McMaster University

SCIENCE
Department of Kinesiology

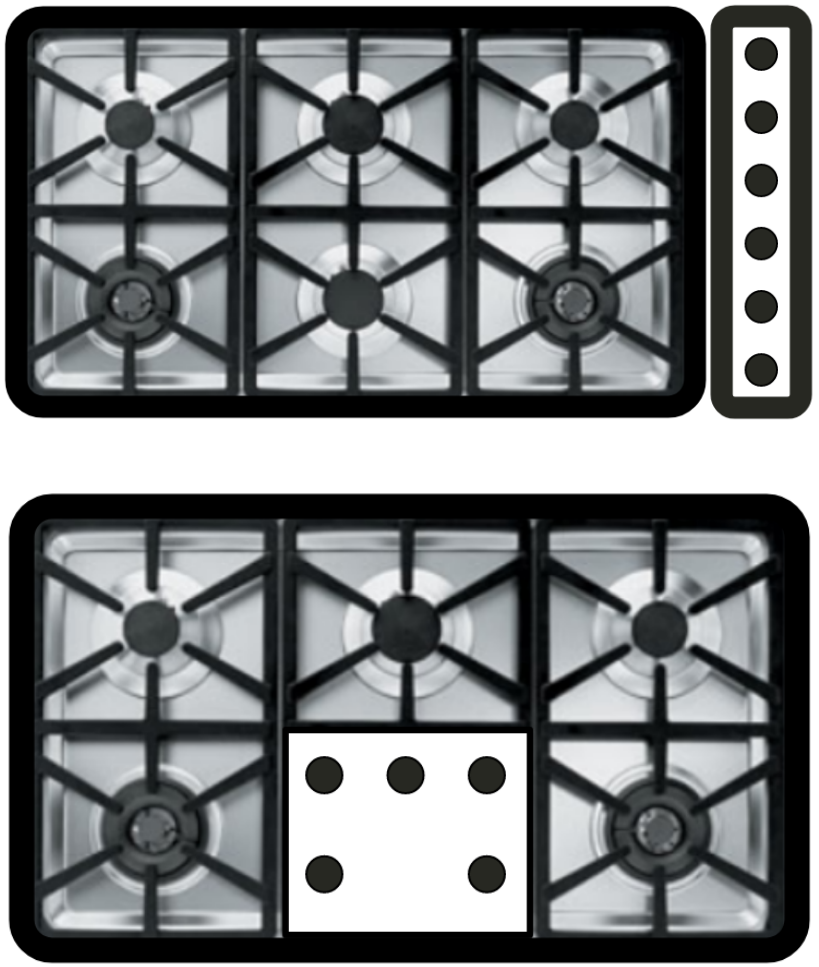
Action execution: Attention

KINESIOL 1E03 - Motor control and learning

Laura St. Germain
Fall 2021 Week 5
Lecture 10

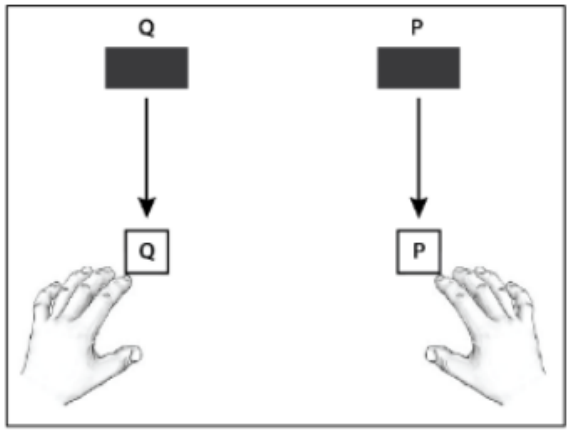
Review from last lecture

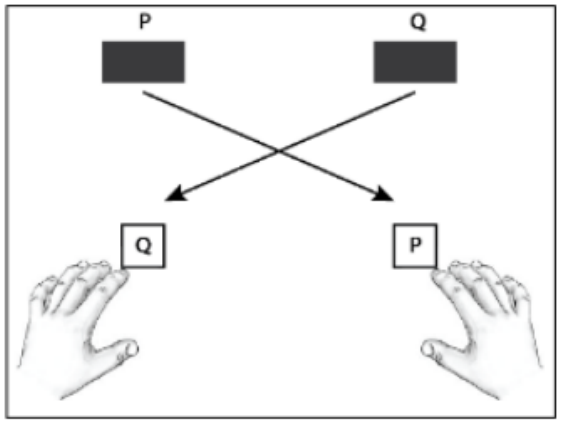
Stimulus-response compatibility

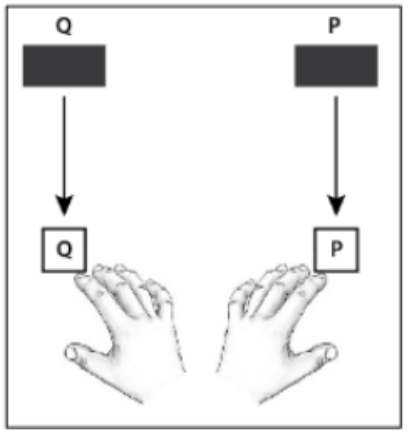


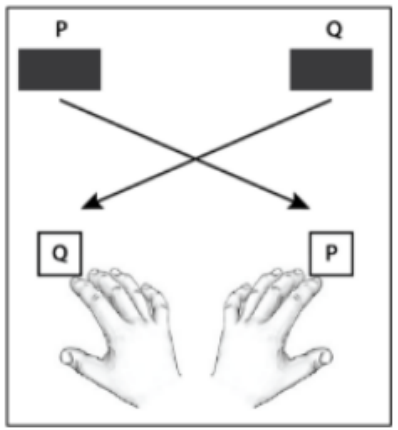
- refers to the **naturalness** of the mapping between the **stimulus** and the **required response**
- when compatibility is **high**...
  - **faster** learning
  - **faster** reaction times
  - **fewer** errors
  - **lower** mental workload
  - **higher** user satisfaction
- most common type is **spatial** compatibility

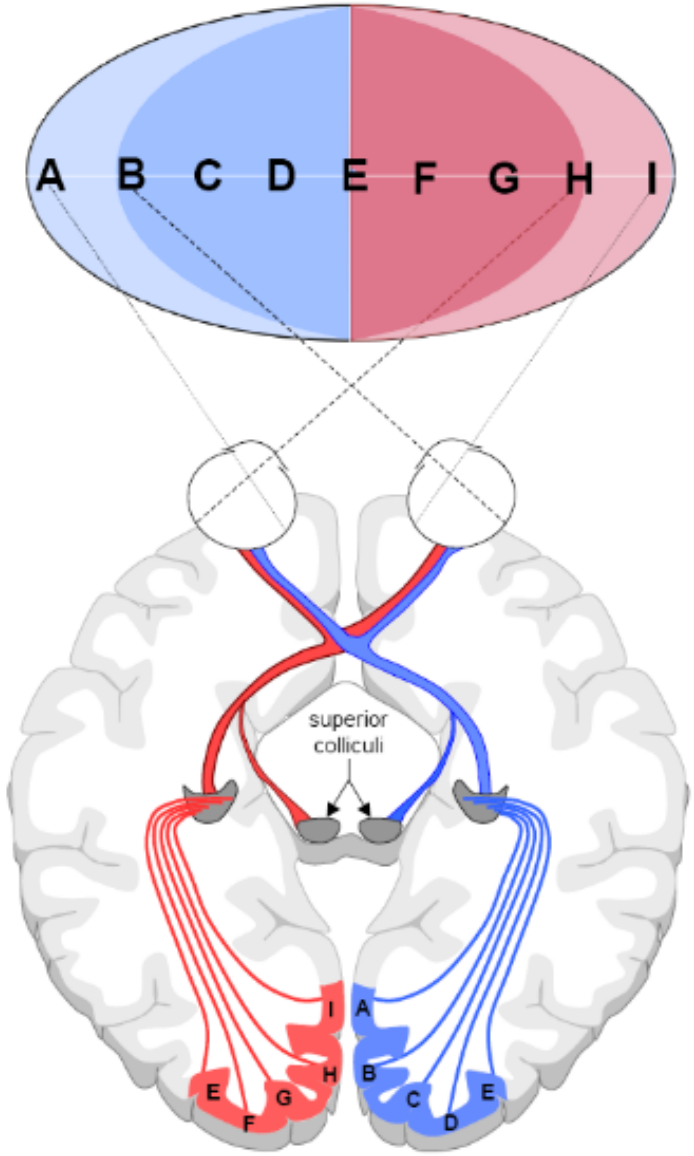
A simple setup to study S-R compatibility in the lab

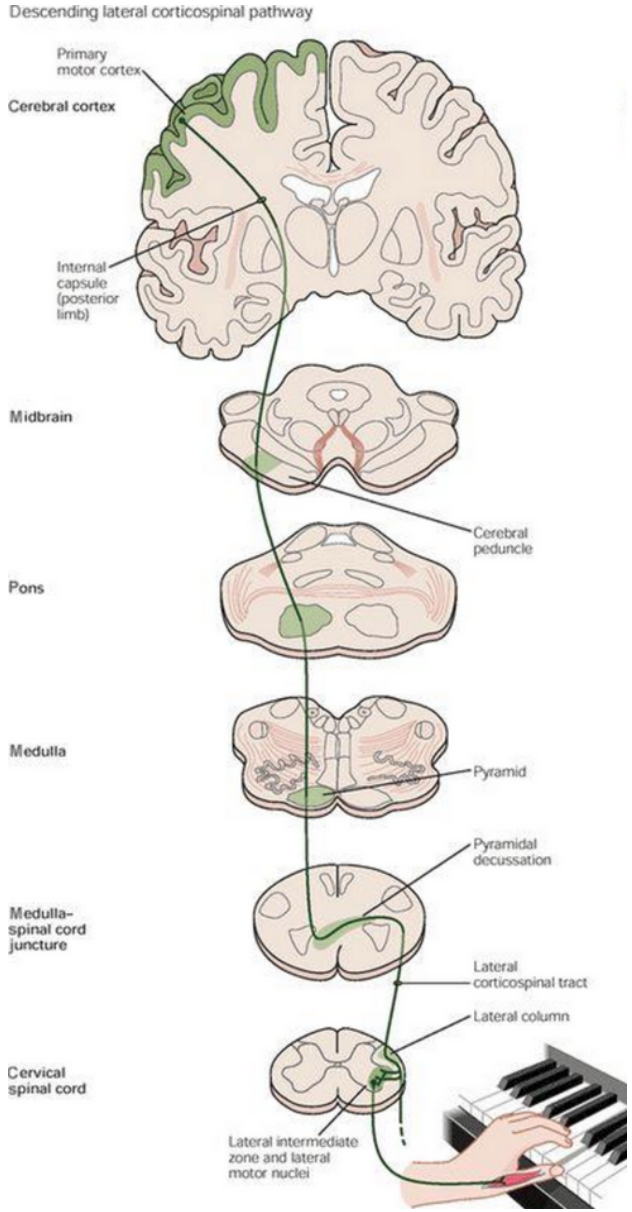






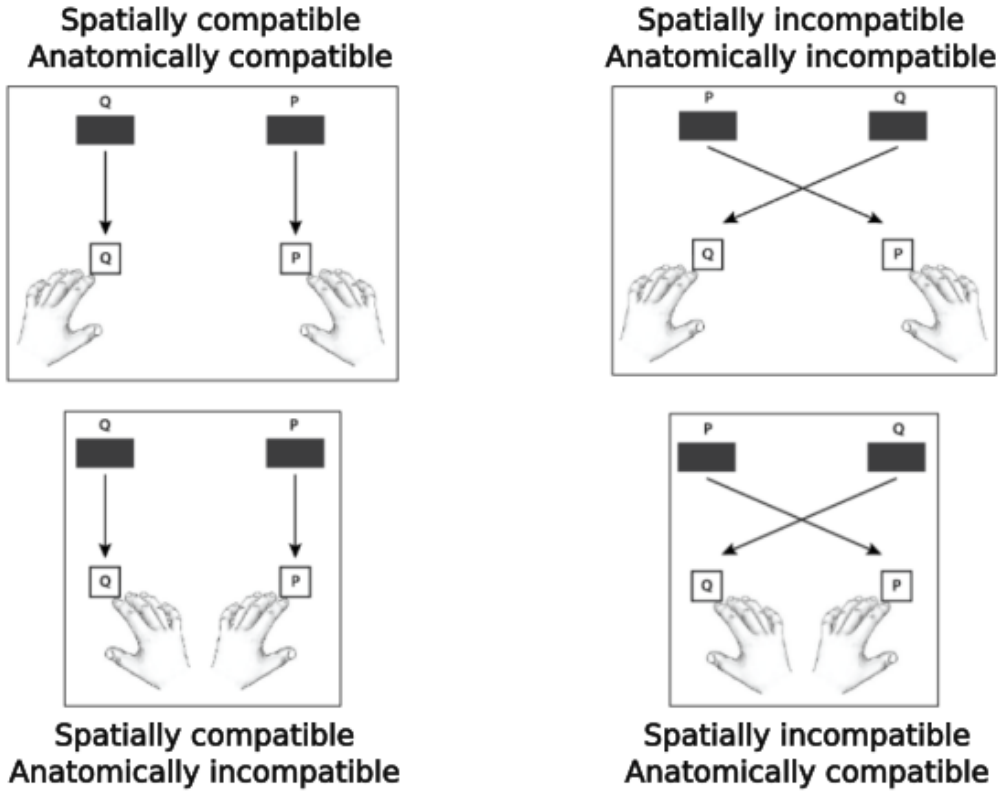




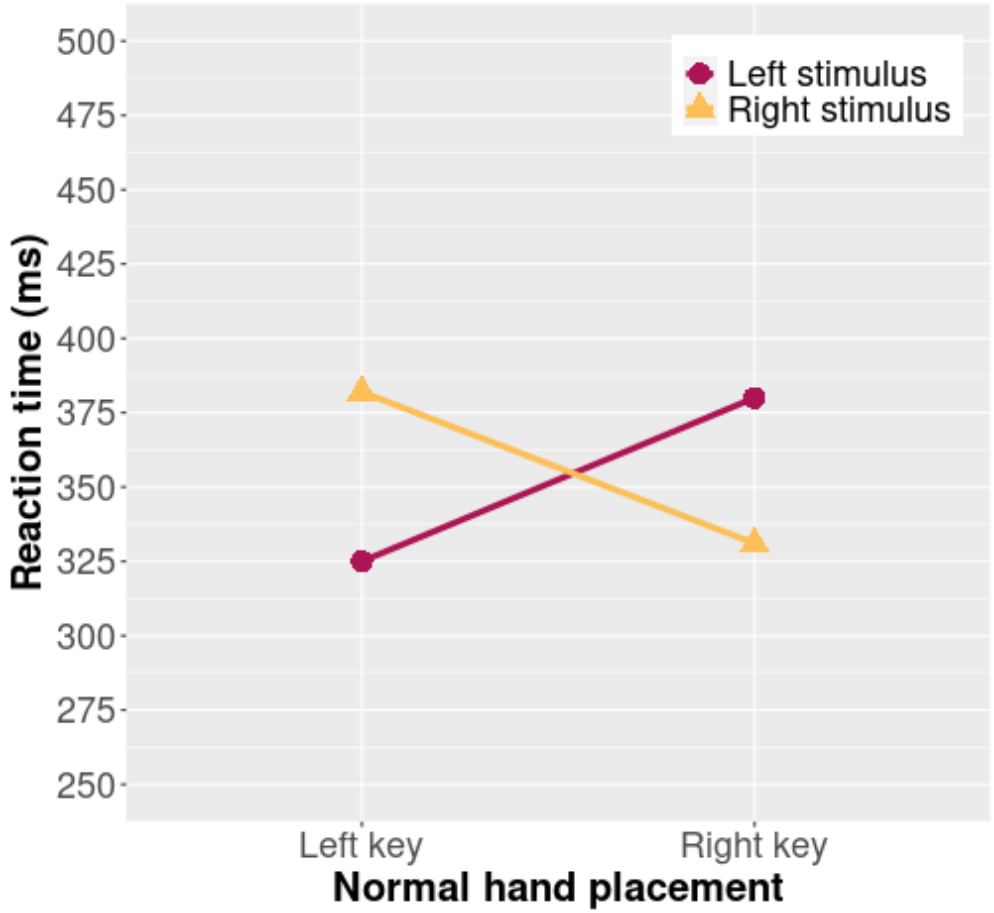


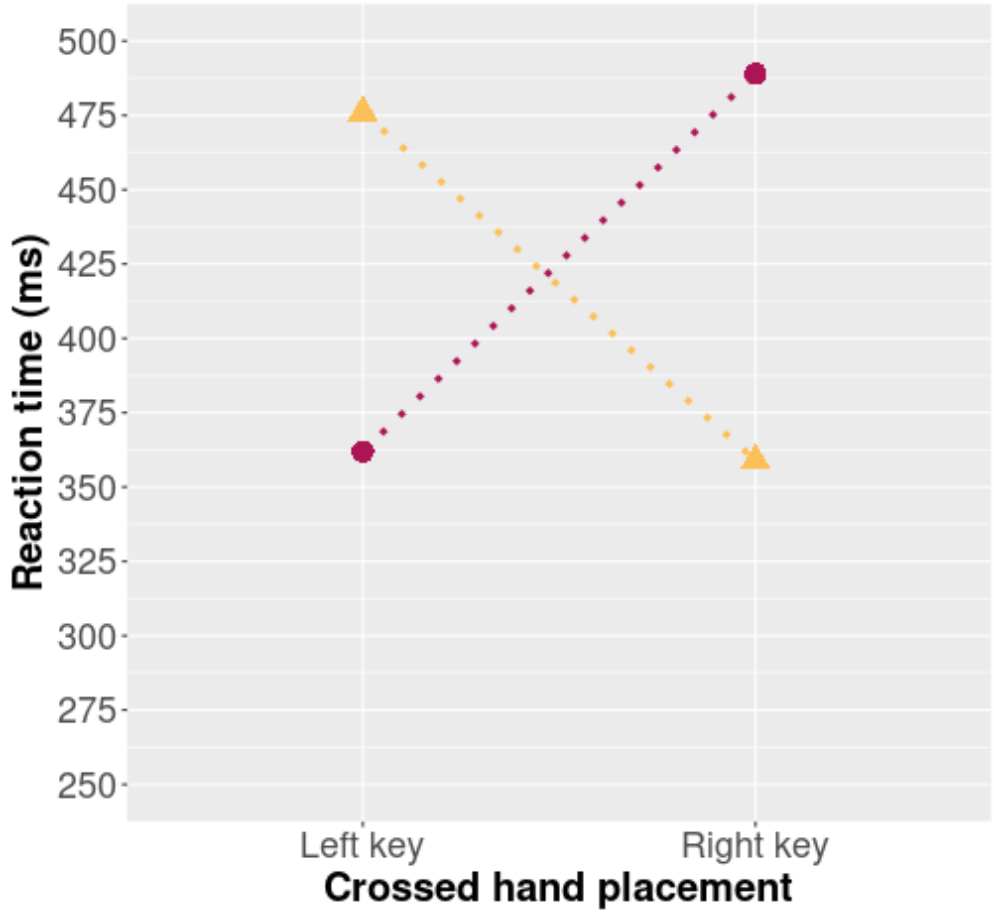
Left: Tresilian 2012 ; Right: Kandel et al. 2013

How can we dissociate between the spatial and anatomical explanations?



Which explanation is supported by this data?





Hypothetical data for illustrative purposes

Any questions?

What is attention?

What is attention?

> *Everyone knows what **attention** is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization, concentration of consciousness, is of its essence. It implies withdrawal from some things in order to deal effectively with others.*
>
> William James 1890

Attention, Perception, & Psychophysics (2019) 81:2288–2303
https://doi.org/10.3758/s13414-019-01846-w

TIME FOR ACTION: REACHING FOR A BETTER UNDERSTANDING OF THE DYNAMICS OF COGNITION

Check for updates

No one knows what attention is

Bernhard Hommel[1] · Craig S. Chapman[2] · Paul Cisek[3] · Heather F. Neyedli[4] · Joo-Hyun Song[5] · Timothy N. Welsh[6]

Published online: 5 September 2019

Learning objectives

1. Define the term **attention** as it relates to the performance of motor skills.

2. Describe how researchers can **assess** the attention demands of performing a motor skill and how attention **may limit** information-processing activities during task performance.

Take-home message:

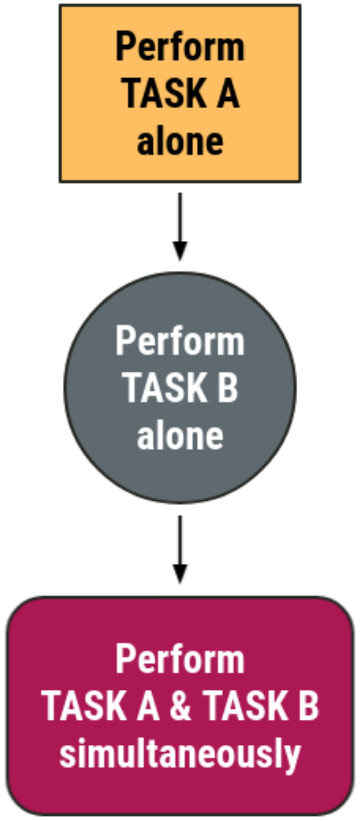
The performance of any motor skill is affected by cognitive, motor, and biomechanical factors.

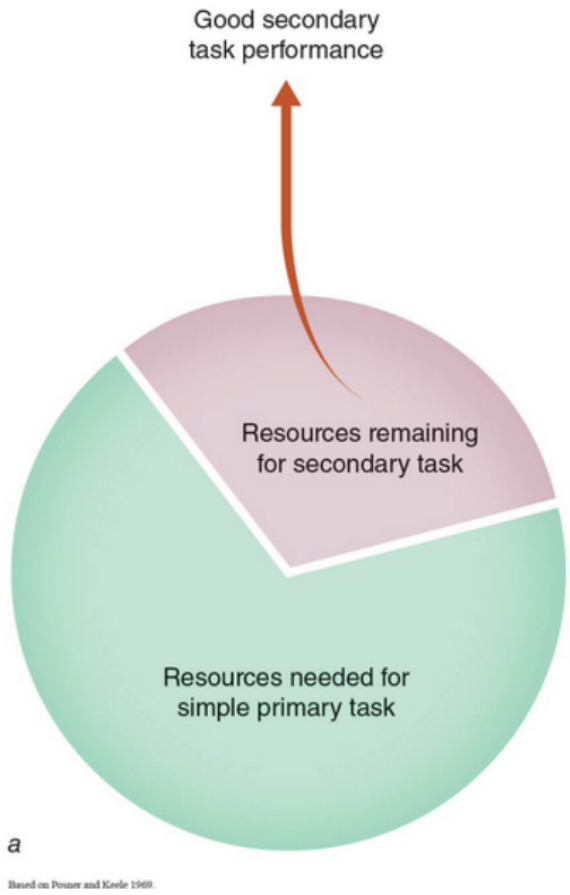
What is attention?

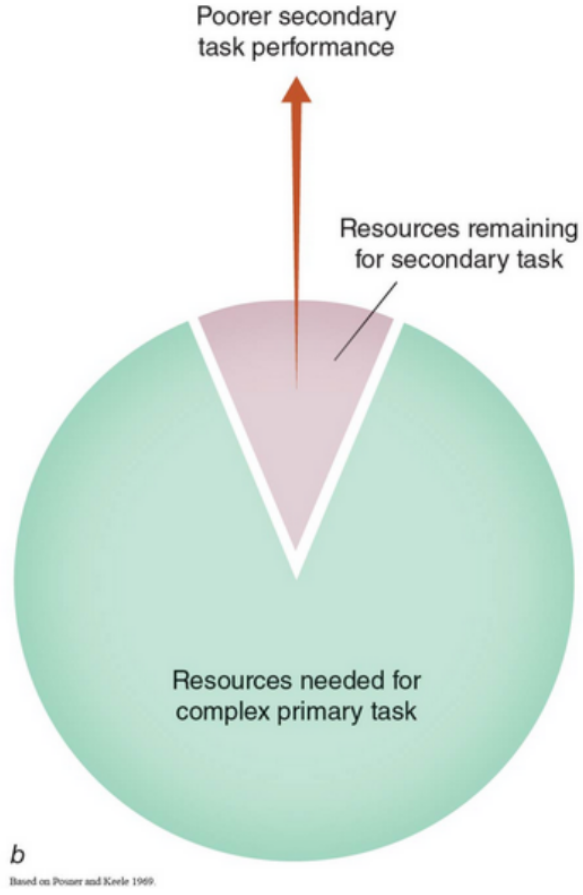
- **limited capacity** to engage in multiple cognitive and/or motor activities **simultaneously**
- **selective** attention to specific **environmental features** when we perform motor skills
    - this can happen either through **intentional** or **incidental** processes

- in **multi-task** situations, performance can suffer for two broad reasons:
    - **structural interference** occurs when physical or neurological structures are the cause of the reduced performance (e.g., eyes, limbs, etc)
    - **capacity interference** occurs when required attentional resources exceeds some attentional limit

We can leverage interference as an indirect measure of attention







Right fig: Schmidt & Lee 2011

We can use a probe reaction time task to gauge the attention demands of an action

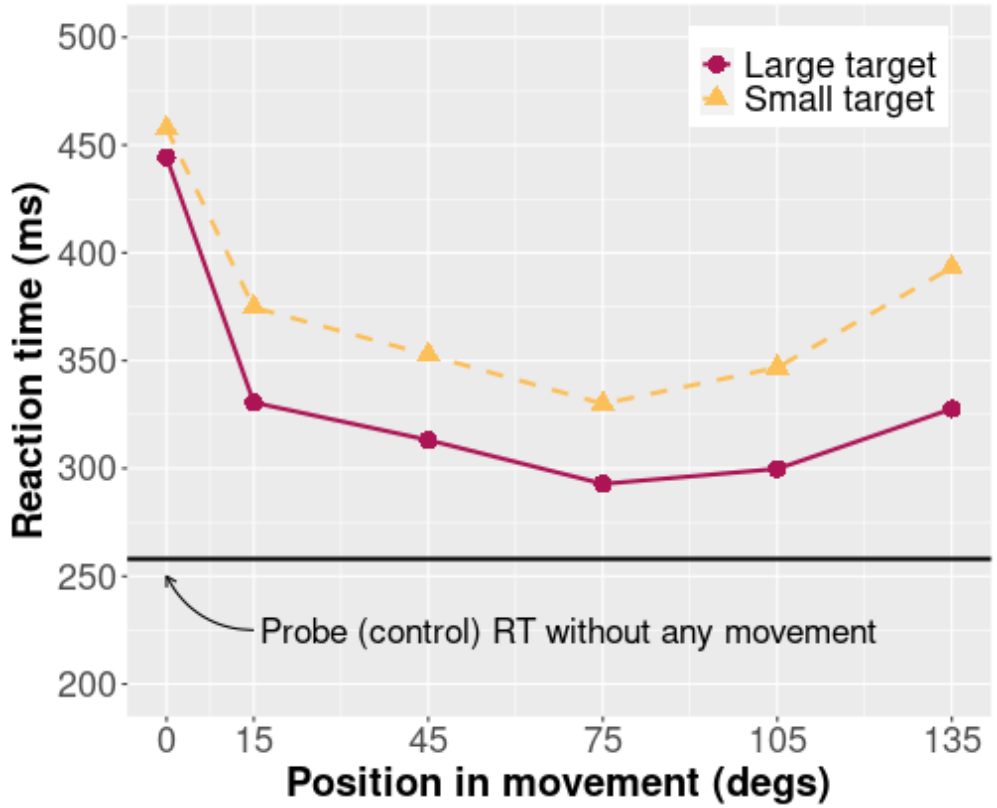
Primary task

- Reach to a target (small or large)

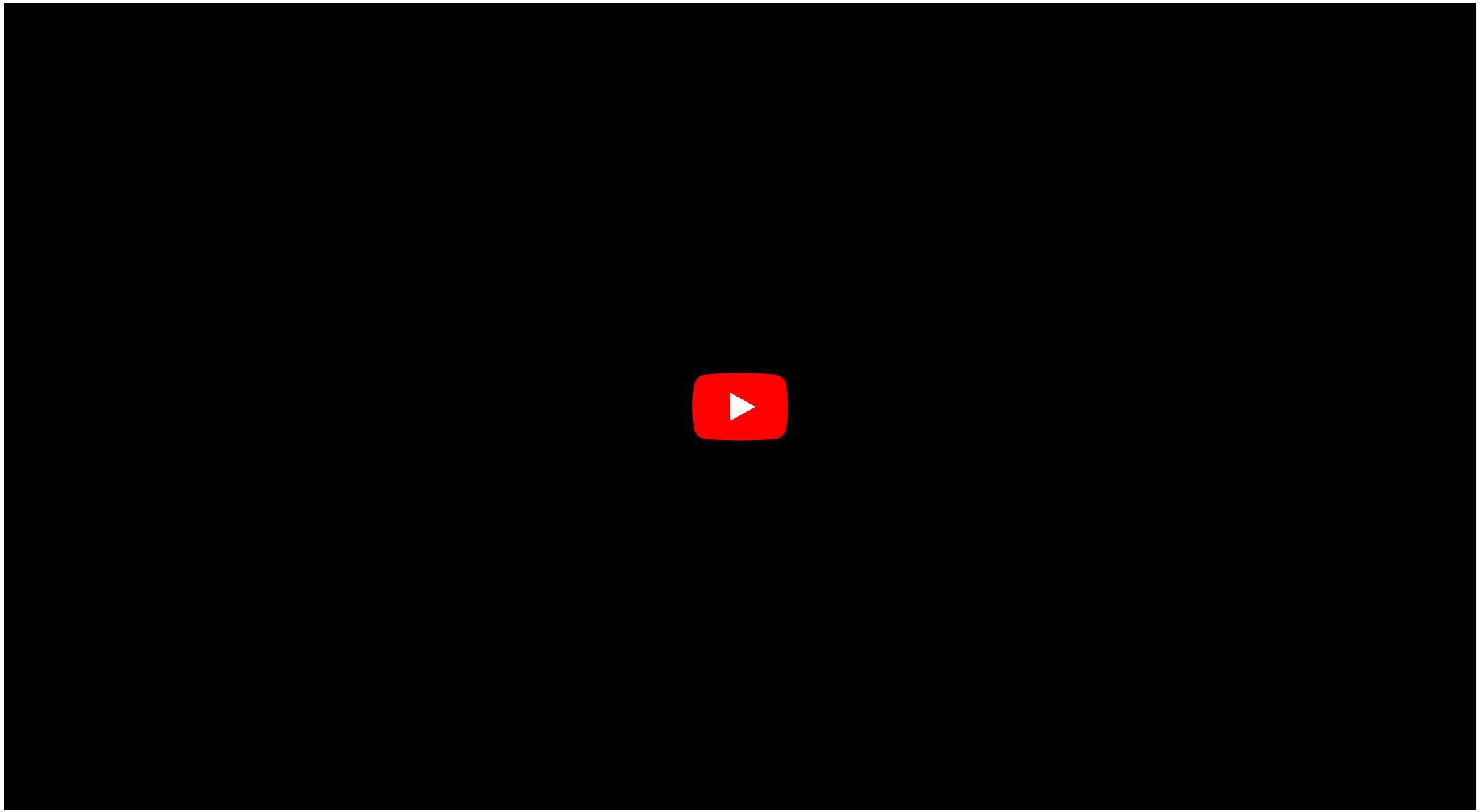
Secondary task

- Simple reaction time task of pressing a button as quickly as possible whenever you hear an auditory tone

The auditory probe could be **presented randomly** at **6 possible positions** in the movement: 0, 15, 45, 75, 105, or 135 degrees



Approximate data from Posner and Keele 1969 through plot digitization



Source: https://youtu.be/ZaaK36mX_Pk

The time between the presentation of two stimuli can have a strong influence on performance

Task 1 alone: **Say** a word (e.g., *"TOP"*) as quickly as possible when you **hear** an auditory cue

Task 2 alone: **Press** a key with your right hand when you **see** a visual cue

Sequential: Perform Task 1 **then** Task 2 but **manipulate** time **between** the auditory and visual cues

Approximate data from Posner and Keele 1969 through plot digitization

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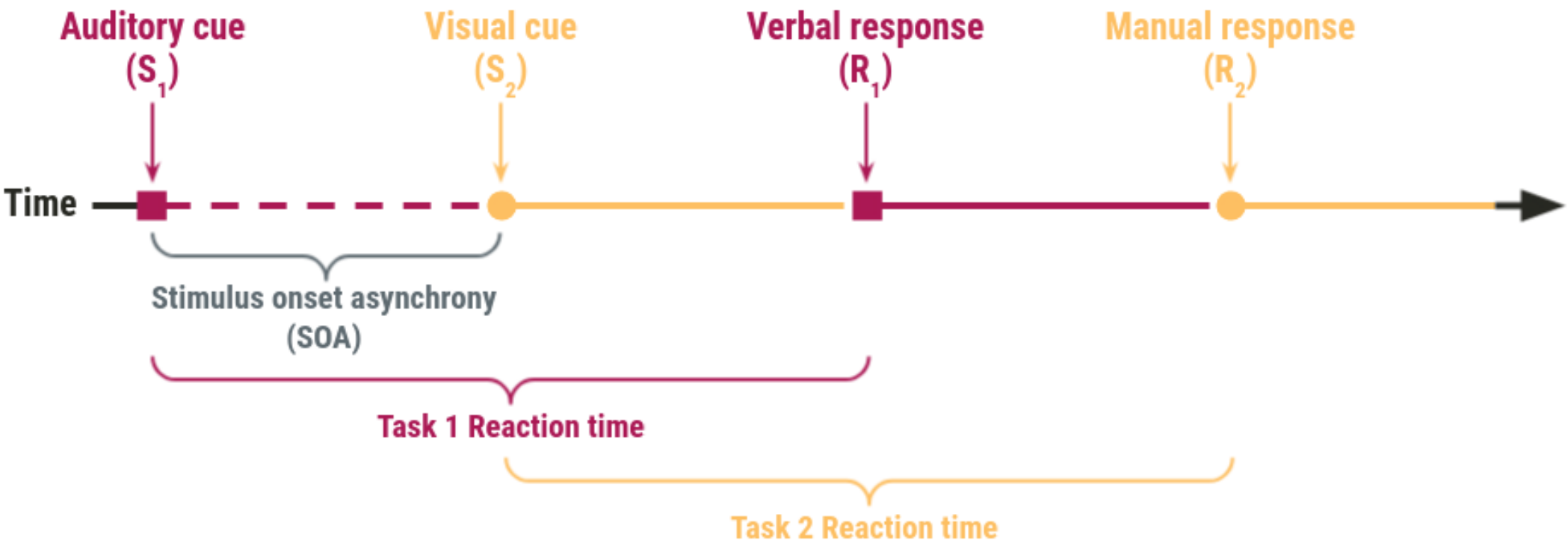
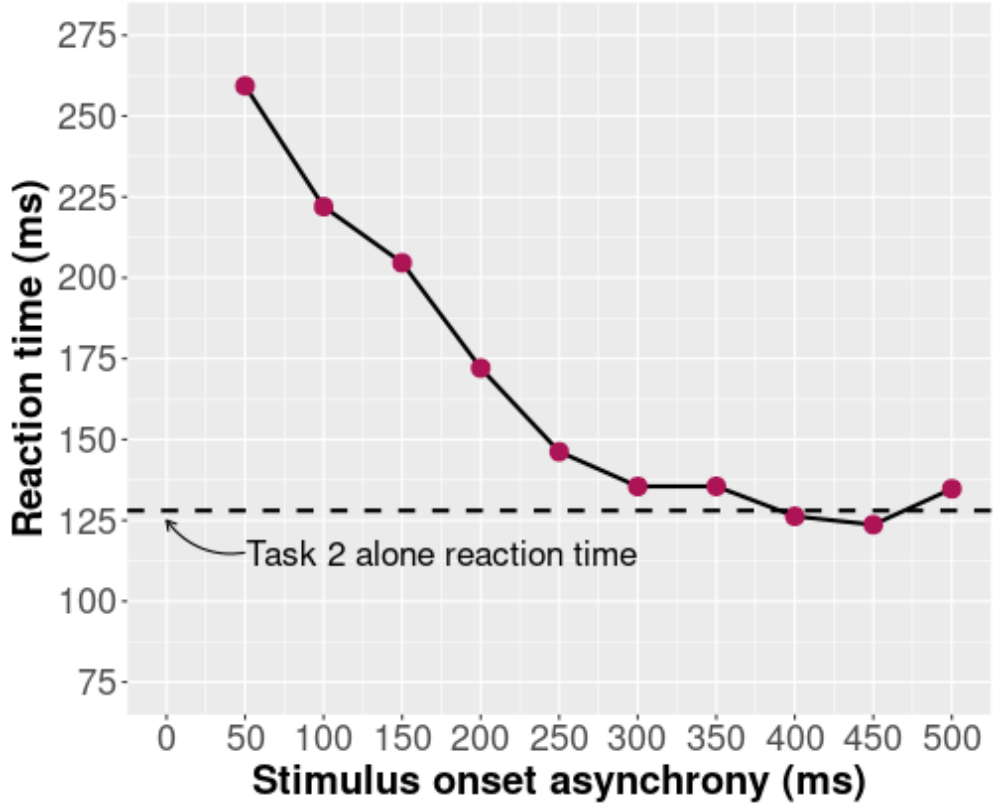


Psychological refractory period (PRP) decreases as SOA increases

Task 1 reaction time: 161 ms

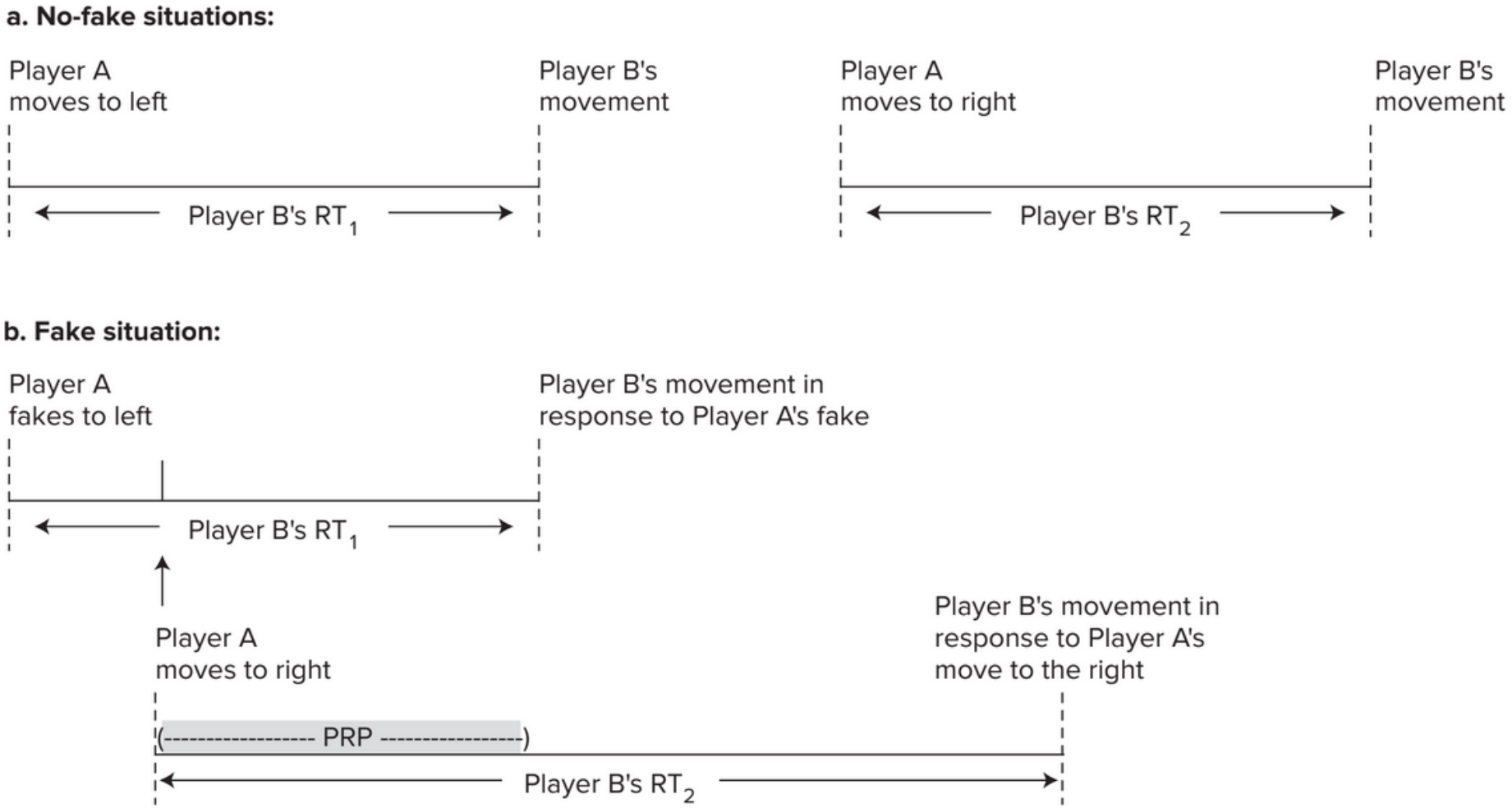
Task 2 (control) reaction time: 128 ms

*We need to **compare** the reaction times of **Task 2 in the sequential condition** (Task 1 then Task 2) to the **Task 2 alone** (i.e., control condition) to determine whether a **PRP** happened*

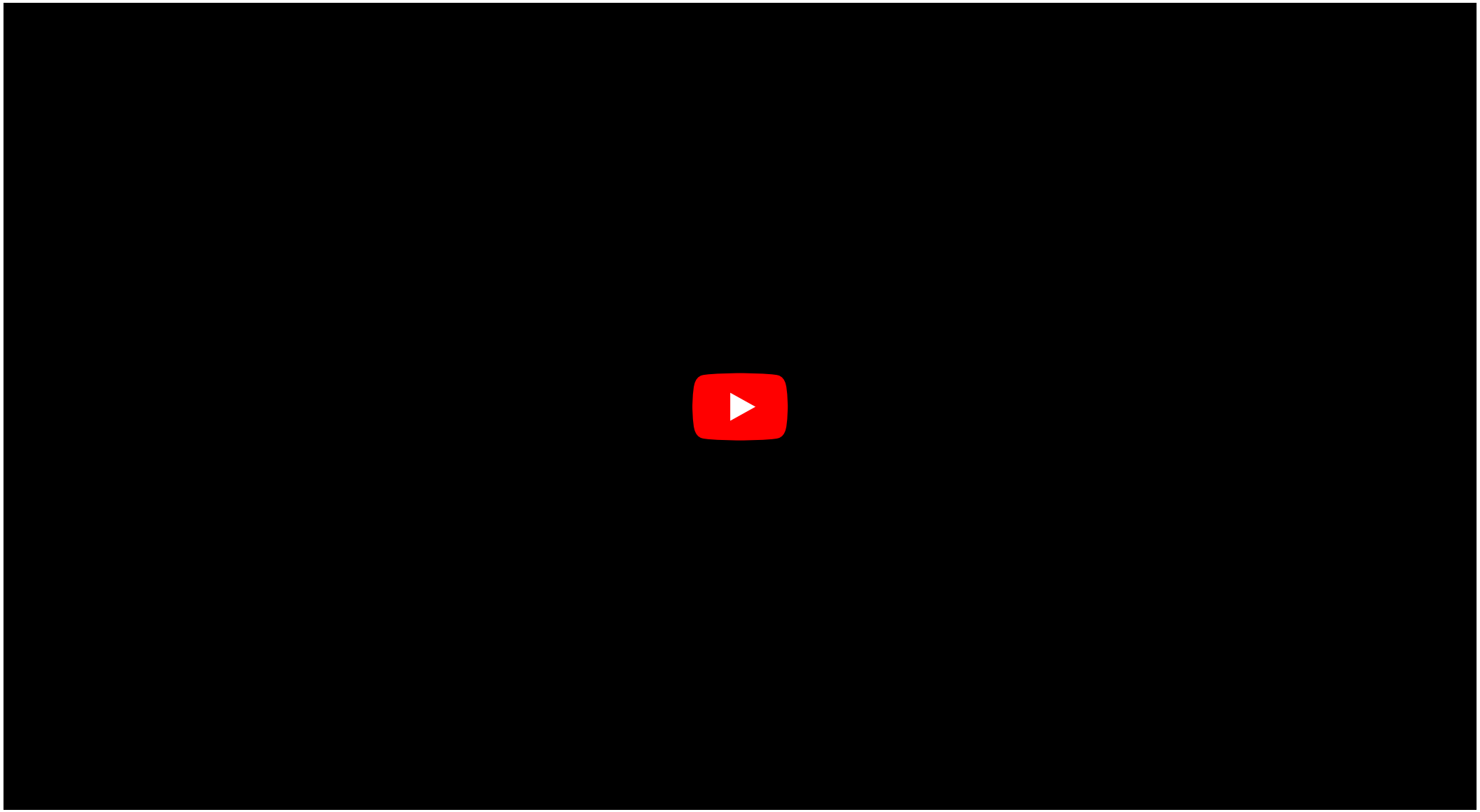


Approximate data of Davis 1959 through plot digitization of adapted figure in Schmidt & Lee 2011

The psychological refractory period in action...



Video: https://youtu.be/WMB4k-OINM0



Source: https://youtu.be/Yoh9K4mllos

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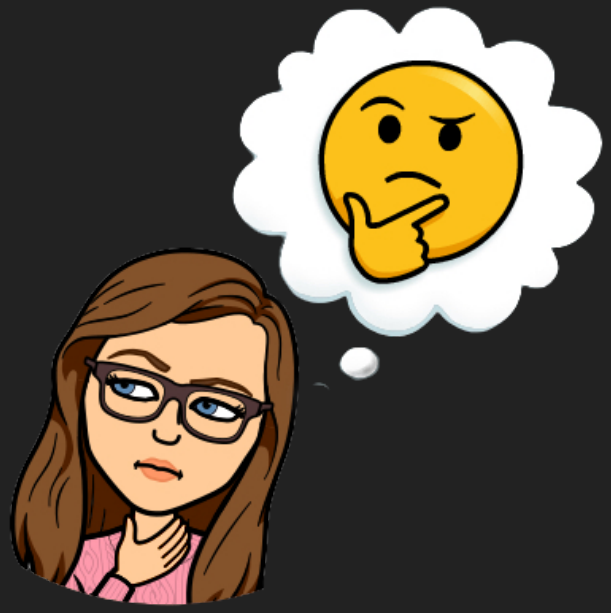
What questions do you have?



@_LauraStGermain
@LauraStGermain
www.cartermaclab.org