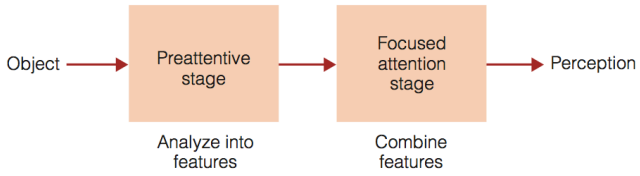
Attention III

PSYC 313 - Lecture 9
Dr. J. Nicol

Feature Integration Theory

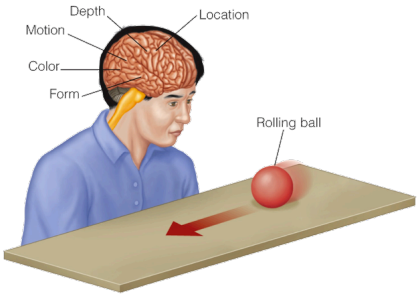


Treisman (1986)

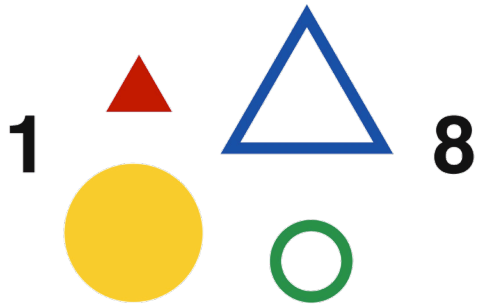
Feature Integration Theory

- Proposed to explain how we perceive what are initially separate features as part of the same object (Treisman, 1986)
- *Pre-attentive stage*—according to the theory the first step in processing is the pre-attentive stage where objects are analyzed into separate features
- *Focused attention stage*—the "free-floating" features of an object are combined

Attention plays a key role in solving the binding problem



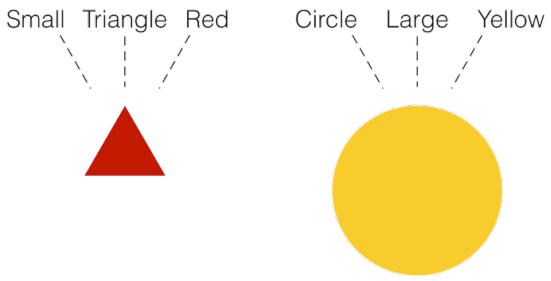
To provide evidence that objects are first analyzed into features, Treisman and Schmidt did an experiment which showed that early on in the perceptual process, features exist independently of one another



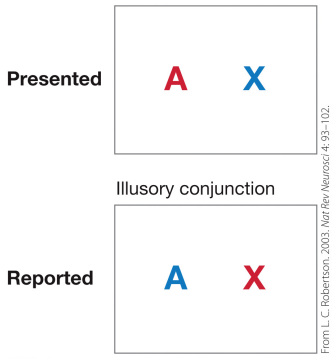
Treisman & Schmidt (1982)

Features are "free floating" in the pre-attentive stage and as a result are sometimes incorrectly combined when there are multiple objects in the environment

"Free-Floating" Features



According to Treisman, illusory conjunctions occur because at the beginning of the perceptual process features exist independently and are not associated with a specific object



From L. C. Robertson. 2003. *Nat Rev Neurosci* 4: 93–102.

COGNITION 7e, Figure 4.10
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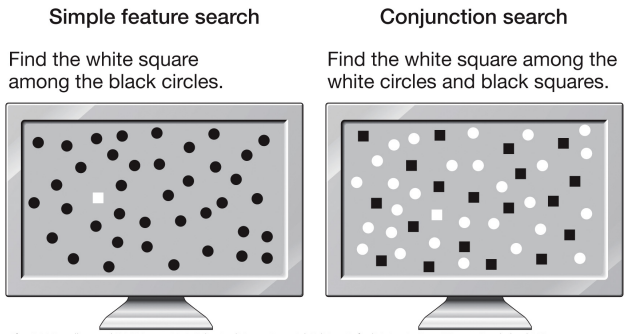
Visual Search

- ***Feature search:*** look for a single feature (e.g., colour) that distinguishes the target from the distractors
- Set size (i.e., number of distractors) does not affect search time in feature search because the search is done in a parallel fashion and the target "pops out"
- ***Conjunction search:*** two ore more features (i.e., colour and shape) have to be combined to find the target
- Larger set sizes (i.e., more distractors) slows down this kind of visual search because the items must be searched in a serial fashion (i.e., one by one)



After S. M. Breedlove and N. V. Watson. 2019. *Behavioral Neuroscience*, 9th Edition. Oxford University Press/Sinauer: Sunderland, MA. Based on A. M. Treisman and G. Gelade. 1980. *Cogn Psychol* 12: 97–136.

COGNITION 7e, Figure 4.8
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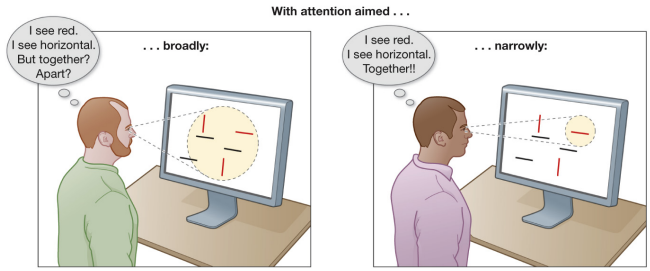
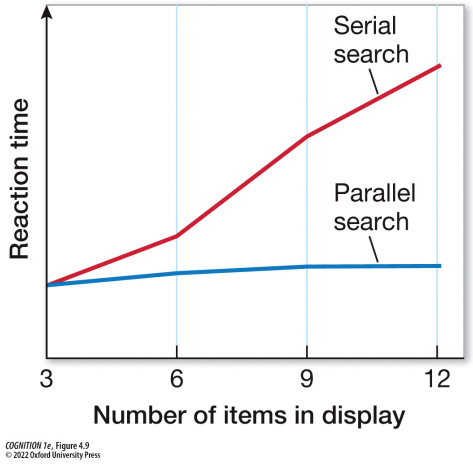
The trade-off of focused attention on performance in a visual search task





COGNITION 1e, Figure 4.9
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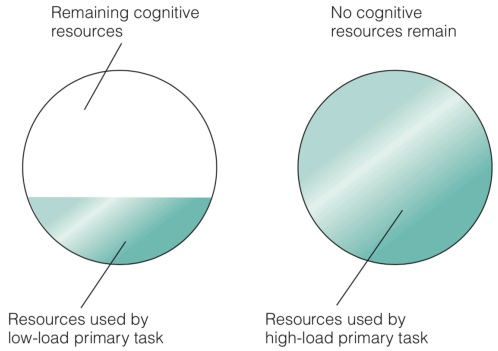
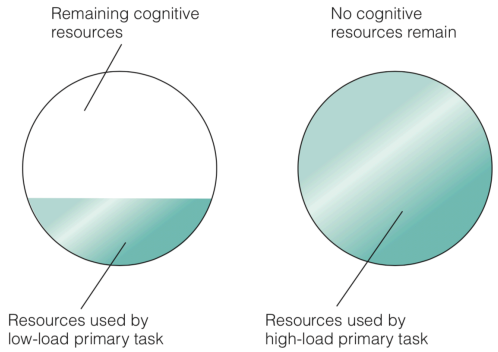
Cognitive Control

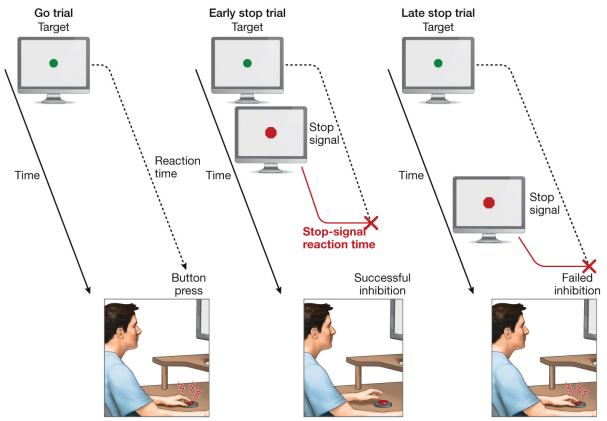
- The ability to orchestrate thought and action in accordance with our goals (Miller & Cohen, 2001)
- A ***mental resource*** refers to limitations in how much information the mind can process at any given time
- The effectiveness of multitasking is largely determined by two factors: *cognitive overlap and cognitive load*
- Cognitive interference occurs when load is high or when two tasks overlap, and performance suffers as a result
- With a lower load or less overlap, less cognitive interference will occur, allowing for better multitasking

Low-load tasks that use few cognitive resources leave resources available for processing unattended task-irrelevant stimuli



High-load tasks that use all of a person's cognitive resources don't leave any resources to process unattended task-irrelevant stimuli

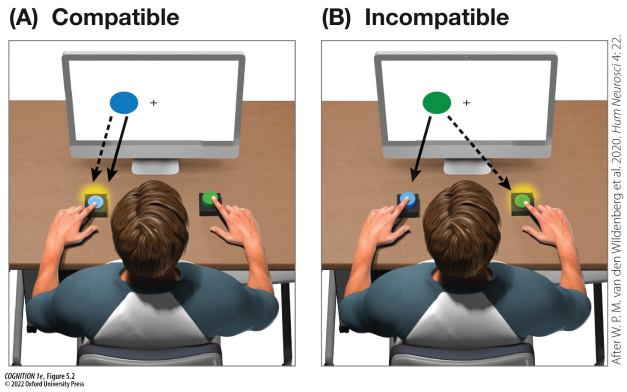


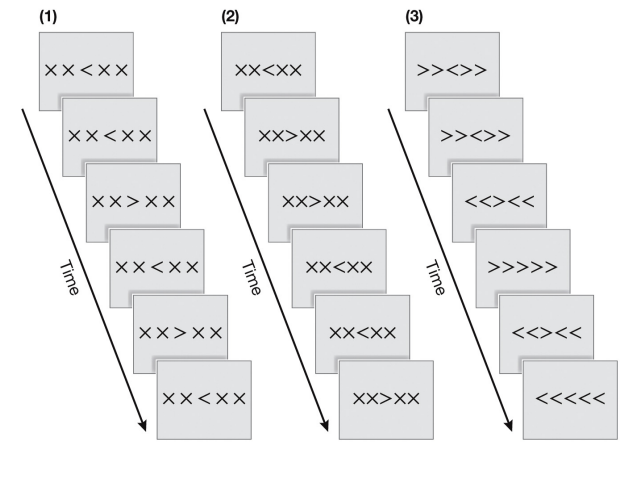


Helfinstein & Poldrack (2012)

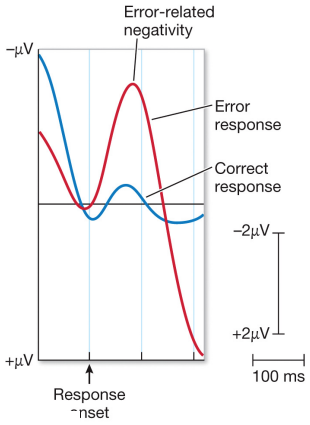
RED GREEN YELLOW BLUE
ORANGE GREEN RED GREEN
PURPLE BLUE BLACK ORANGE

GREEN RED BLUE YELLOW
GREEN ORANGE BLUE RED
YELLOW GREEN ORANGE BLACK

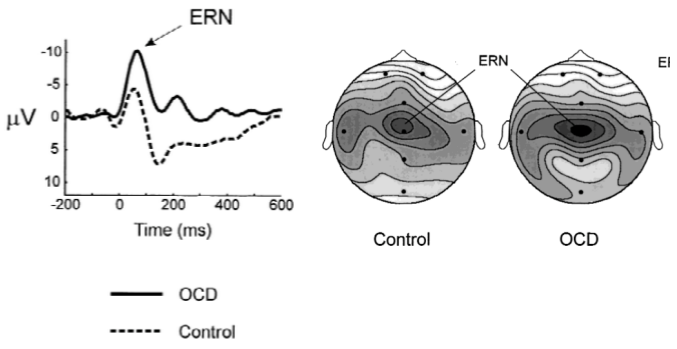




The ERN reflects conflict-monitoring and error-detection



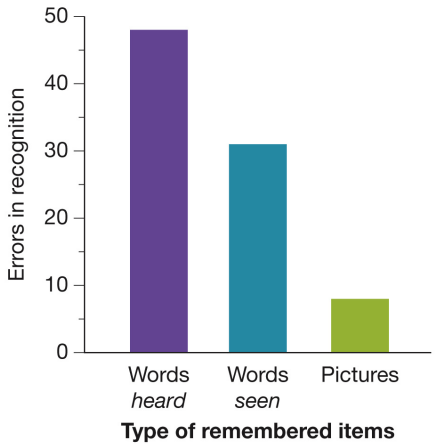
The error-related negativity (ERN) ERP component is larger and more prolonged in patients with OCD



Gehring et al. (1999)

Divided Attention

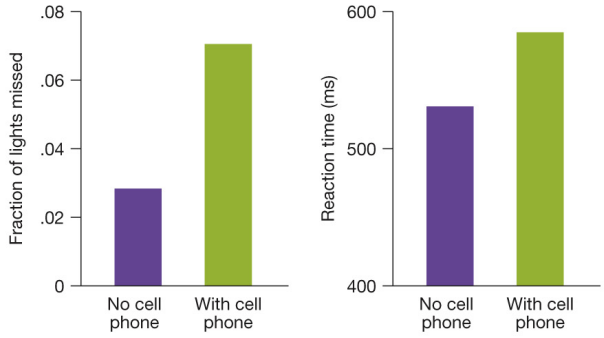
- In our daily lives we have to do several tasks at once, and so we have to divide our attentional resources across tasks
- In cognitive psychology, researchers say that multitasking involves divided attention
- ***Divided attention:*** the mental effort to divide your attentional focus between multiple tasks or inputs
- Dividing attention across tasks is more difficult when the two tasks that draw on similar mental resources then it is to perform two tasks that draw on different mental resources



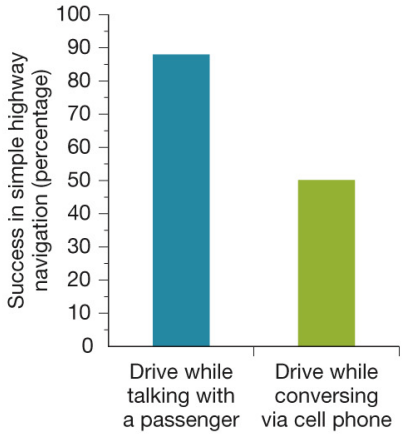
Allport et al. (1972)

Divided Attention

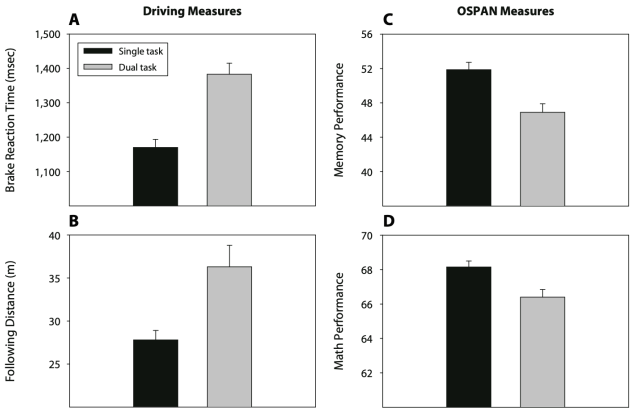
- A survey of accidents and cell phone use in Toronto showed that the risk of a collision was four times higher when using a cell phone than when a cell phone was not being used (Redelmeier & Tibshirani, 1997)
- These two tasks are very different and so should not be in competition for the same cognitive resources (i.e., driving is a visuomotor task and talking on the phone is a verbal task)
- Dual-task studies in driving simulators have led researchers to conclude that having cell phone conversations while driving may be as dangerous as driving drunk, and texting is even more dangerous (Strayer & Johnson, 2001)



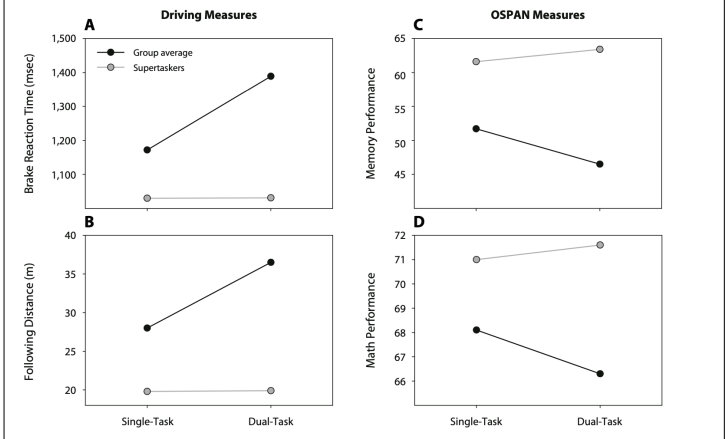
Strayer & Johnston (2001)



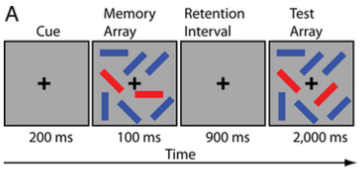
Drews et al. (2008)

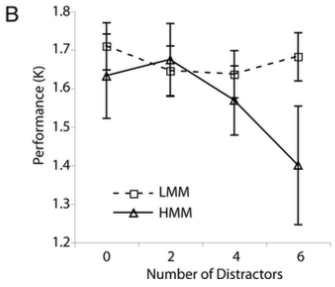


Watson & Strayer (2010)



Watson & Strayer (2010)





Ophir et al. (2009)