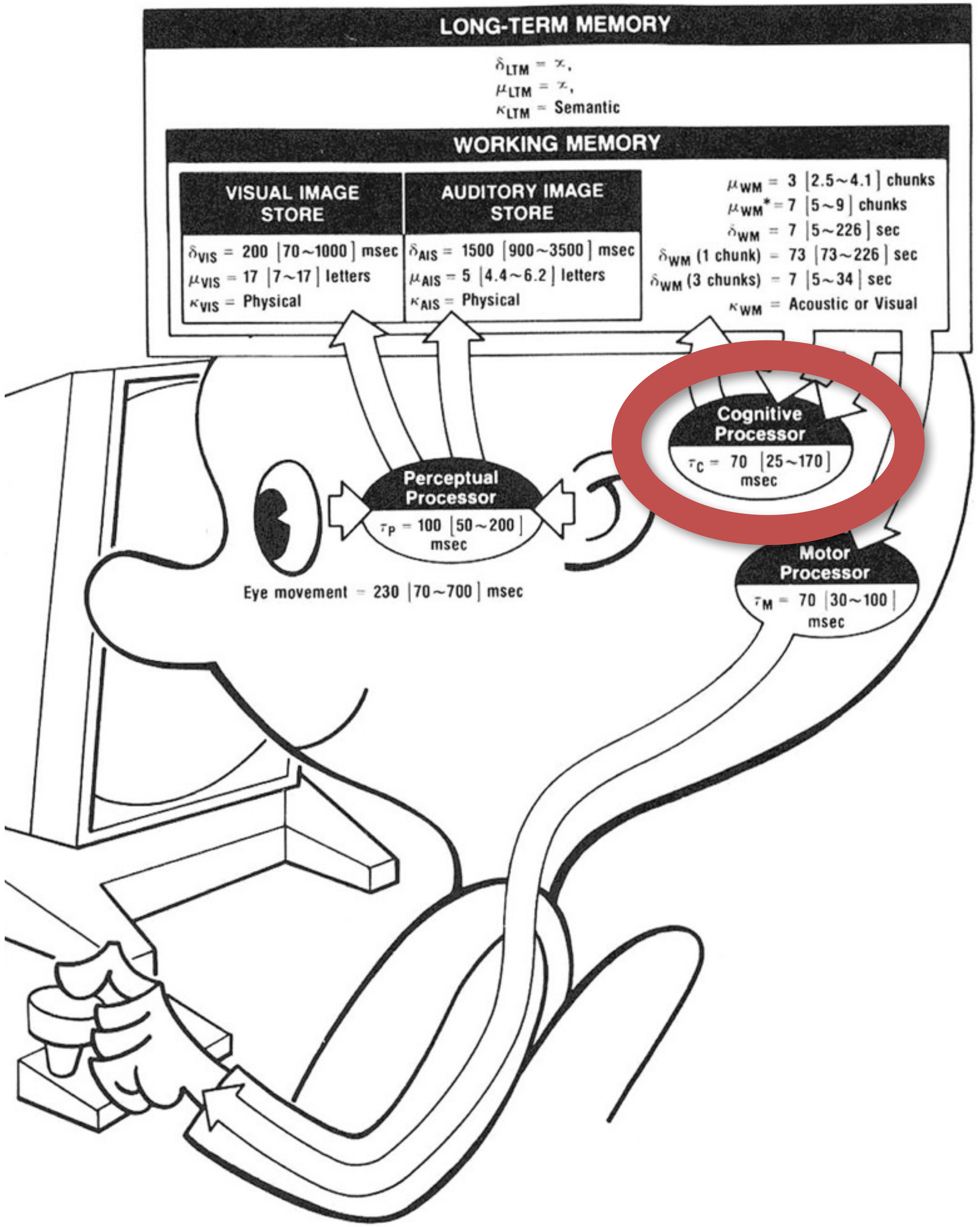
Associative access

Fast read: 70ms

Expensive write: 10s

Can also move from WM to LTM via rehearsal

Context at the time of acquisition key for retrieval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τ_M = 70 [30~100] msec

COGNITIVE PROCESSOR

Cycle time: 70ms

Can be modulated

Typical matching time

Digits: 33ms

Colors: 38ms

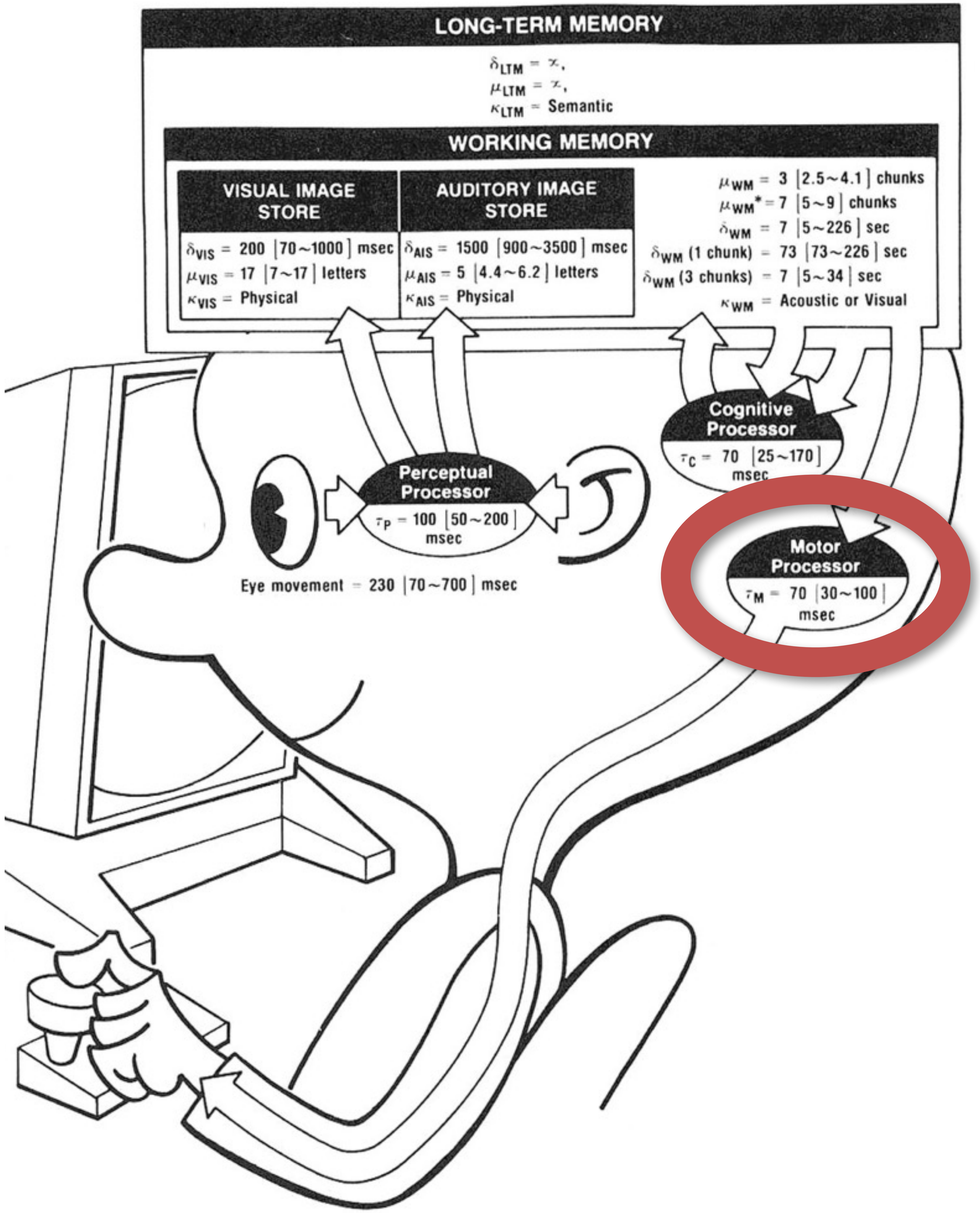
Geometry: 50ms...

Fundamentally serial

One locus of attention at a time

Eastern 401, December 1972

Crew focused on landing gear indicator bulb,
Aircraft is loosing altitude (horn, warning indicator...),
Aircraft crashed in the Everglades
see “The Human Interface” by Raskin, p25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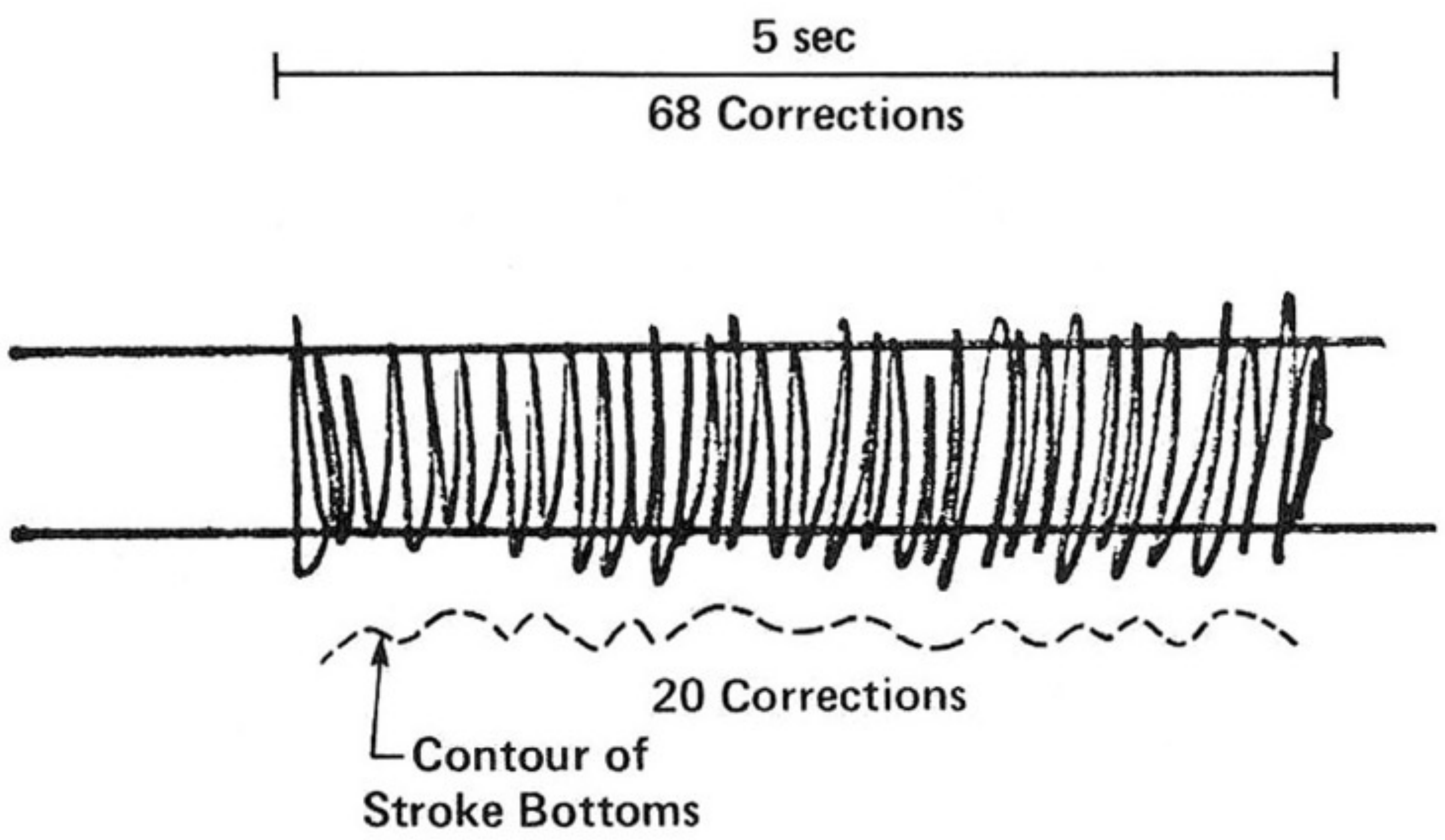
MOTOR PROCESSOR

Receive input from the cognitive processor

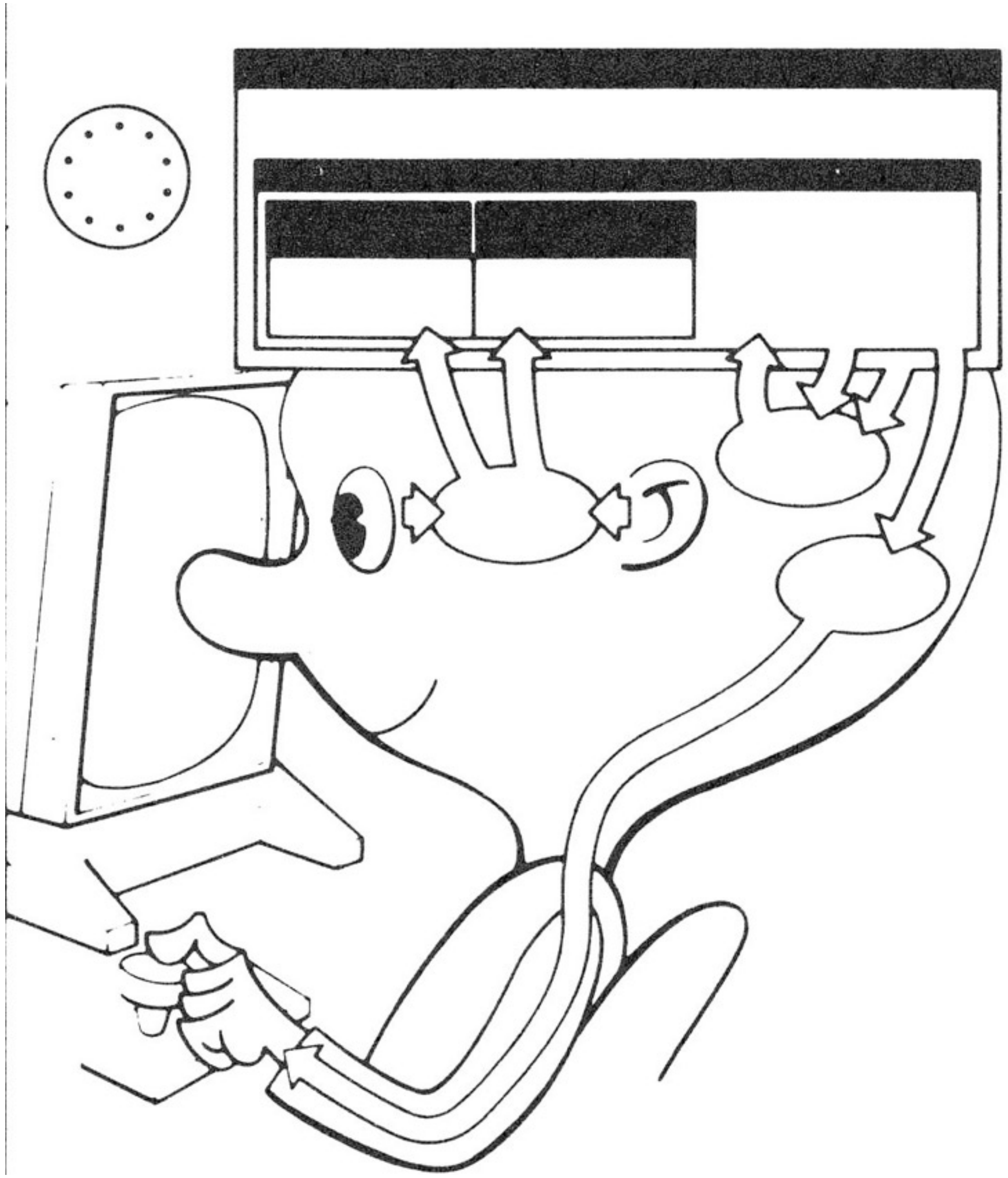
Execute motor programs

Pianist: up to 16 finger movements per second

Point of no-return for muscle action



HIT SPACE WHEN CHARACTER APPEARS



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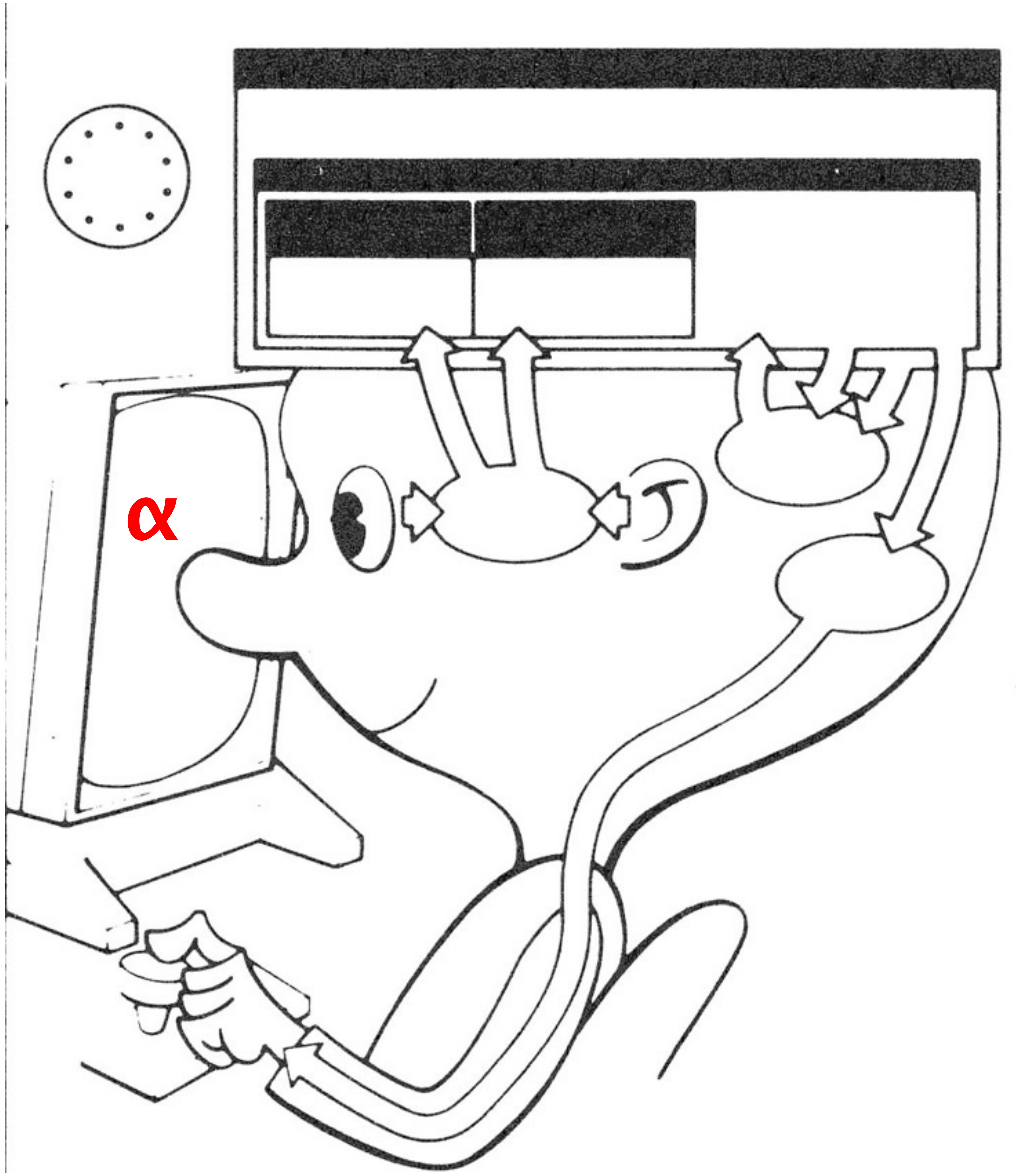

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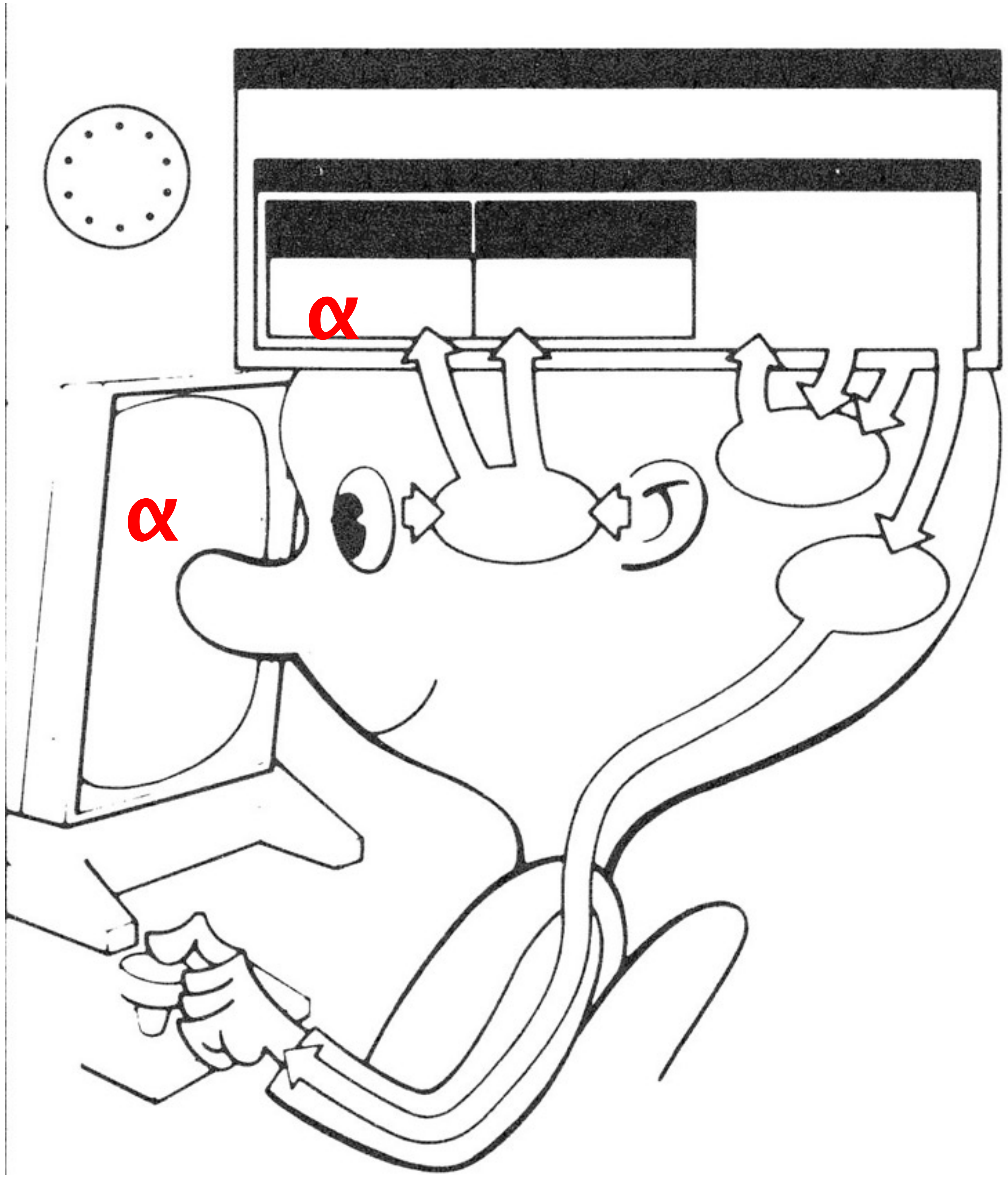

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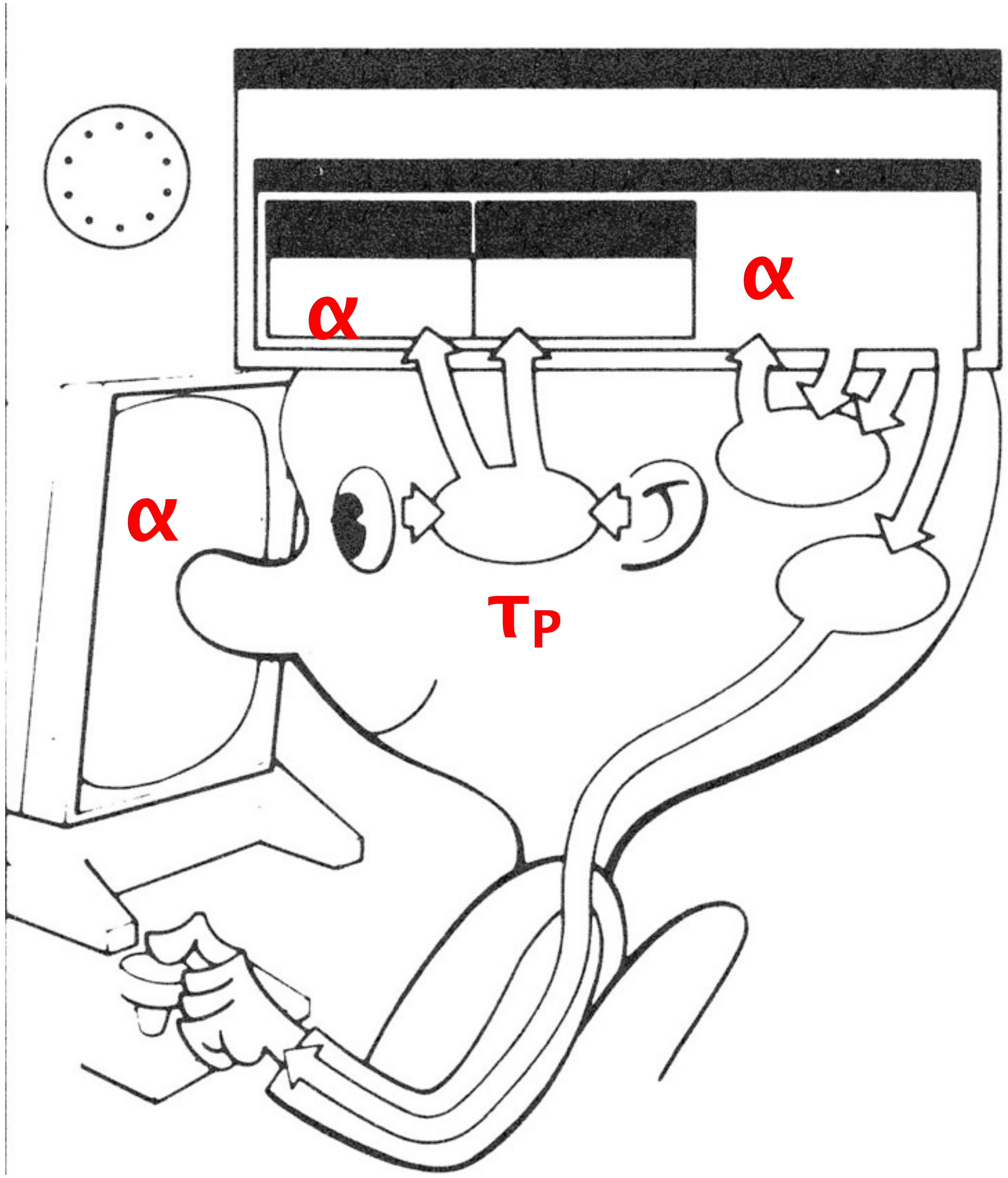

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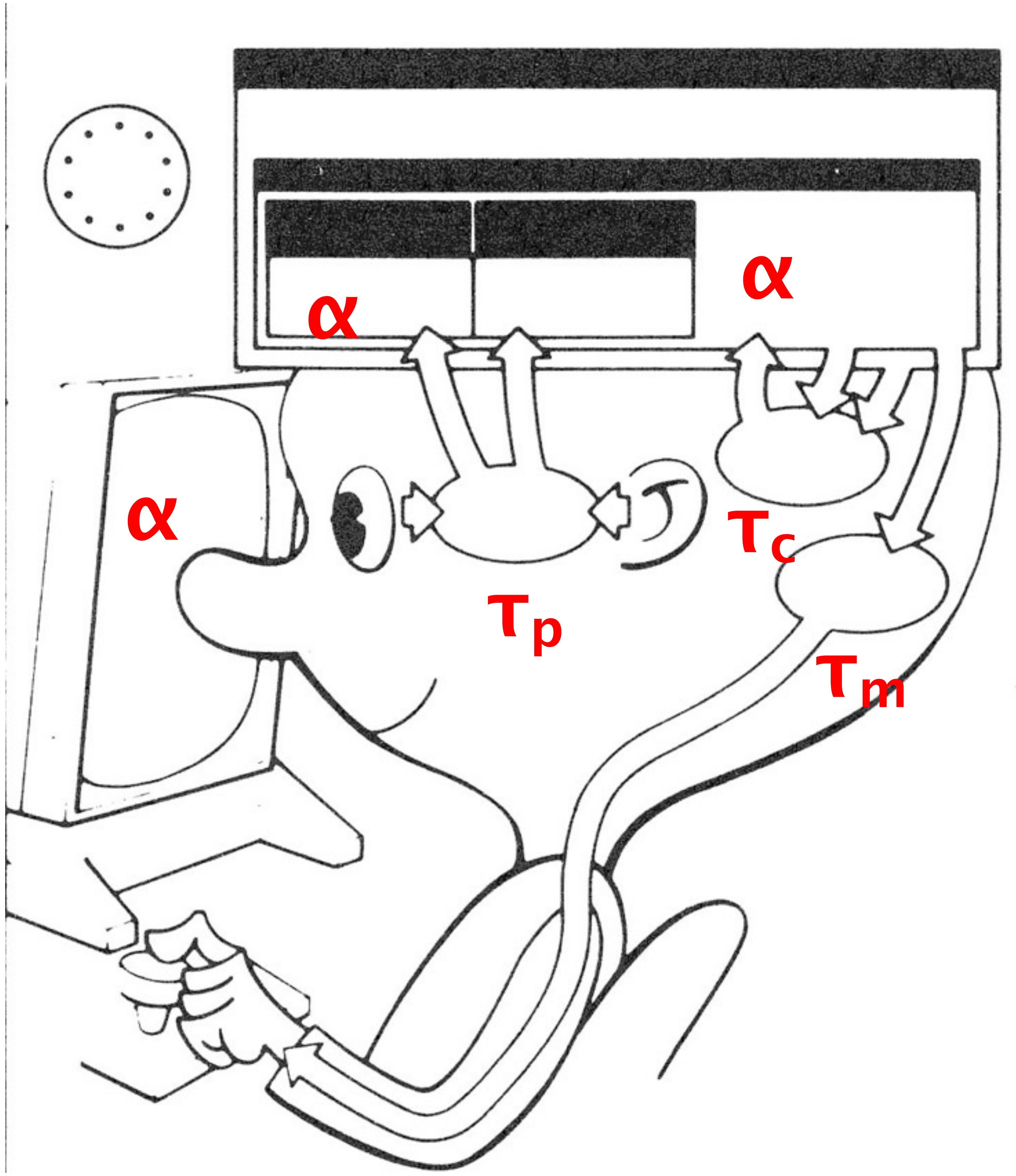

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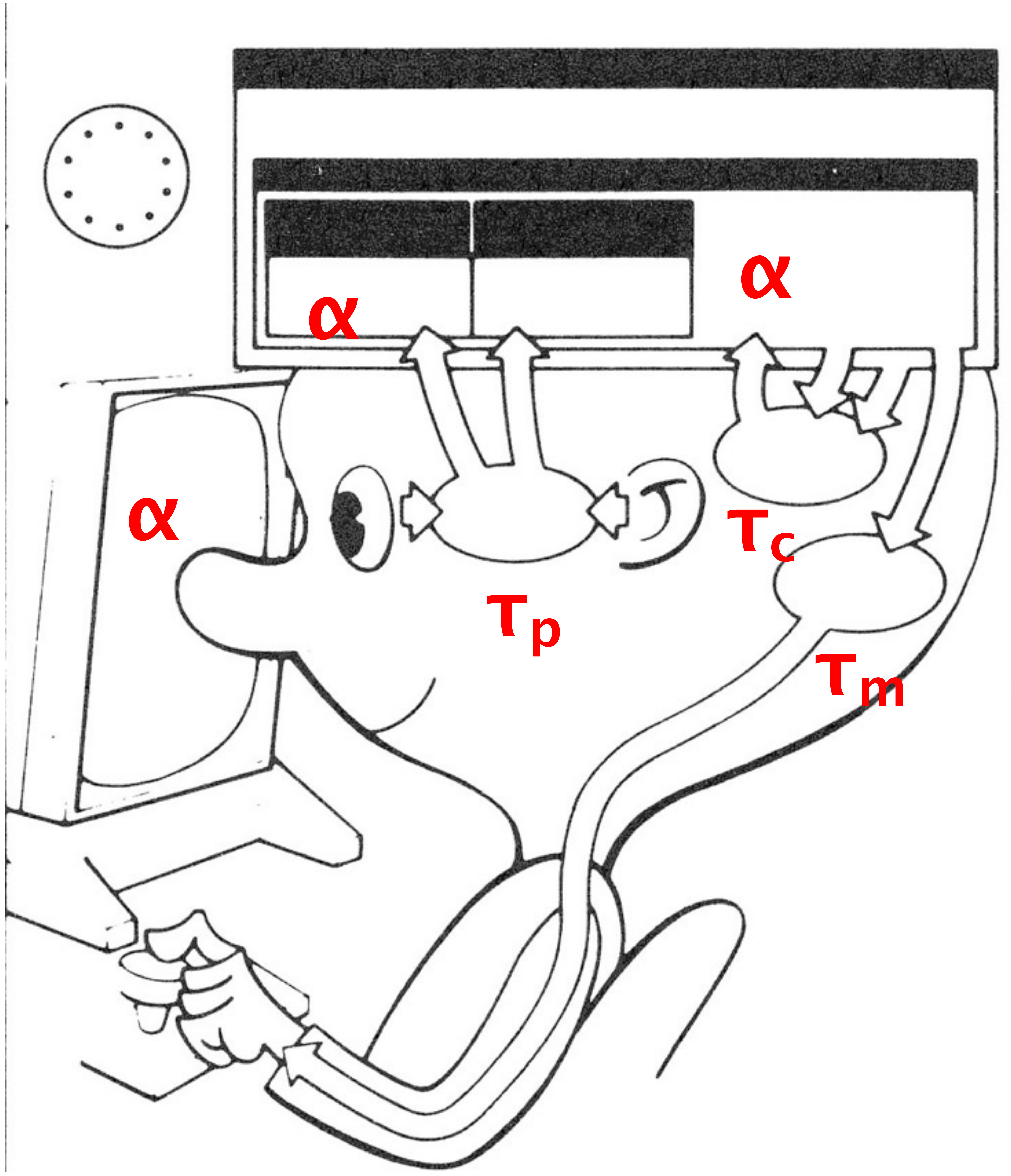
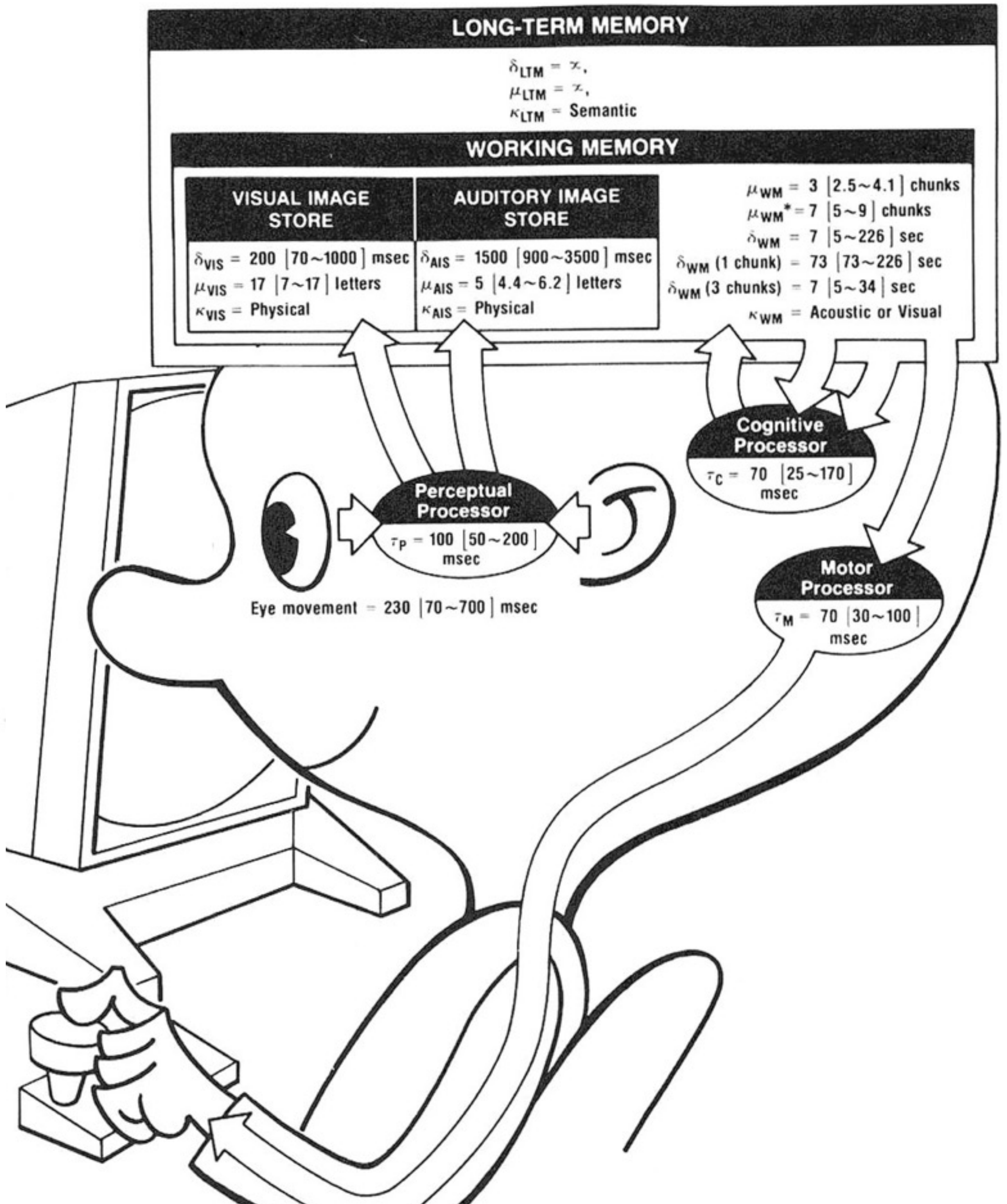
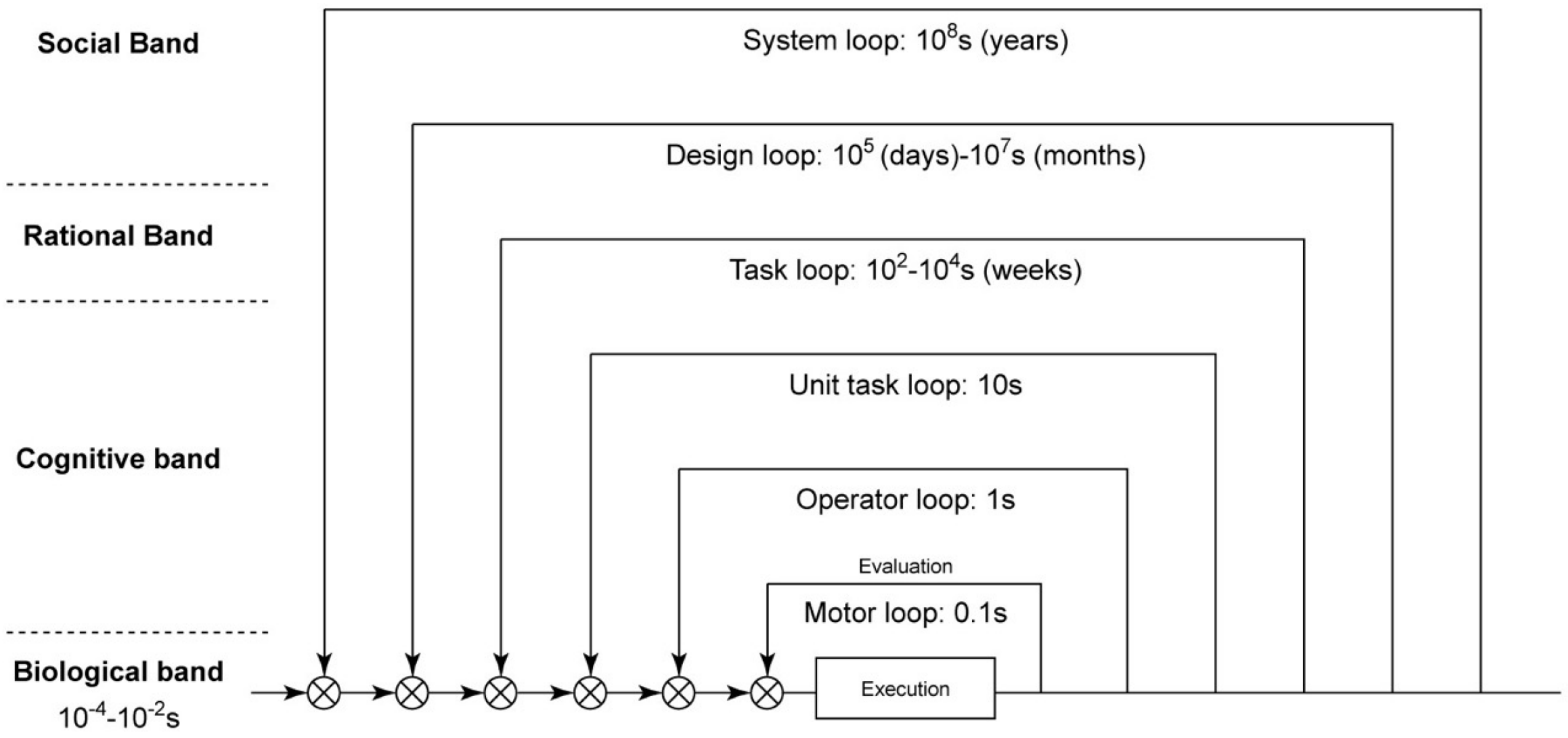




HUMAN INTERACTION LOOPS

(NEWELL)



PRINCIPLES OF OPERATION

Interface should respect limits of human performance

Preattentive features pop-out
Events within cycle time fuse together
Causality

Recognize-Act Cycle of the cognitive processor

On each cycle contents in Working Memory initiate cognitive actions
Cognitive actions modify the contents of Working Memory


F
D
E
IR0
IR1
IR2
MD DIR
DATA CONT
SW
PAUSE
BRK PROG
BRK
LINK
GT
INT BUS
NO INT
ION
UM
IF0
IF1
IF2
DF0
DF1
DF2
0
1
2
3
4
5
6
7
8
9
10
11
STATE
STATUS
AC
MD
MQ
BUS

MEMORY

SIMPLE EXPERIMENT

Volunteer

Start saying colors you see in list of words

When slide comes up

As fast as you can

Say “done” when finished

Schedule

Paper

Page

Back

Change

Home

SIMPLE EXPERIMENT

Do it again

Say “done” when finished

Blue
Red
Black
White
Green
Yellow

INTERFERENCE

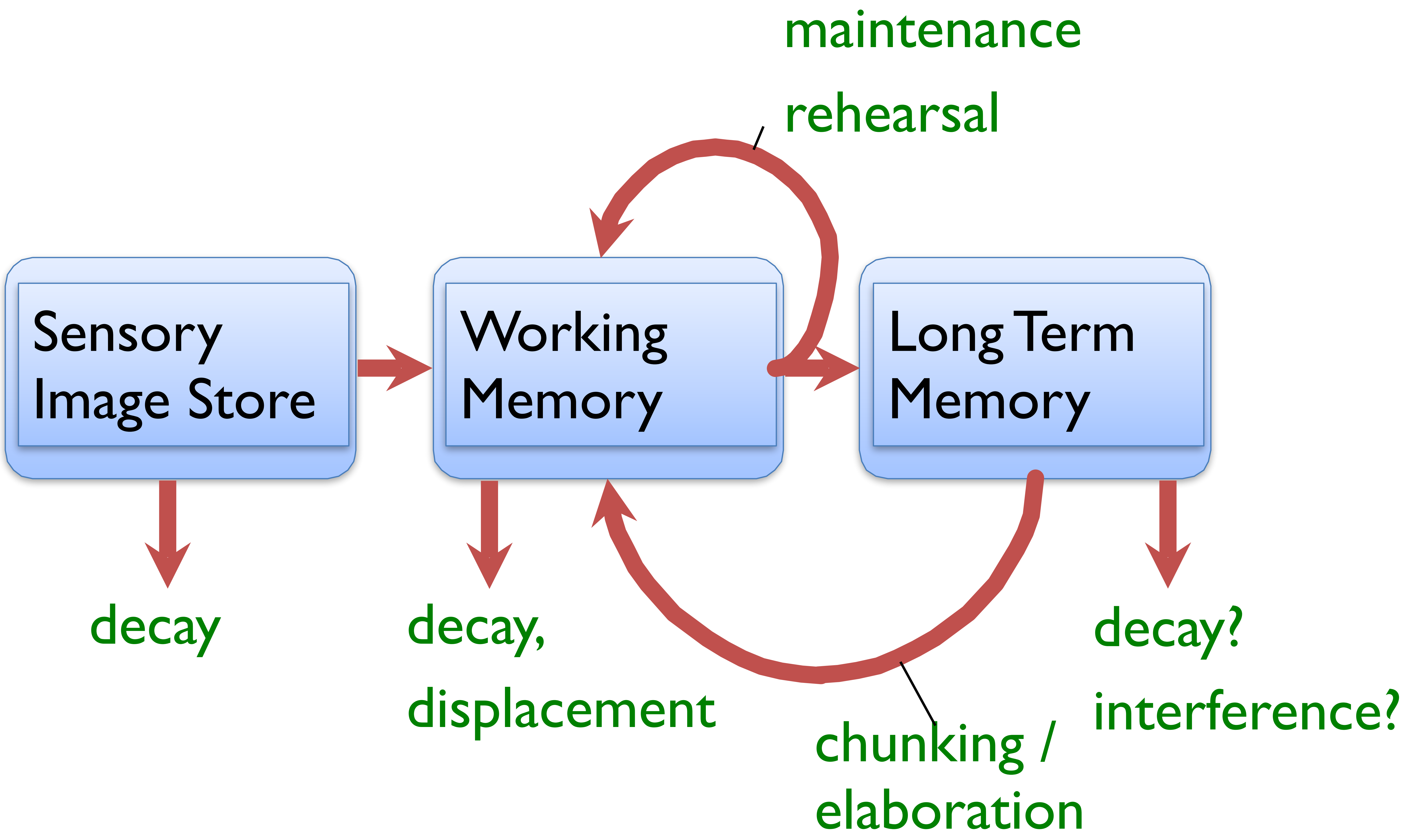
Stroop Effect:

when the *color spelled out by a word* is incongruent with the *color used to show* that word, naming the word color is slower and more error prone.

Explanation:

Relationship between meaning and physical form of stimulus are in conflict.

STAGE THEORY



STAGE THEORY

Working memory is small

Temporary storage

decay

displacement

Maintenance rehearsal

Rote repetition

Not enough to learn information well

LTM AND ELABORATION

Recodes information

Organize (chunking)

Relate new material to already learned material

Link to existing knowledge, categories

Attach meaning

Make a story

RECOGNITION OVER RECALL

Recall

Info reproduced from memory

Recognition

Presentation of info helps retrieve info (helps remember it was seen before)

Easier because of cues to retrieval

We want to design UIs that rely on recognition!

FACILITATING RETRIEVAL: CUES

Any stimulus that improves retrieval

Example: giving hints

Other examples in software?

icons, labels, menu names, etc.

Anything related to

Item or situation where it was learned

SUMMARY

Model human processor

5 parts

Perceptual processor

Working memory

Long term memory

Cognitive processor

Motor processor

May not be biologically accurate

But …

Provides rough estimate of performance

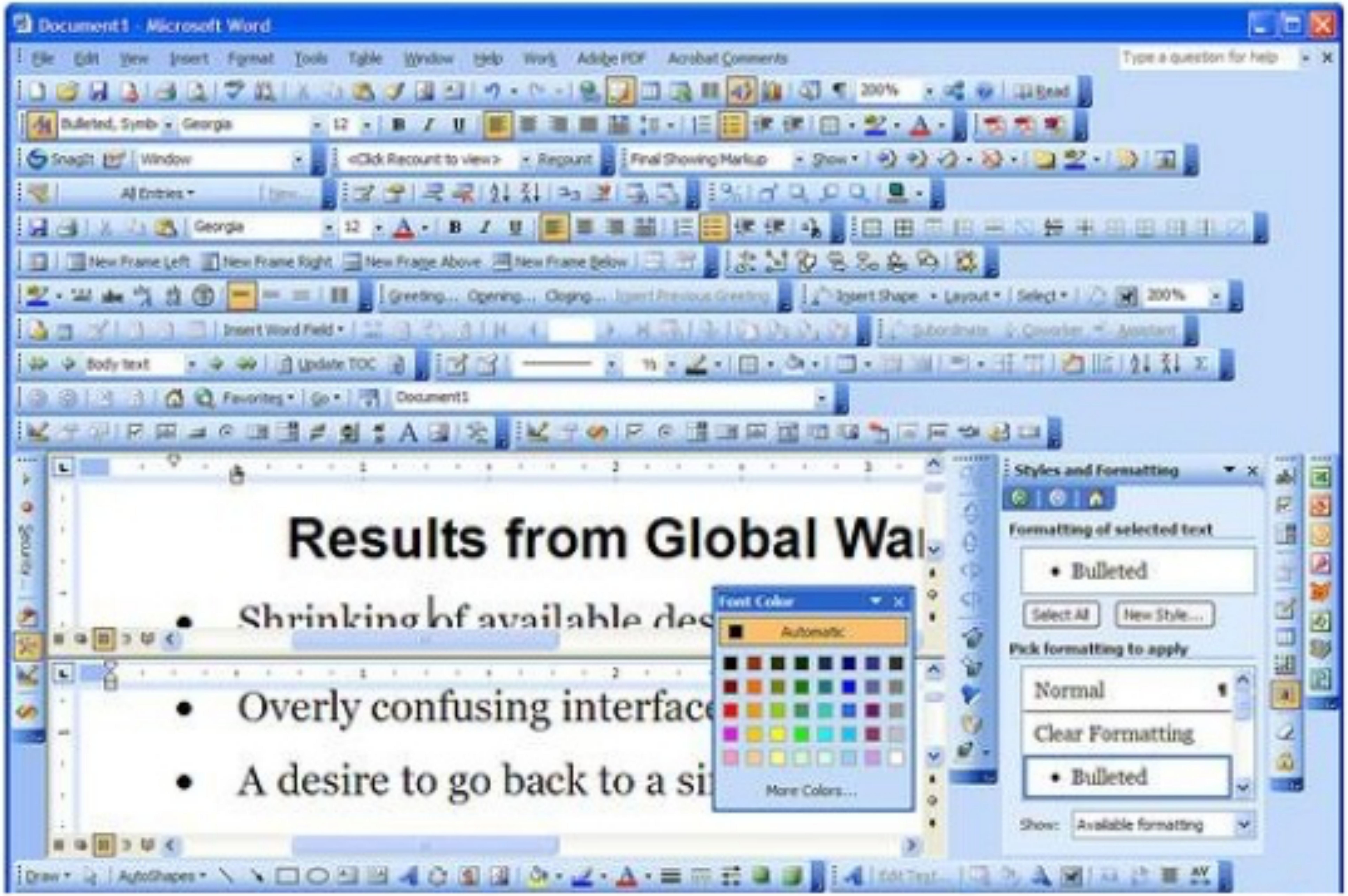
Can help us compare and evaluate interfaces

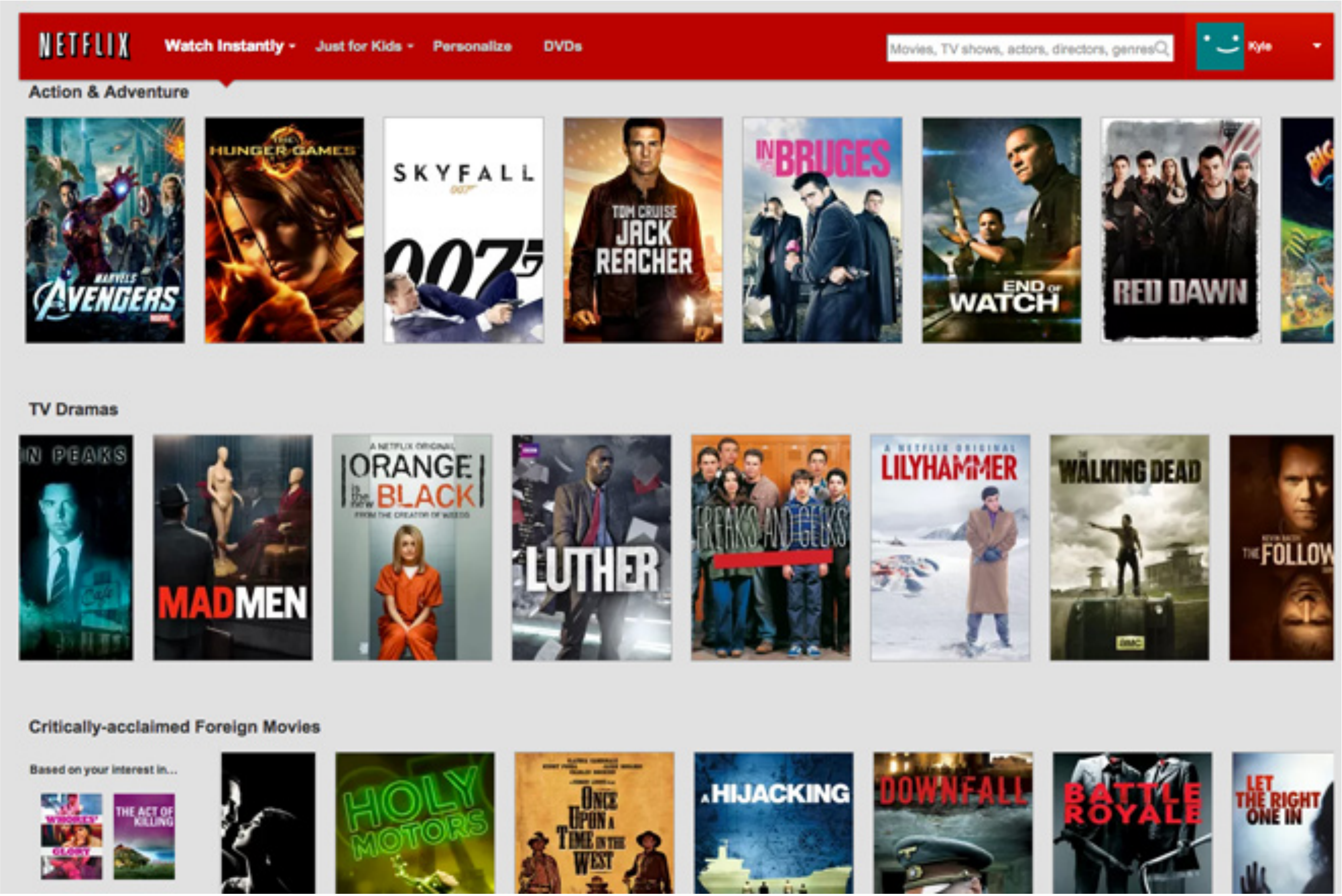
Interfaces should both aid and exploit human capabilities

DECISION MAKING AND LEARNING

Colgate
Total
Crest
PRO-HEALTH
MaxFresh
MaxWhite
MaxClean
Cavity Protection
Tartar Protection
Triple Action
LUMINOUS
AdvanceWhite
PeroxiCare
CLOSE-UP
Ultrabrite
Aim
Fixodent
Sensitive Pro-Relief
bonus!
Save even more on gas.
$4.99

Too Many Options




NETFLIX
Watch Instantly
Just for Kids
Personalize
DVDs
Movies, TV shows, actors, directors, genres
Kyle
Action & Adventure
AVENGERS
THE HUNGER GAMES
SKYFALL
007
TOM CRUISE
JACK REACHER
IN BRUGES
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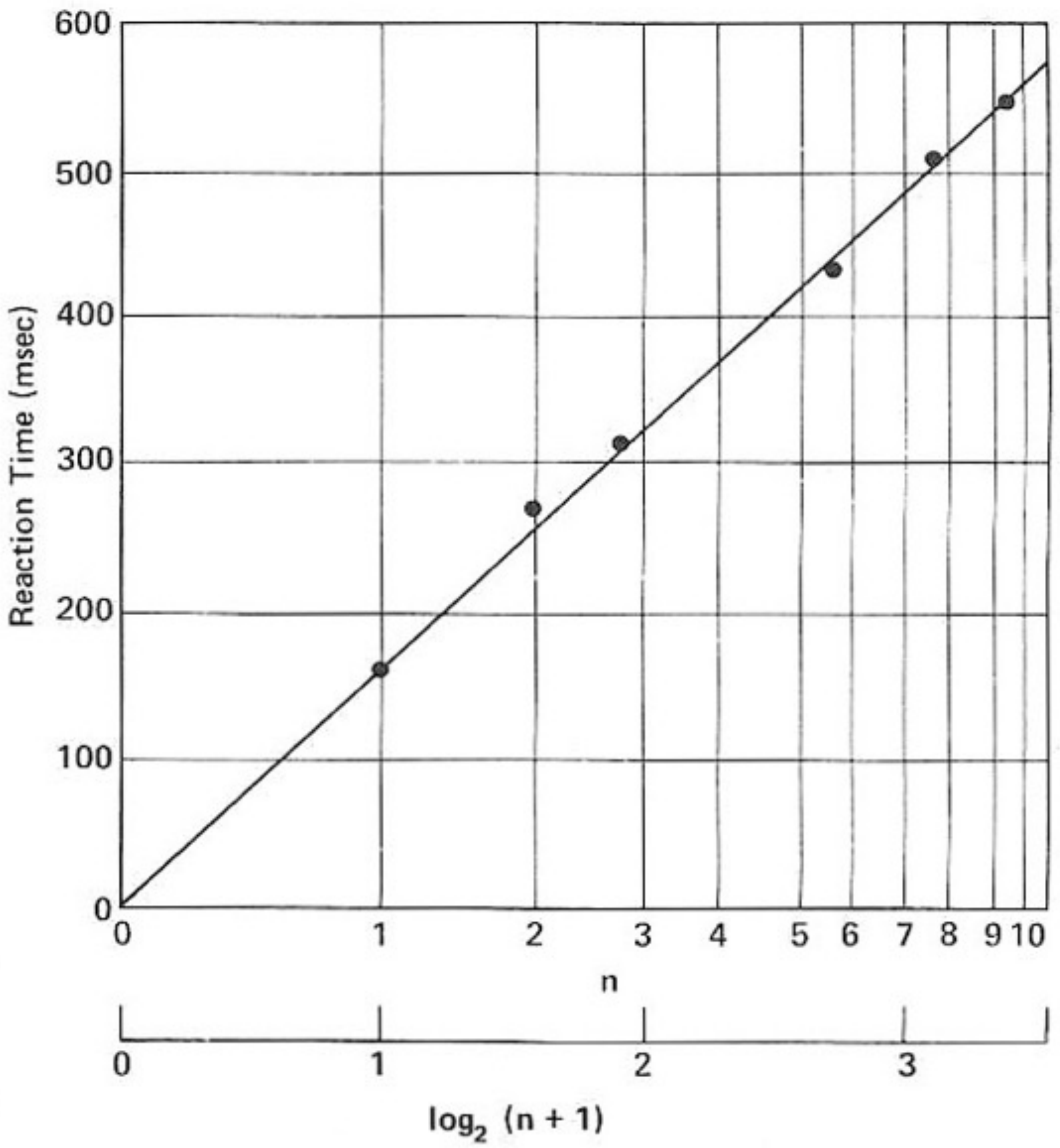
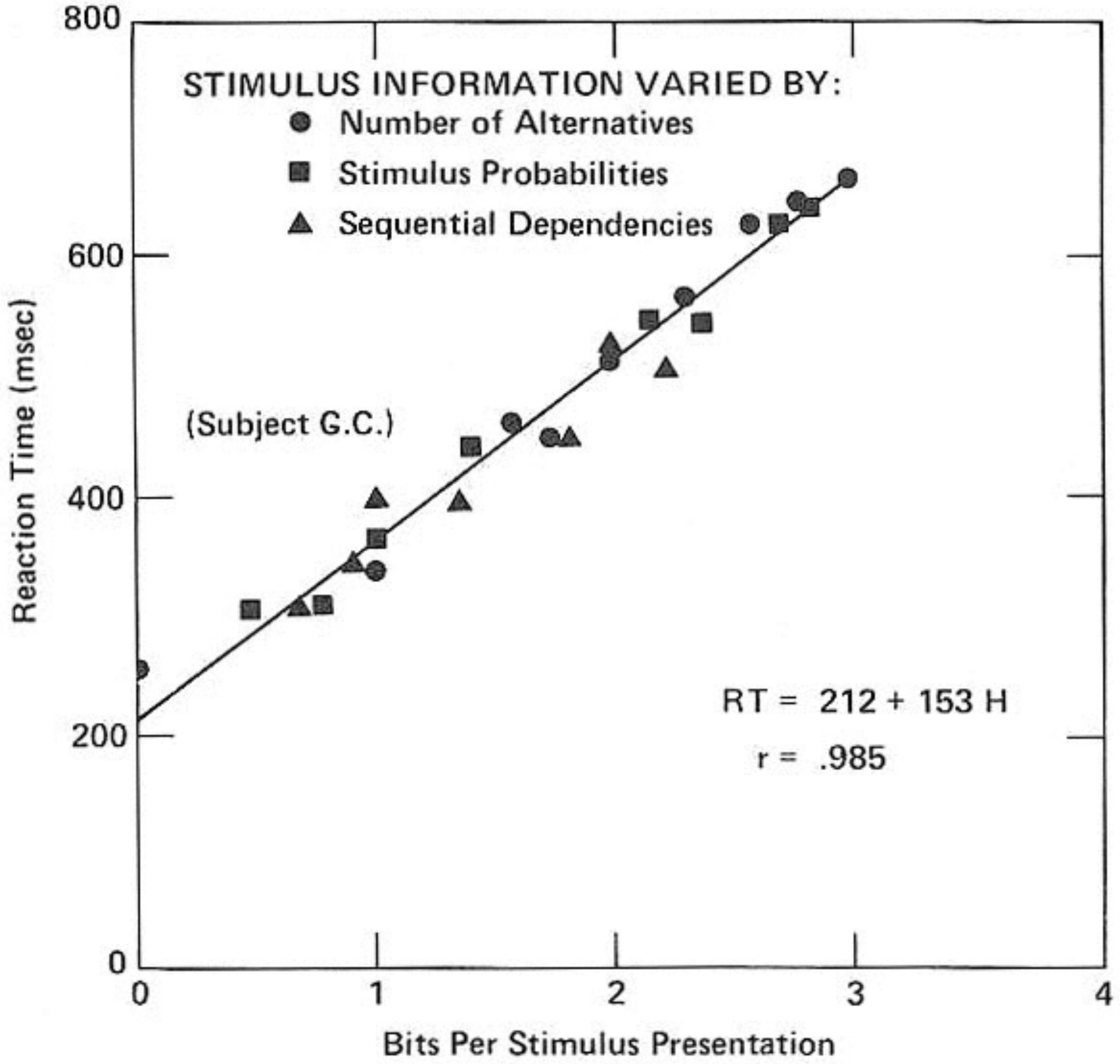
RED DAWN
TV Dramas
MAD MEN
A NETFLIX ORIGINAL
ORANGE is the new BLACK
LUTHER
FREAKS AND GEEKS
A NETFLIX ORIGINAL
LILYHAMMER
THE WALKING DEAD
Critically-acclaimed Foreign Movies
Based on your interest in...
THE ACT OF KILLING
HOLY MOTORS
ONCE UPON A TIME IN THE WEST
A HIJACKING
DOWNFALL
BATTLE ROYALE
LET THE RIGHT ONE IN

HICK'S LAW

Cost of taking a decision:
n = number of choices

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





POWER LAW OF PRACTICE

Task time on the nth trial follows a power law

$$T_n = T_1 n^{-a} + c$$

where a = .4, c = limiting constant

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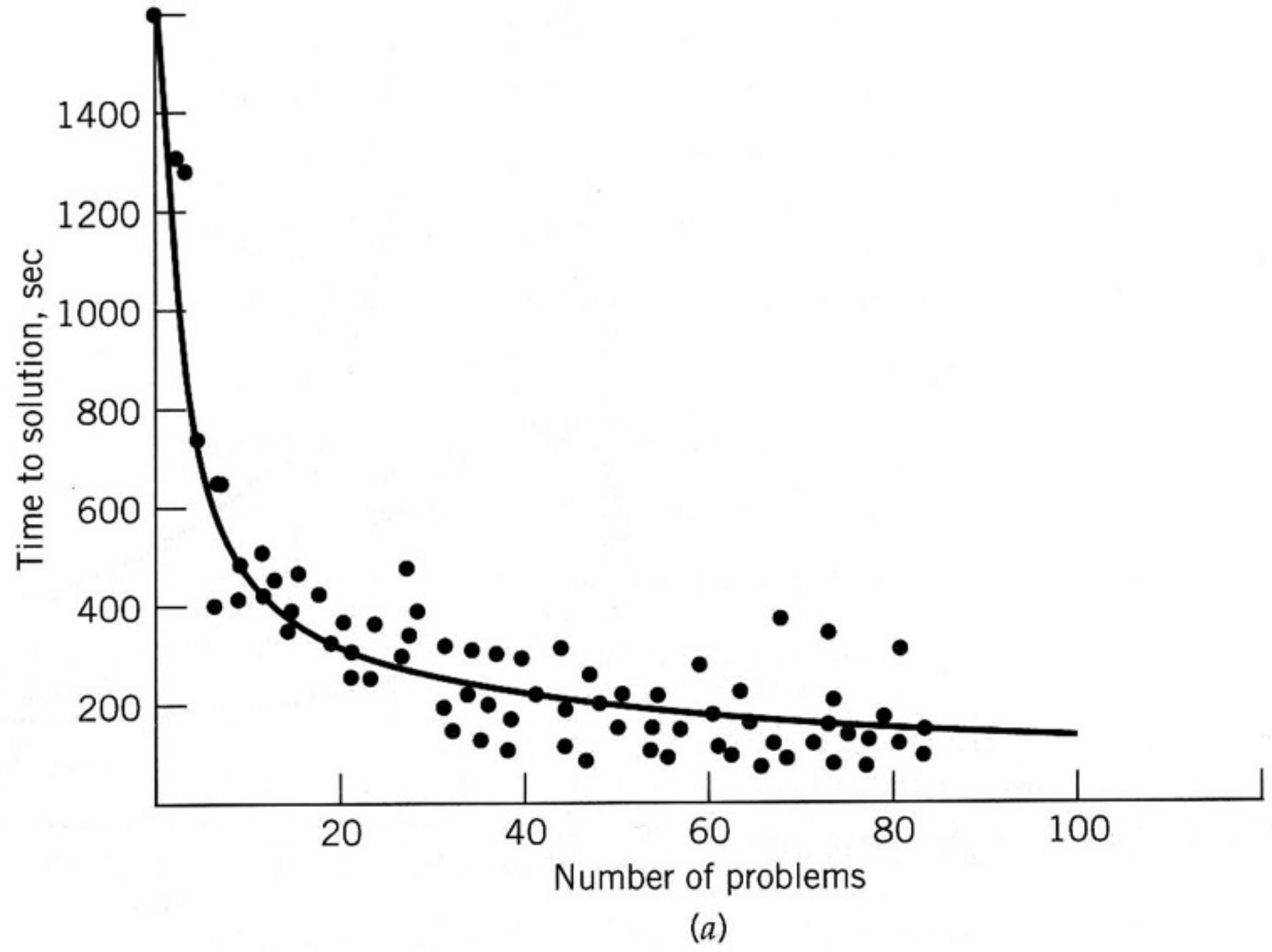


POWER LAW OF PRACTICE

Task time on the nth trial follows a power law

$$T_n = T_1 n^{-a} + c$$

where a = .4, c = limiting constant

You get faster the more times you do something!

Applies to skilled behavior (sensory & motor)

Does not apply to

Knowledge acquisition

Improving quality

SUMMARY

Decision Making and Learning

Time to make decisions depends on number of options

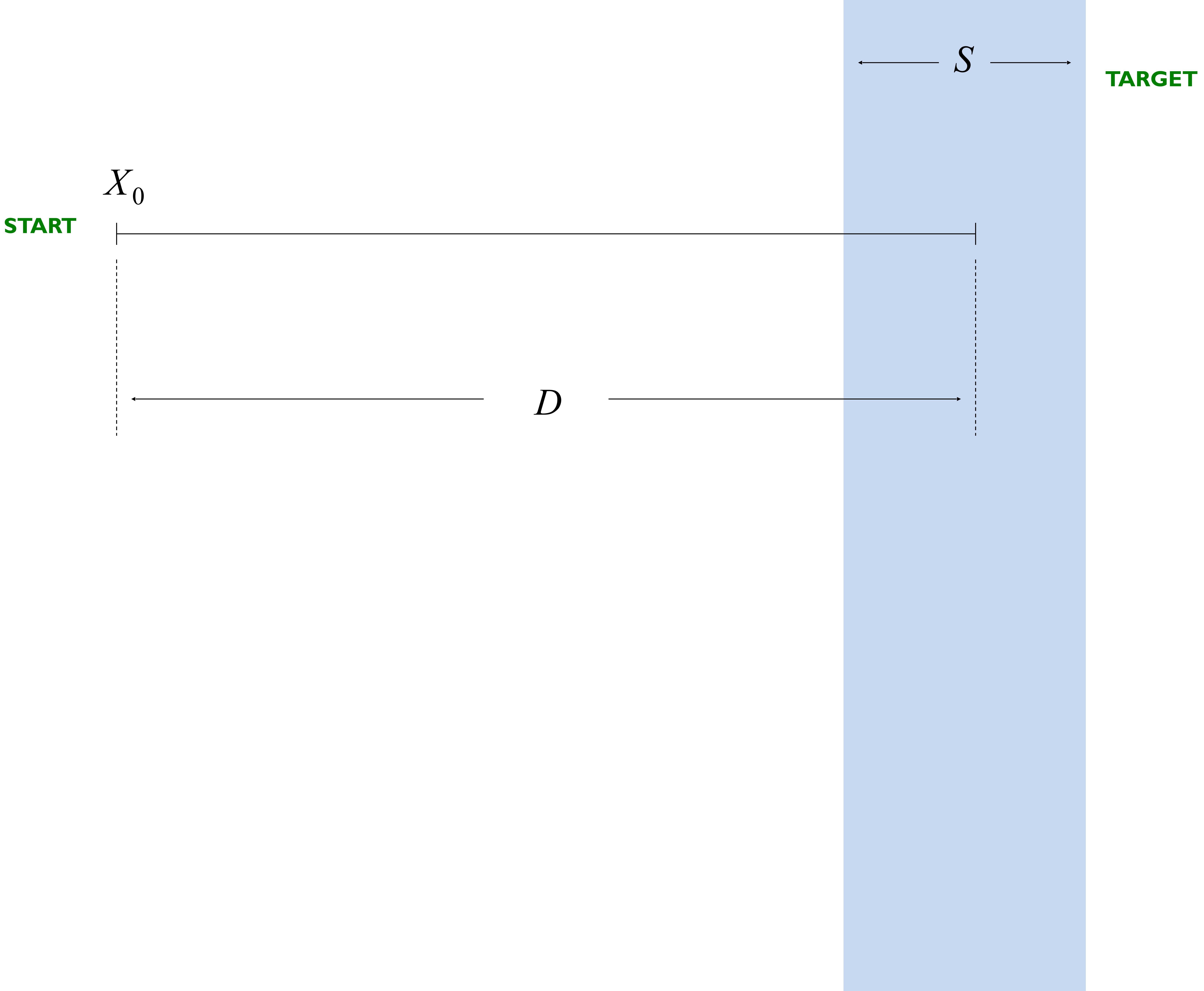
Choosing a movie on Netflix

Learning follows a power law

You get faster as you practice


F
D
E
IR0
IR1
IR2
MD DIR
DATA CONT
SW
PAUSE
BRK PROG
BRK
LINK
GT
INT BUS
NO INT
ION
UM
IF0
IF1
IF2
DF0
DF1
DF2
0
1
2
3
4
5
6
7
8
9
10
11
STATE
STATUS
AC
MD
MQ
BUS

FITTS' LAW



S
TARGET
X_0
START
D

FITTS' LAW

$$T = a + b \log_2(D/S + 1)$$

a, b = constants (empirically derived)

D = distance

S = size

ID is Index of Difficulty = $\log_2(D/S+1)$

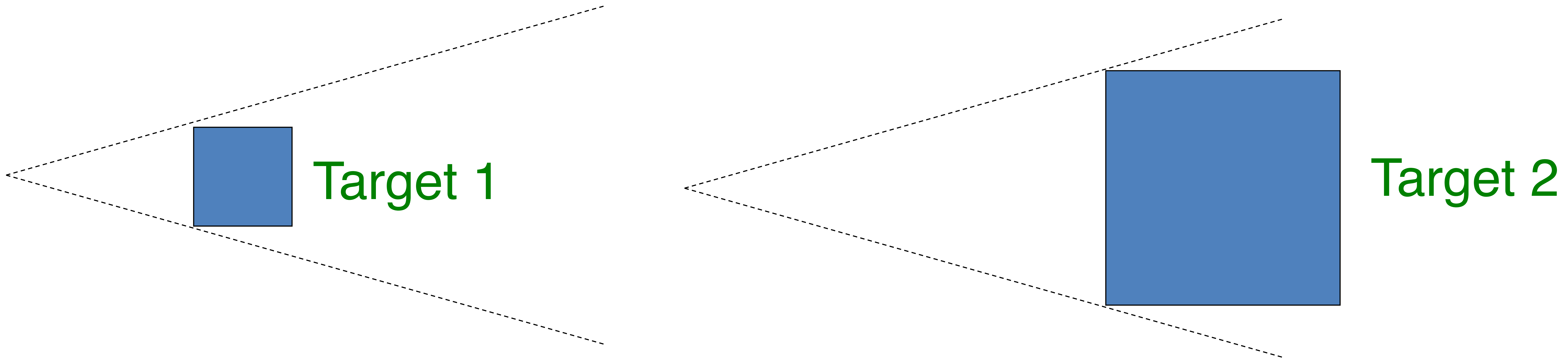
Models well-rehearsed selection task

T increases as the ***distance*** to the target increases

T decreases as the ***size*** of the target increases

CONSIDERS DISTANCE AND TARGET SIZE

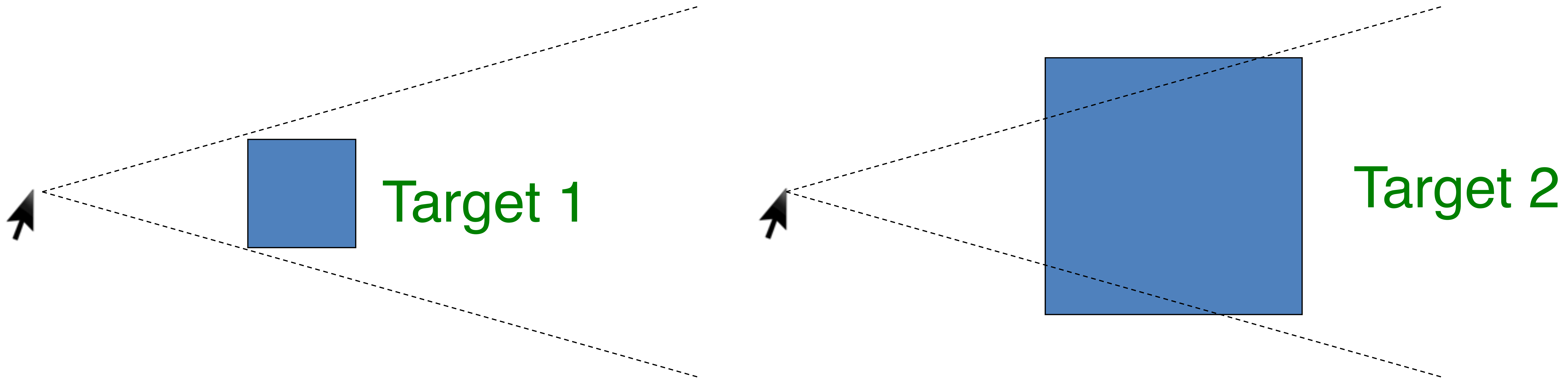
$$T = a + b\log_2(D/S + 1)$$



Same ID → Same Difficulty

CONSIDERS DISTANCE AND TARGET SIZE

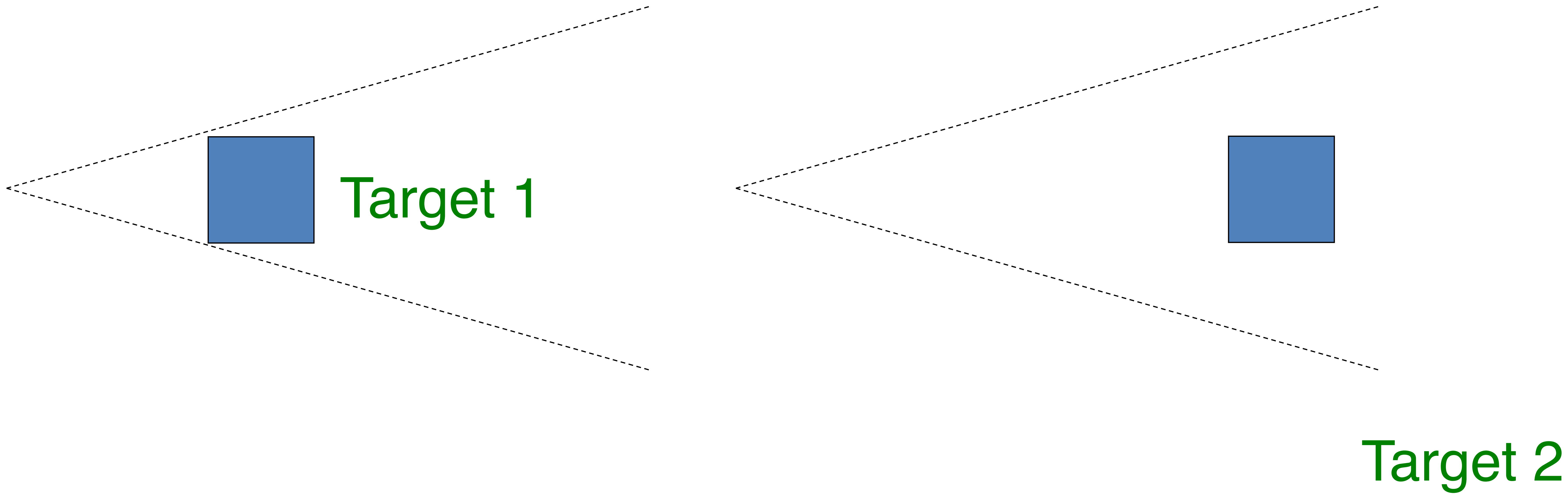
$$T = a + b\log_2(D/S + 1)$$



Smaller ID → Easier

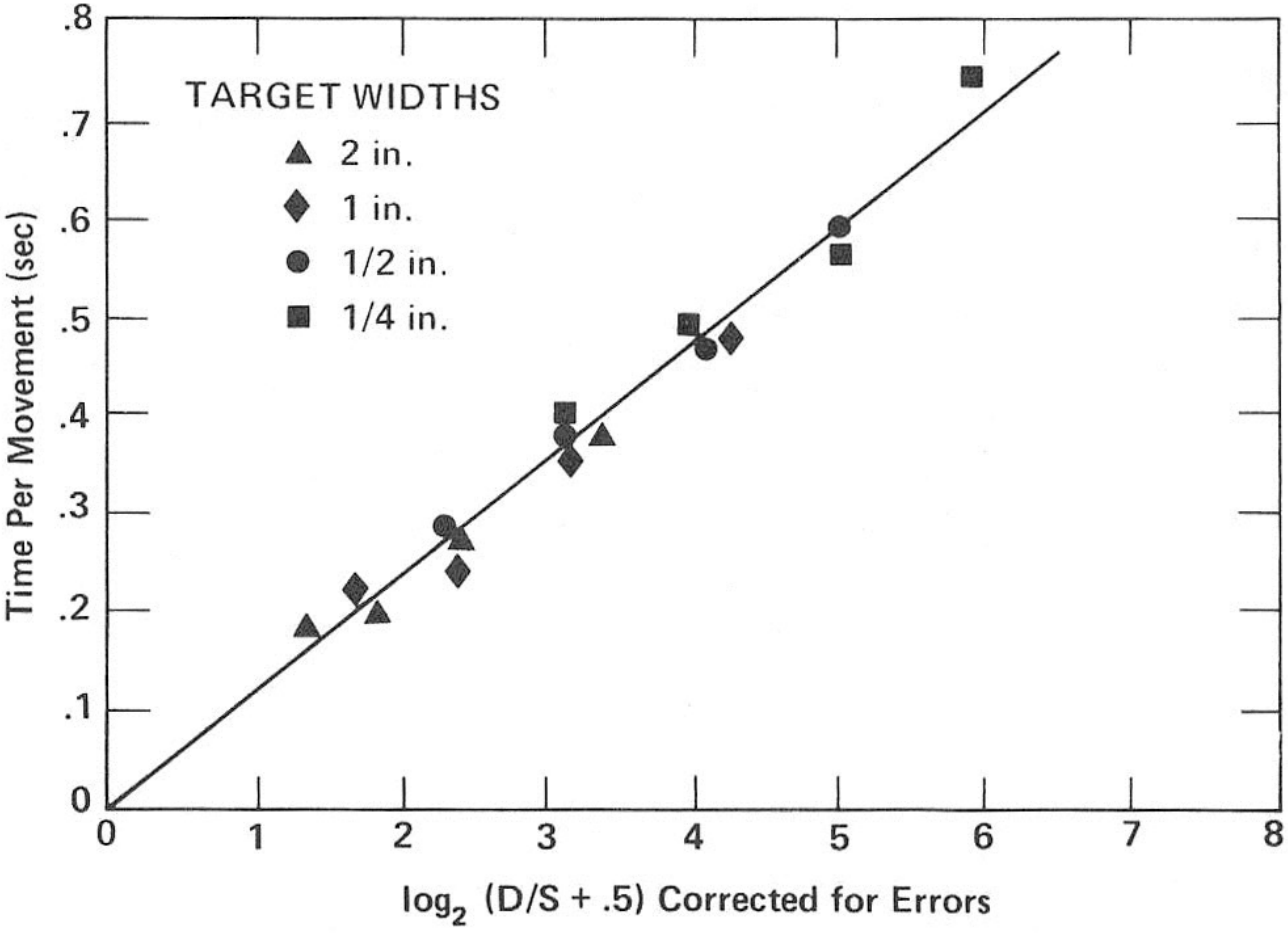
CONSIDERS DISTANCE AND TARGET SIZE

$$T = a + b\log_2(D/S + 1)$$



Larger ID → Harder

EXPERIMENTAL DATA

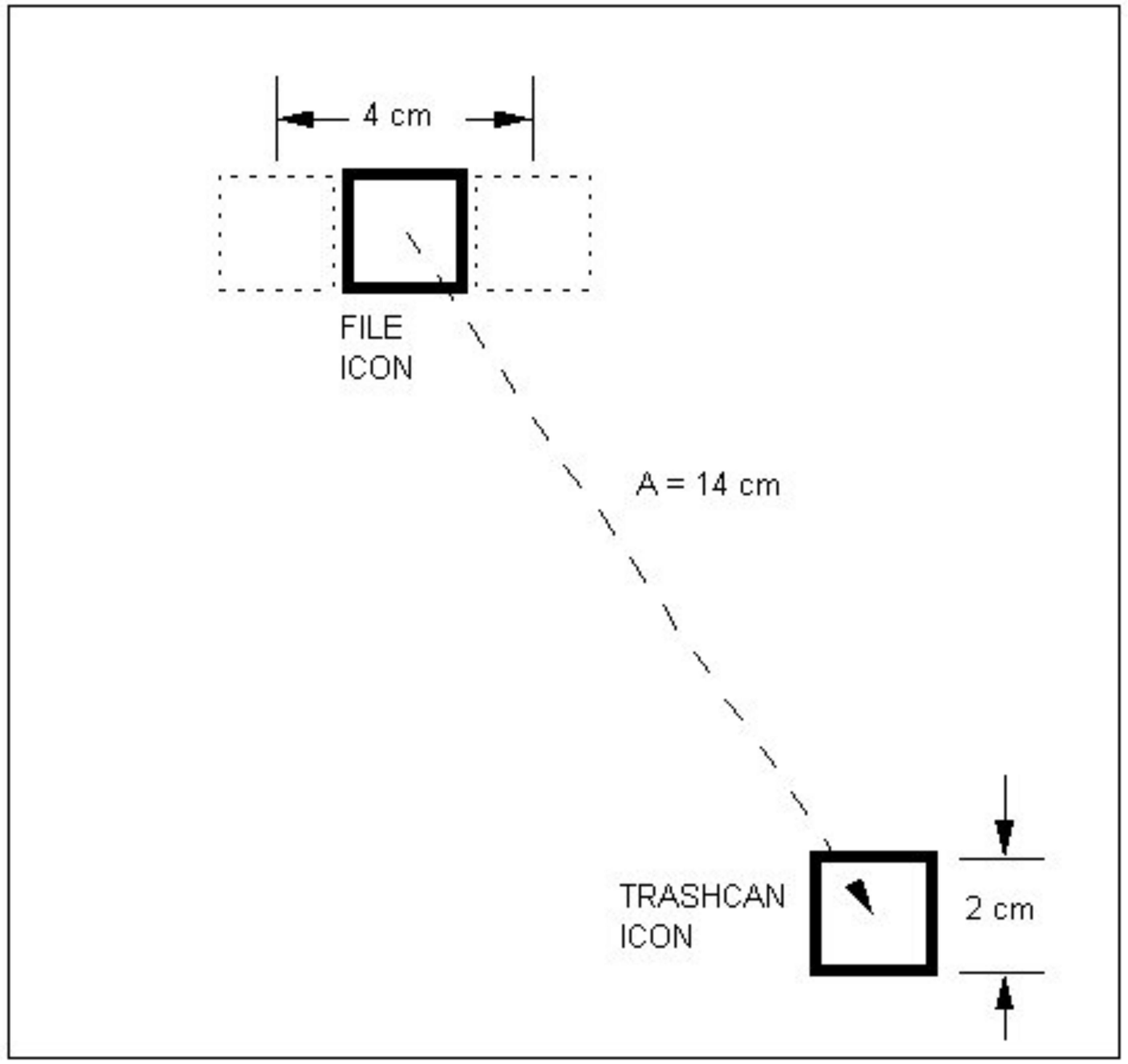


DESIGNING WITH FITTS' LAW

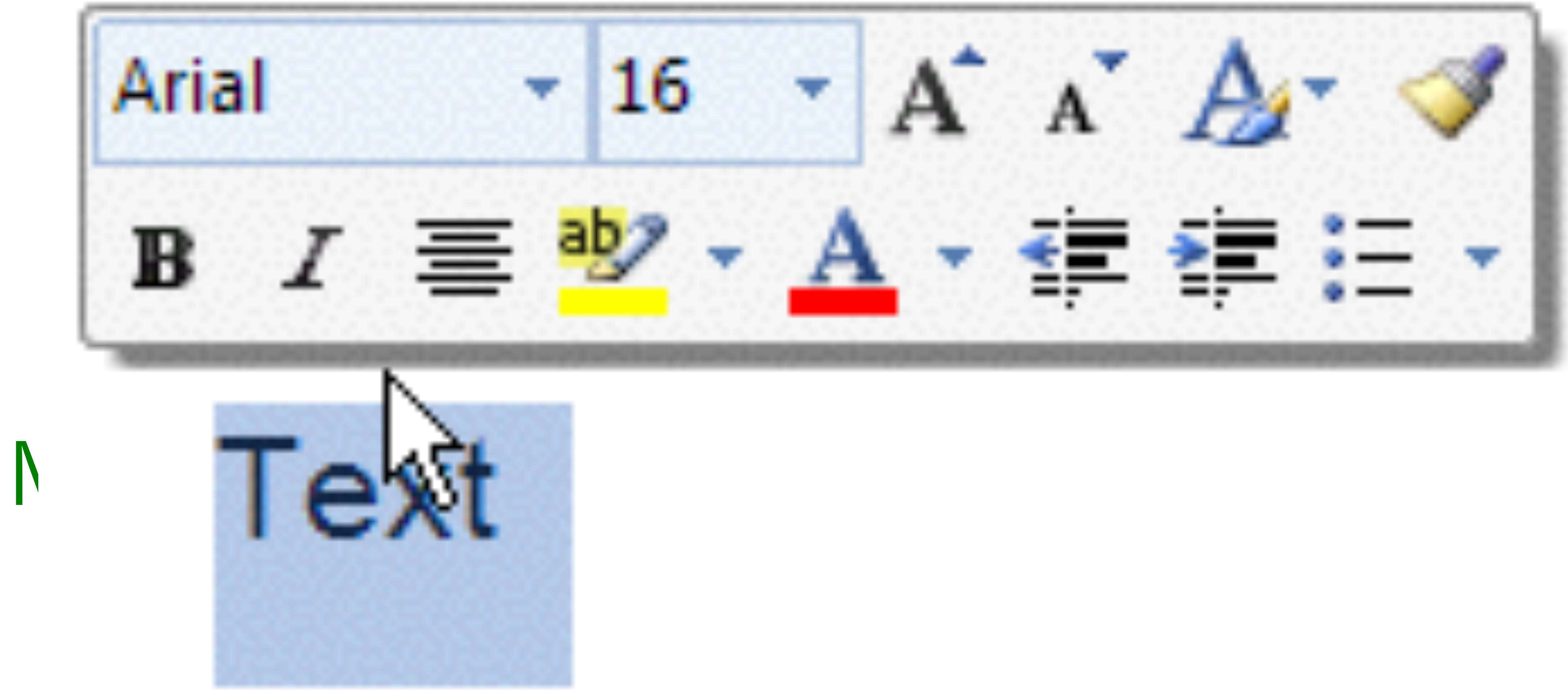
Bring items closer to the cursor

Make them larger

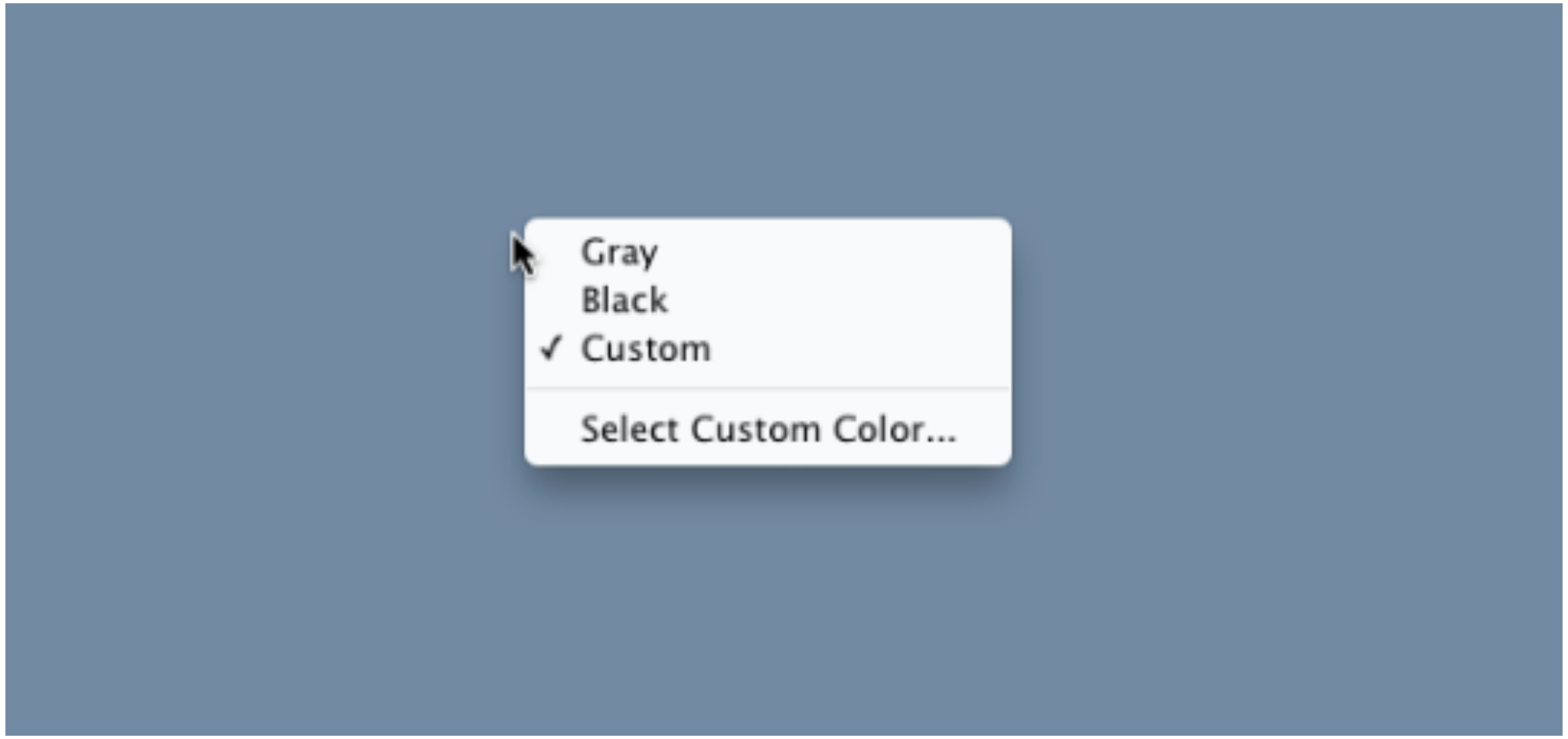
Exploit the edges



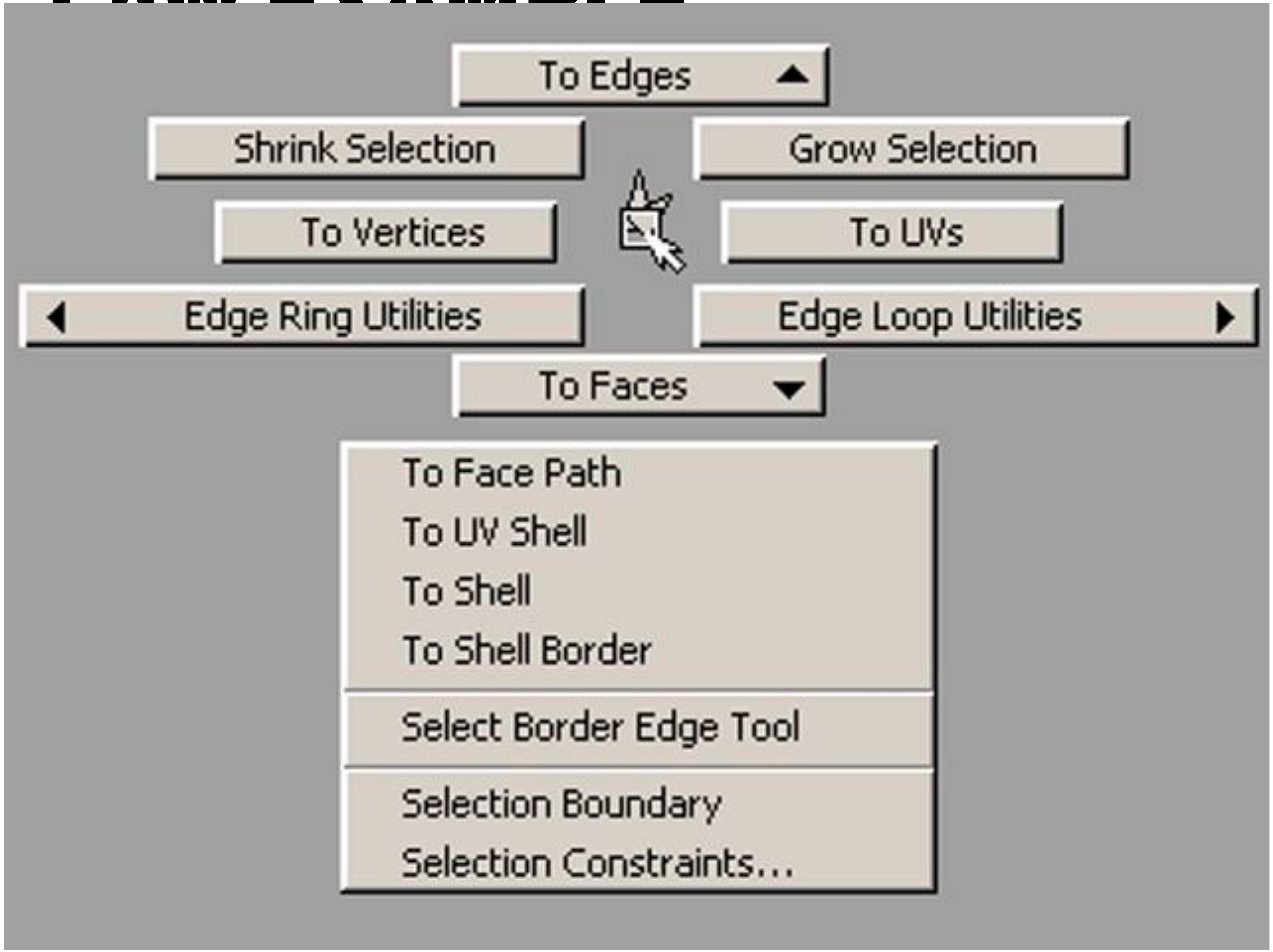
BRING ITEMS CLOSER TO THE CURSOR



BRING ITEMS CLOSER TO THE CURSOR



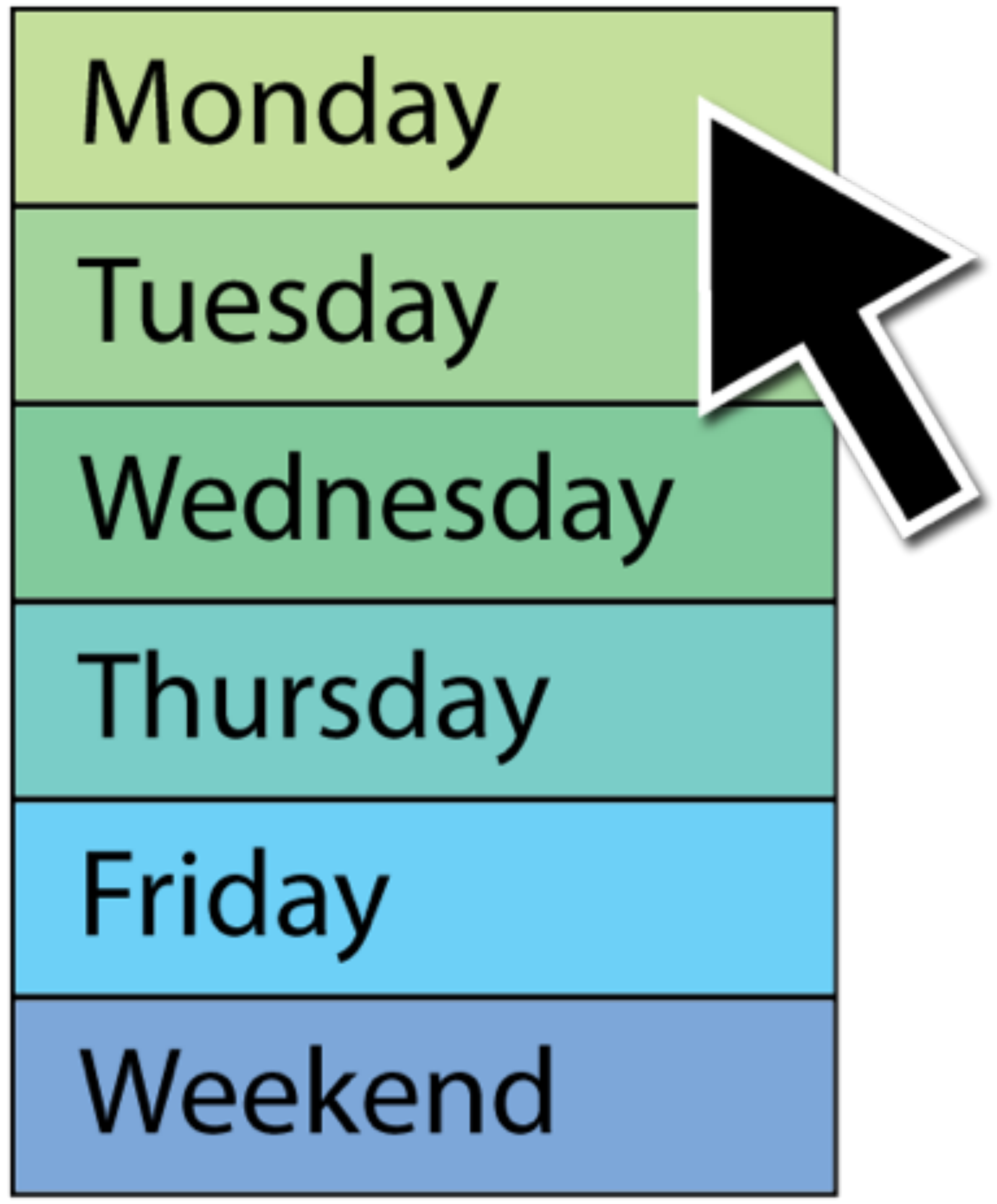
FITTS' LAW EXAMPLE

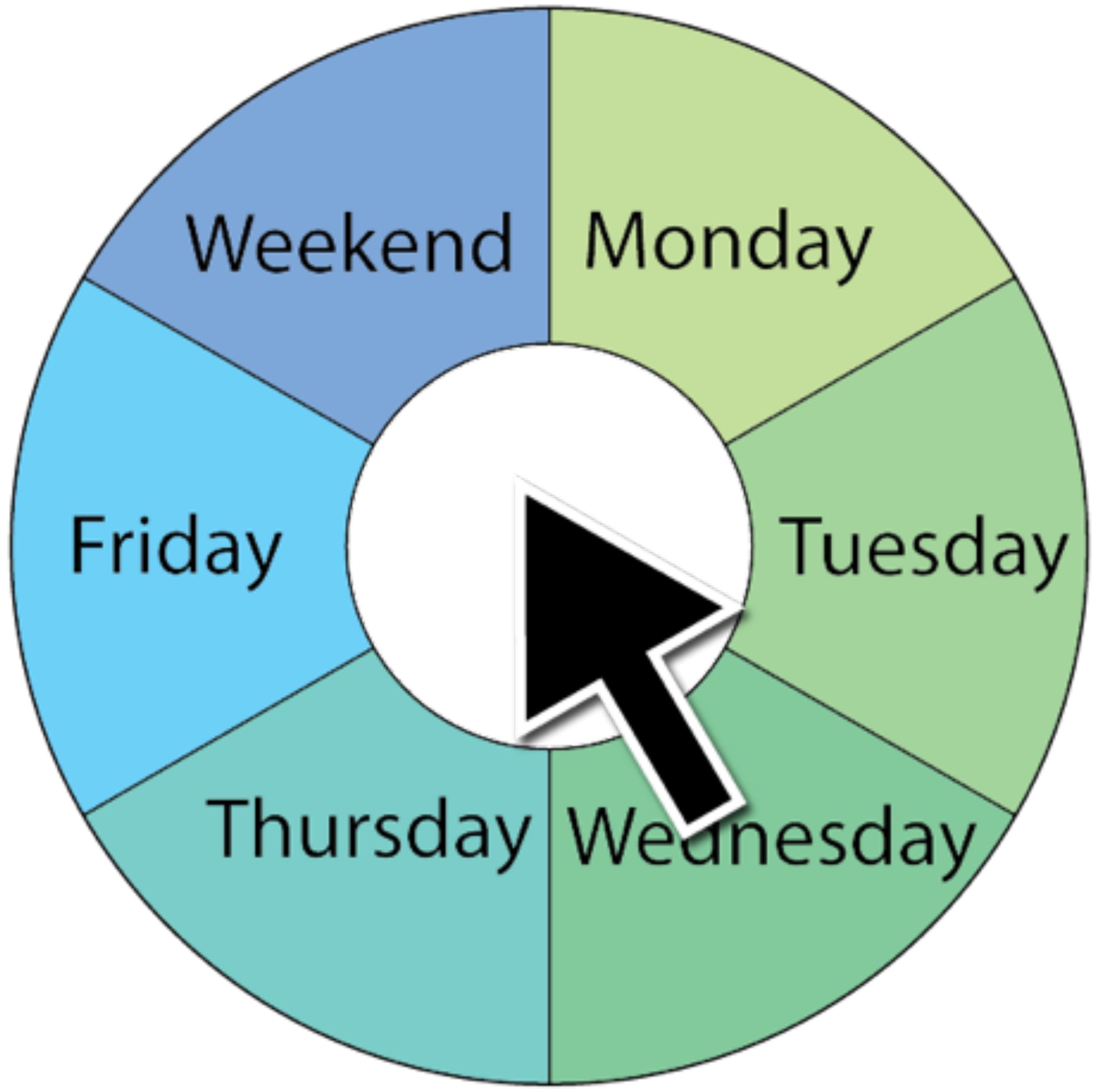


FITTS' LAW EXAMPLE

Which will be faster on average?

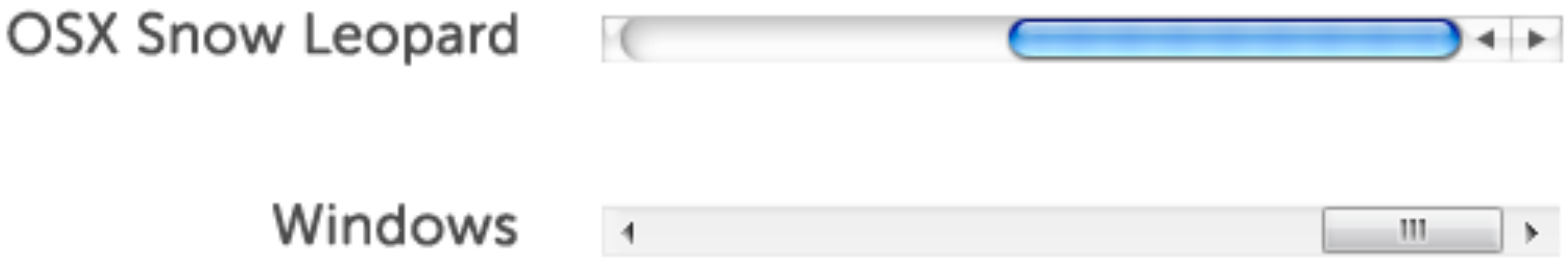
pie menu (bigger targets & less distance)





Source: Landay, James. "Human Abilities". CS160 UC Berkeley.

FITTS' LAW EXAMPLE



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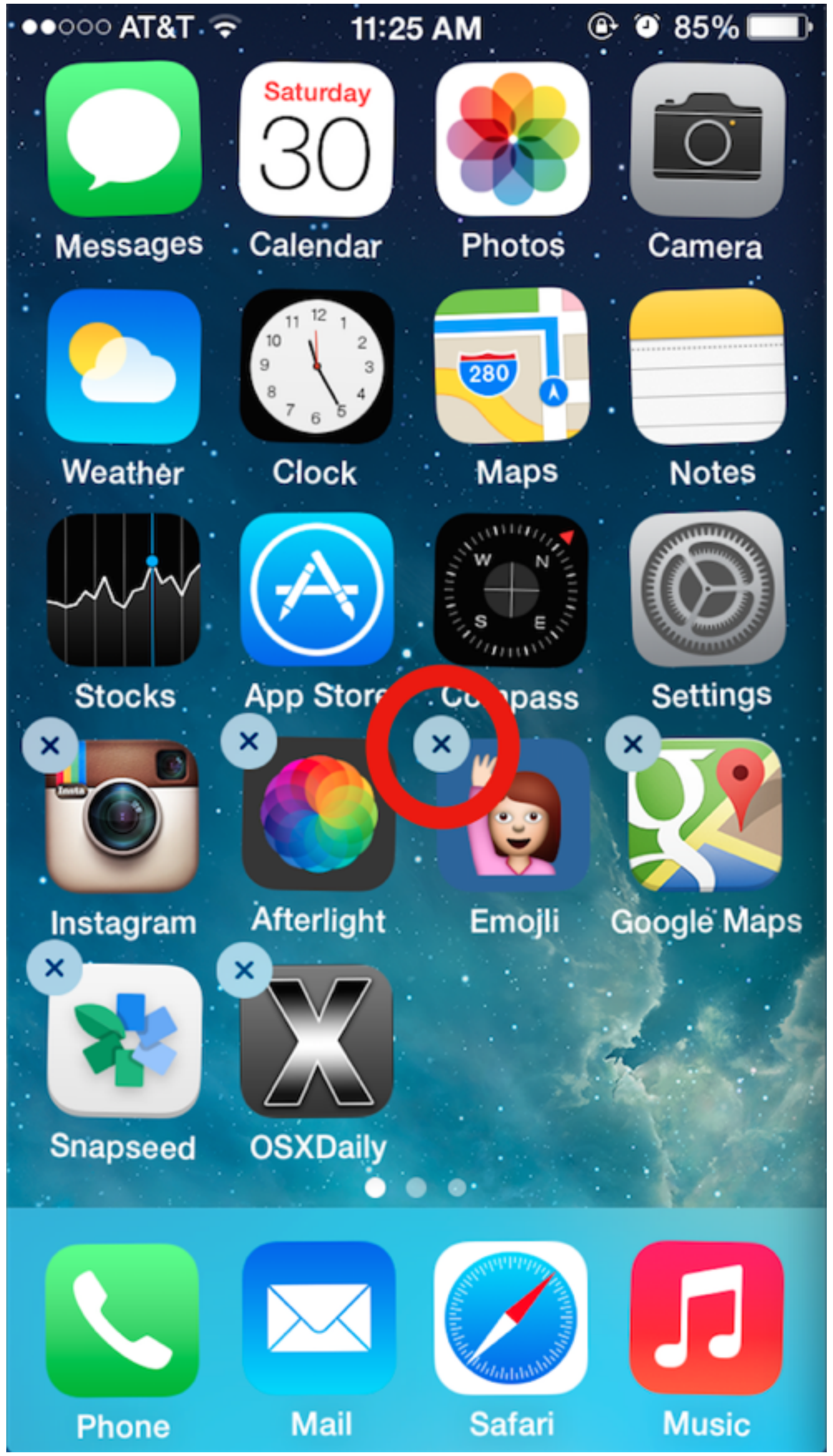

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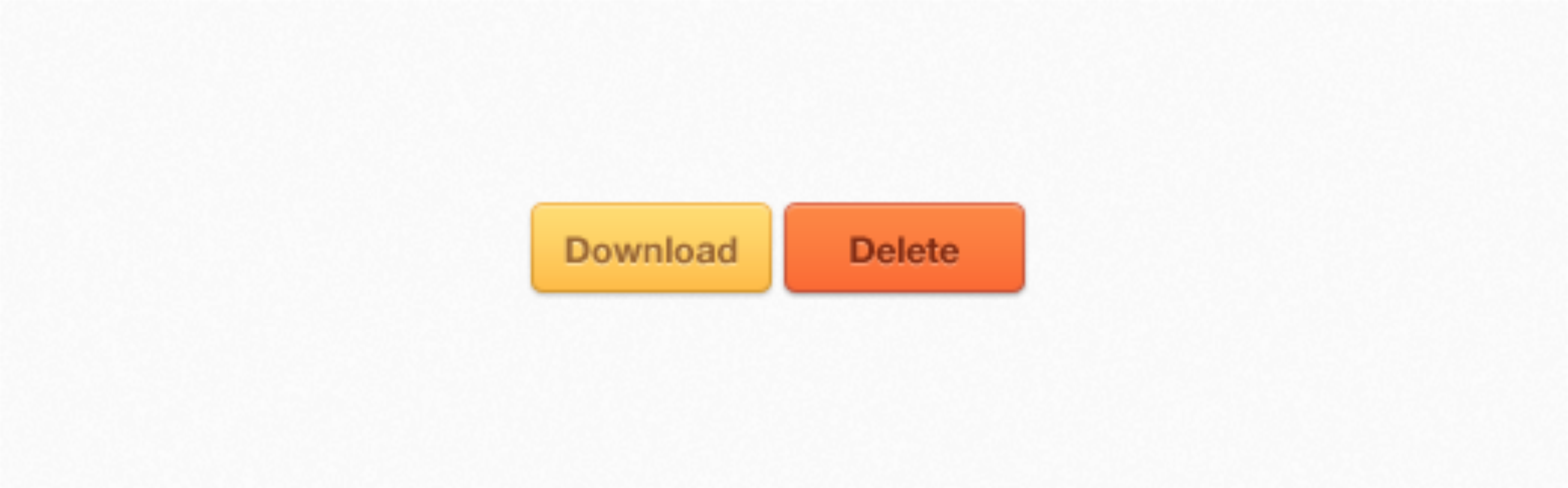
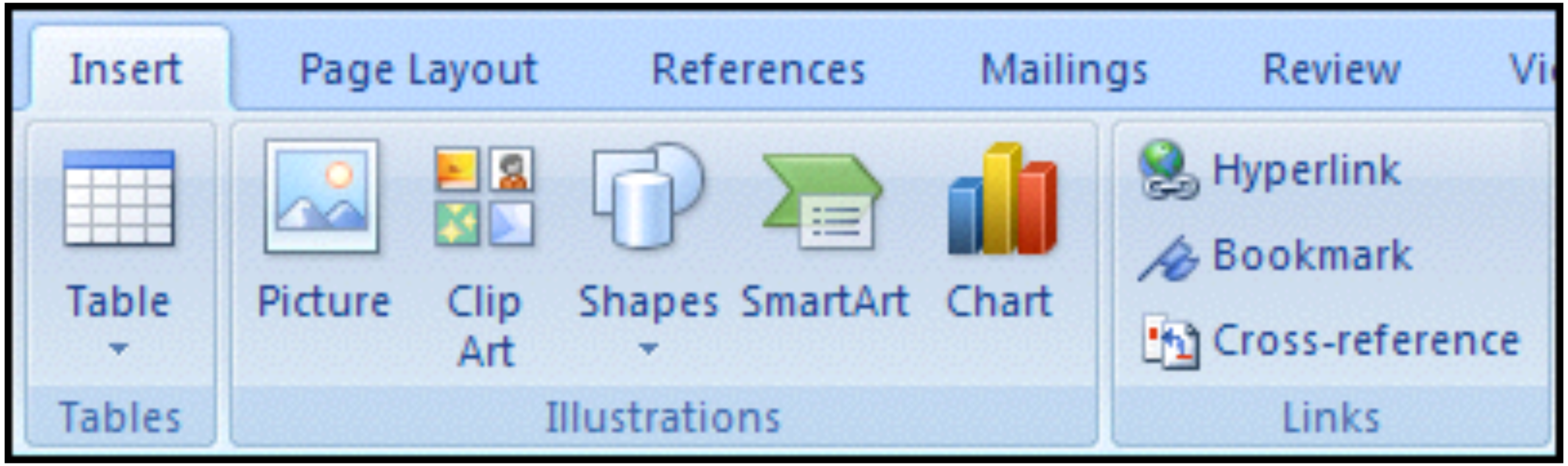


INCREASE TARGET SIZE

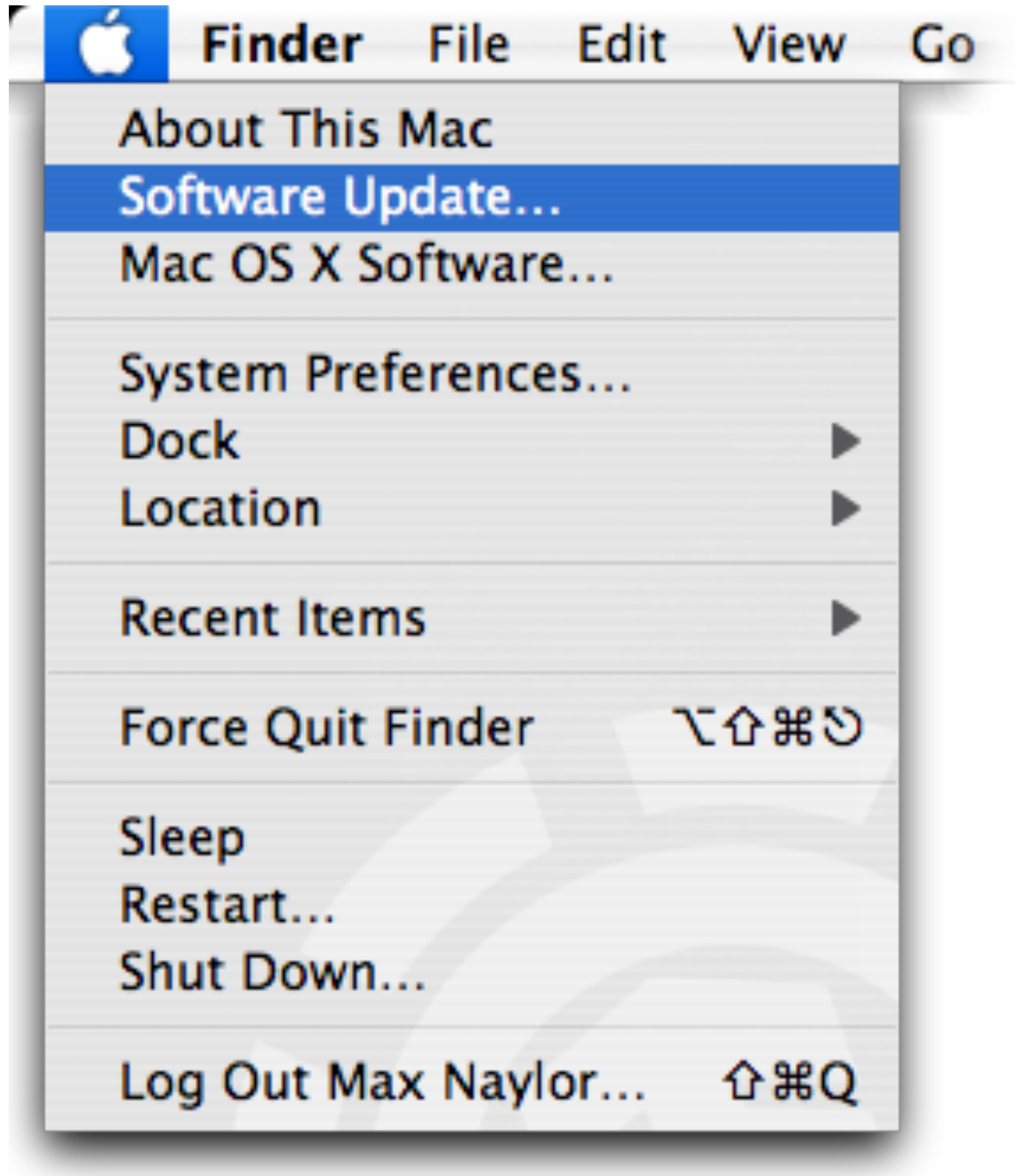


Larger, labeled controls can be clicked more quickly

Source: Jensen Harris, An Office User Interface Blog : Giving You Fitts. Microsoft, 2007.

EXPLOIT THE EDGES

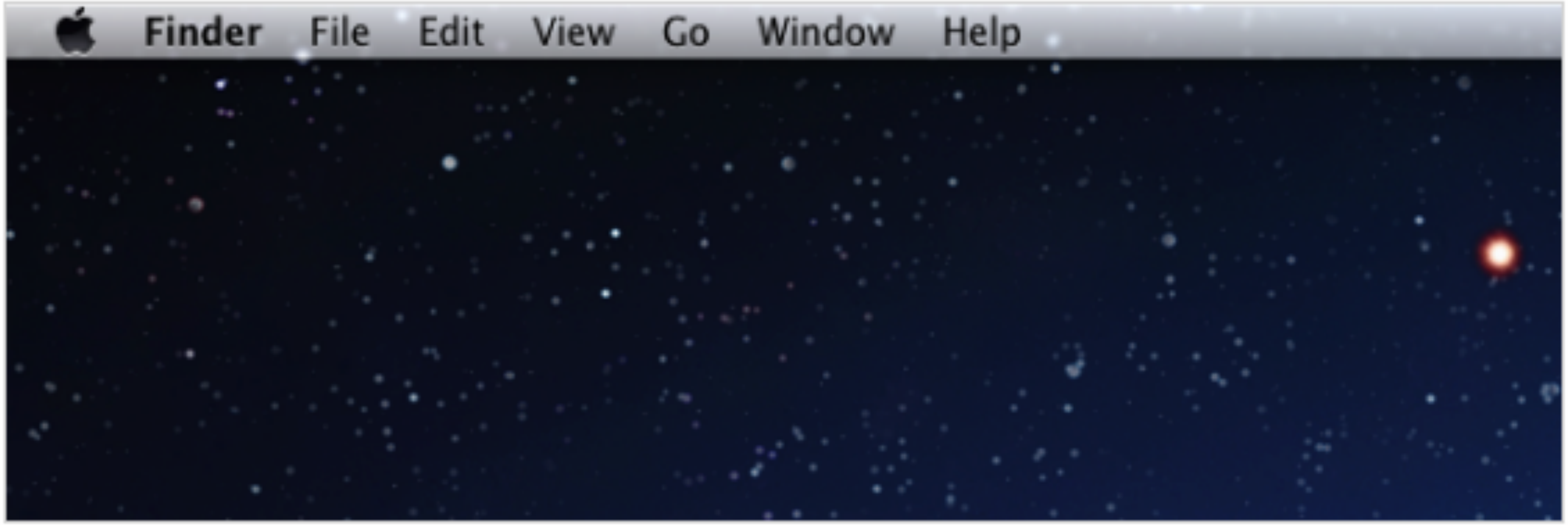
Windows 95: Missed by a pixel
Windows XP: Good to the last drop



The Apple menu in
[Mac OS]()

Source: Jensen Harris, An Office User Interface Blog : Giving You Fitts. Microsoft, 2007; Apple

EXPLOIT THE EDGES



DOES FITTS’ LAW APPLY TO MOBILE DEVICES?

DOES FITTS' LAW APPLY TO MOBILE DEVICES?

Yes! Original experiment by Fitts was on human arm movement, not mouse pointing!

Extension to target acquisition with mouse was a big result of Card et al. and not obvious.

Tablet setting is closer to original experimental setting.

No more benefit on device edges

How device is held

MOBILE