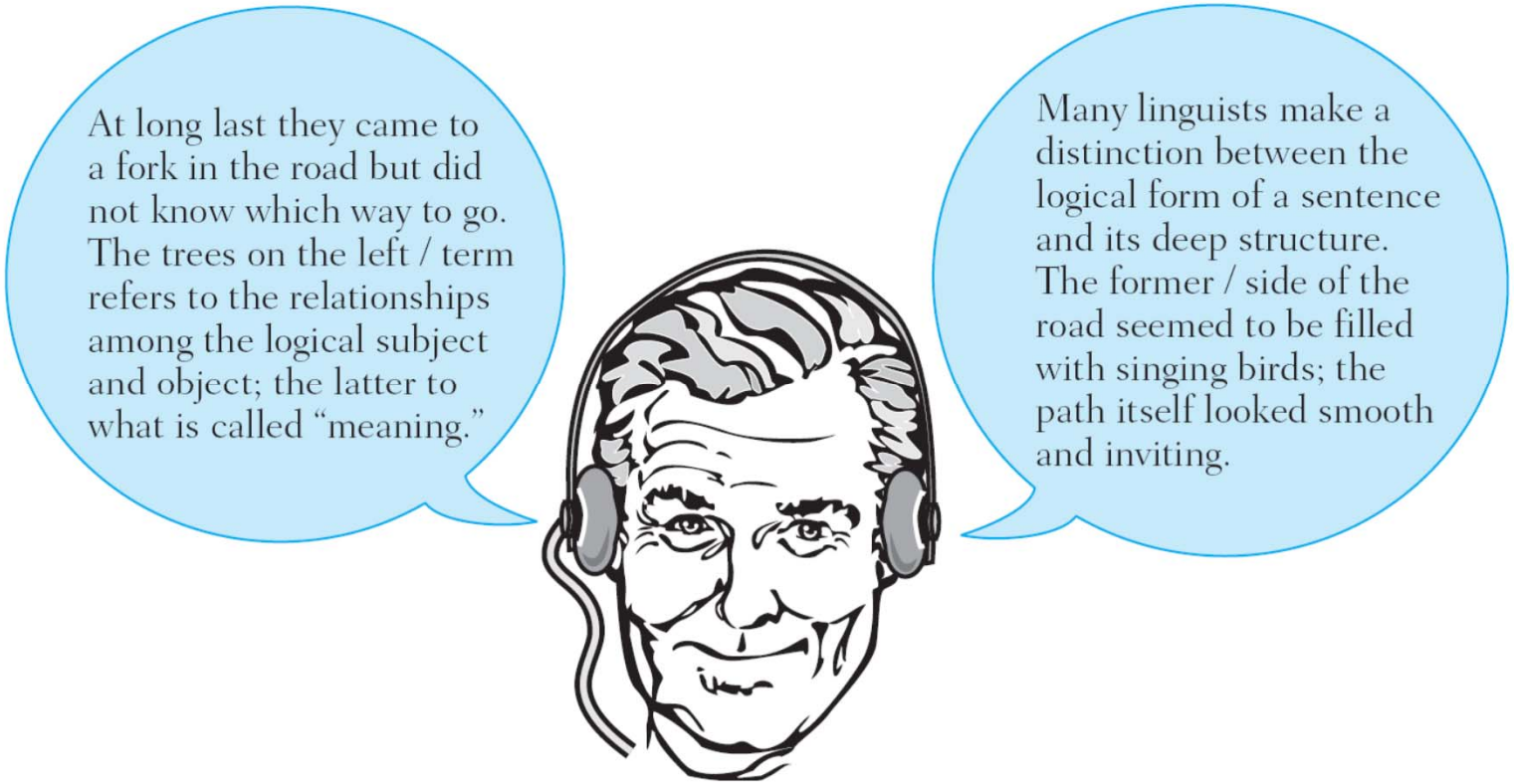
Selective Attention

(dichotic listening)

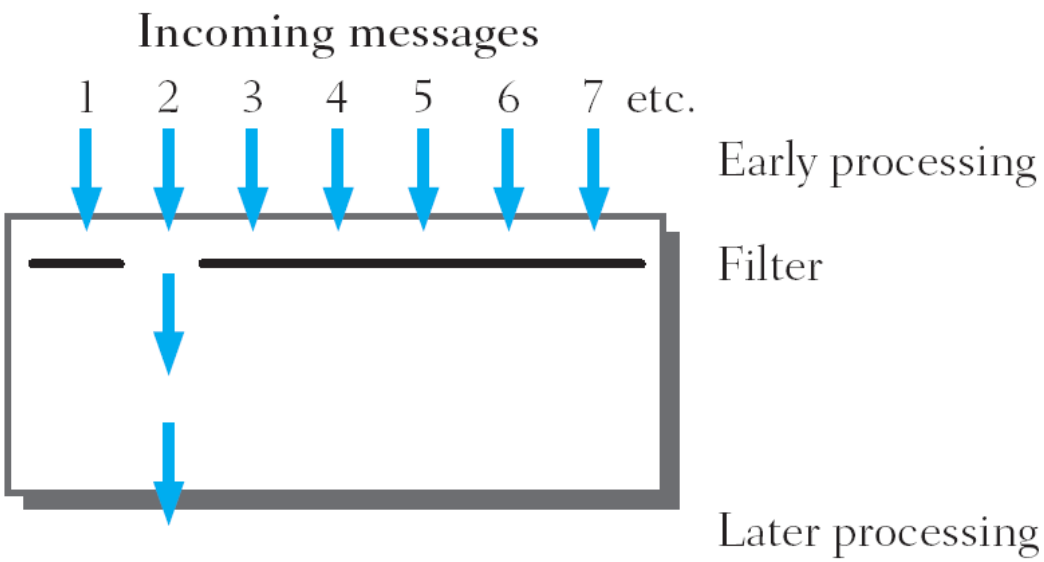
- People attend to one ear by **"shadowing"**
  - failed to notice in the other ear
    - when the unattended speech changed to German
    - speech in Czech spoken with English pronunciation
- What's reported from the unattended ear?
  - speech versus noise
  - gender of talker, loudness, pitch

- What's reported from the unattended ear?
  - noticed own name (cocktail party effect)
    - maybe attention "leaks" over?
  - Treisman (1960): participants mistakenly switch ears when the speech switches
    - can't be explained by attention leaking over

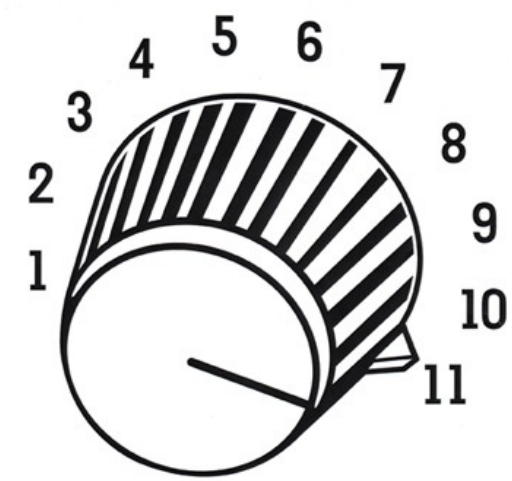


Theories of Attention

- **Filter Theory** (Broadbent, 1958)
  - only a limited amount of information can be attended
    - attention has a **limited capacity**
    - there is an information **bottleneck**
      - only a small amount of information gets through
  - bottleneck early in processing (*early selection*)
    - before meaning has been determined
      - Filtering based on physical properties
      - However, this can't explaining cocktail party effect



- **Attenuation Theory** (Treisman, 1960)
  - Information isn't filtered. Instead it's attenuated
    - the volume is turned down, not off
  - Speech is processed in three stages and information at each stage can be attenuated
    - physical properties (e.g., attend to high voice, not low)
    - linguistic content (e.g., attend to English sounds, not Czech)
    - meaning (e.g., follow this conversation, not that one)
      - important word have lowered threshold (your name, "fire!")
      - thresholds can be temporarily lowered (**primed**) by context
        - » "the dog chased the ____")



Priming vs. Expectations

(costs and benefits = limited resources)

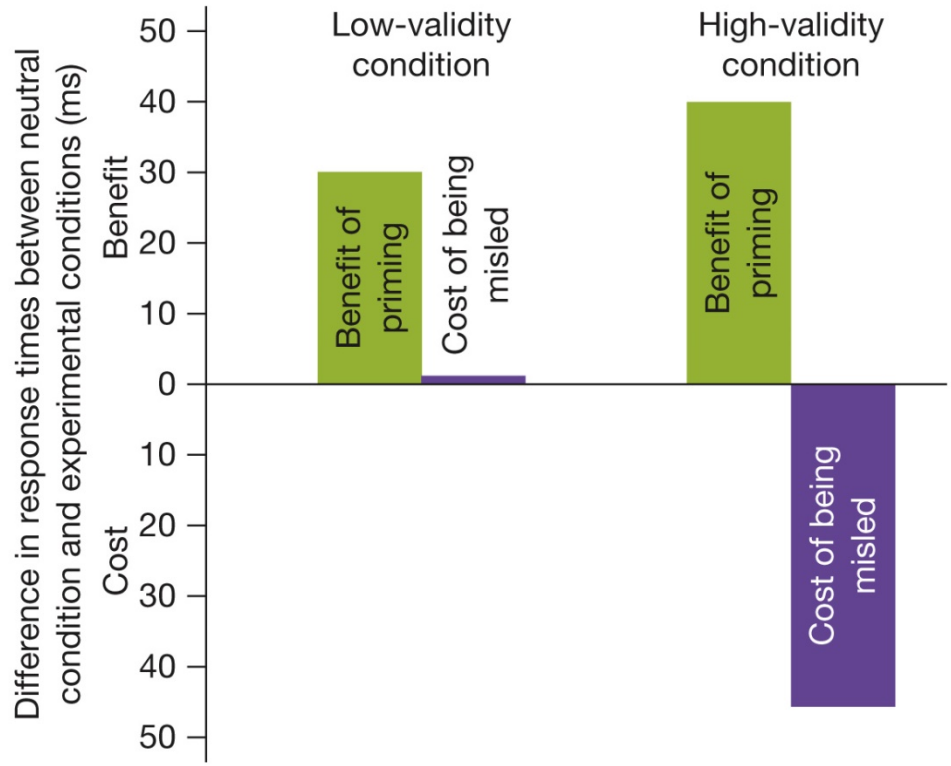
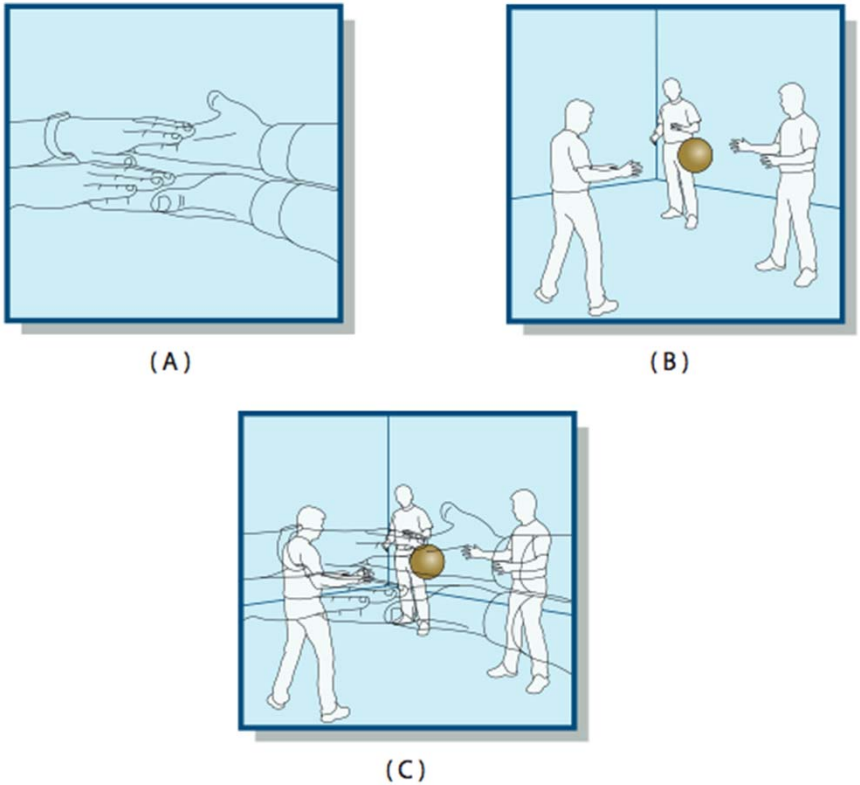


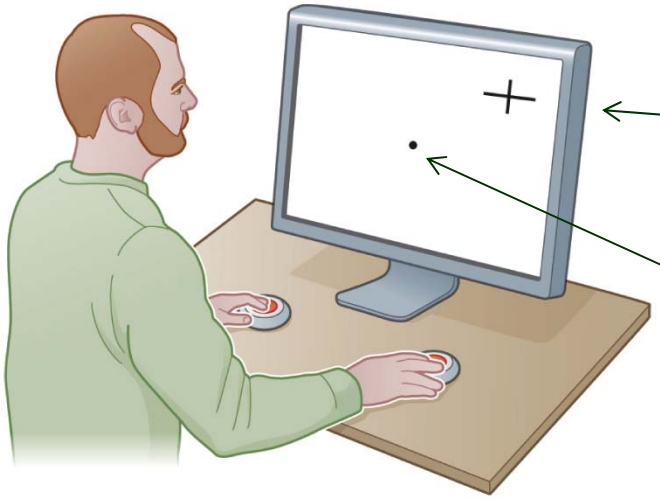
TABLE 5.1 DESIGN OF POSNER AND SNYDER'S EXPERIMENT

	TYPICAL SEQUENCE			Provides Repetition Priming?	Provides Basis for Expectation?
	Type of Trial	Warning Signal	Test Stimuli		
Low-validity Condition	Neutral	+	AA	No	No
	Primed	G	GG	Yes	No
	Misled	H	GG	No	No
High-validity Condition	Neutral	+	AA	No	No
	Primed	G	GG	Yes	Prime leads to correct expectation
	Misled	H	GG	No	Prime leads to incorrect expectation

- **Schema Theory** (Neisser, 1976)
  - attention is a dynamic process that seeks information consistent with the current situation
    - the **schema** of the current situation
    - people attend to one schema (e.g., white t-shirt ball game) and ignore the information in the other schema
      - Selective looking



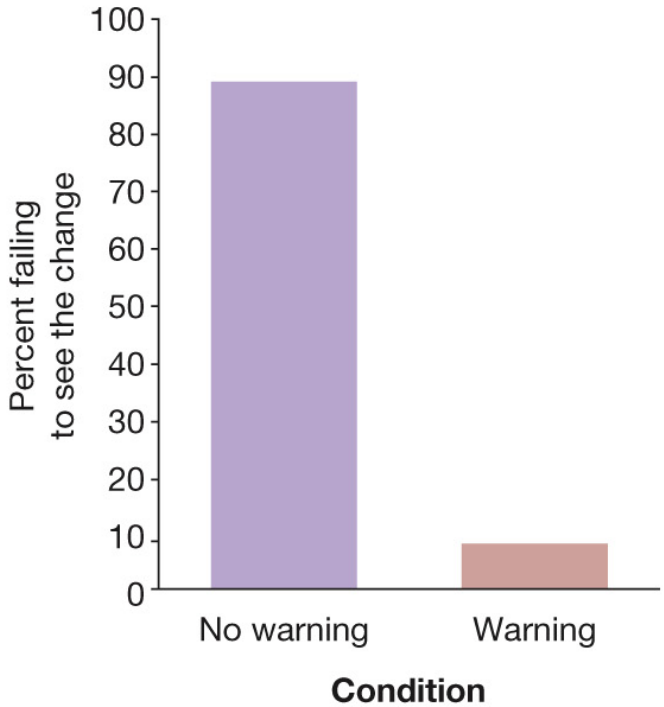
Inattentional Blindness



Attend to another part of the screen

Look at a **fixation target**

No warning leads to failure to detect change



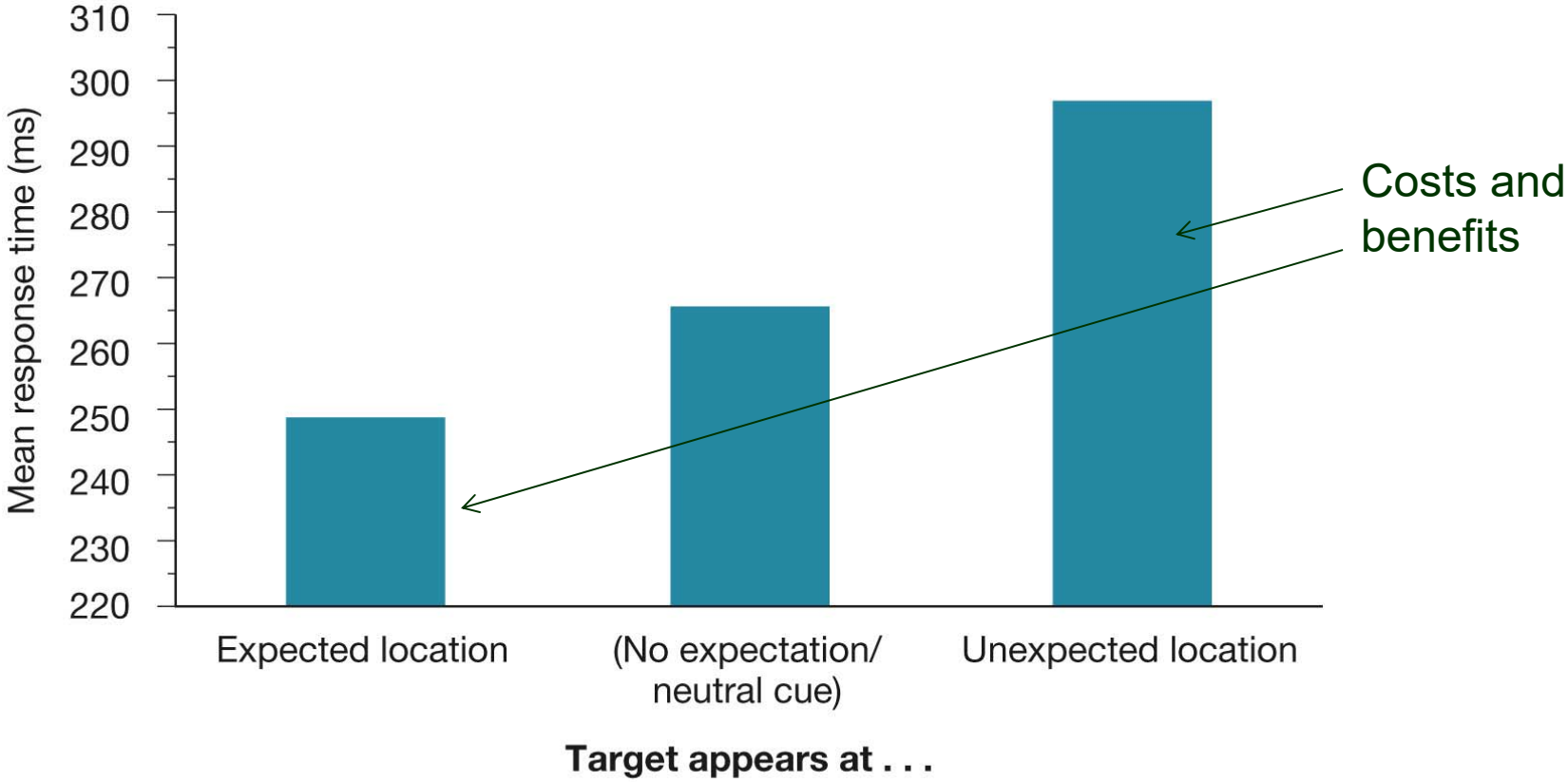
Change Blindness

- When the entire visual scene changes at once, we often fail to notice changes
  - we do not automatically encode and remember entire visual scenes
  - Simons & Levin (1997/1998)
    - Movie editing mistakes
    - Real-life changes
      - 50% of participants did not notice
        - » In/Out group effects: Students noticed more than professors
        - » Changing to out group (construction worker), caused reduction in students noticing

- Flicker paradigm
  - O'Regan, Rensink, & Clark (1999)
  - viewing a blank screen between changed images makes it difficult to detect:
    - changes in color
    - the location of objects
    - the addition/deletion of objects
  - Detection is still disrupted if the change occurs at the same time as "mudsplashes"

- Change Blindness without visual disruption, through gradual change
  - change is too gradual to draw attention

Shifts in Spatial Attention



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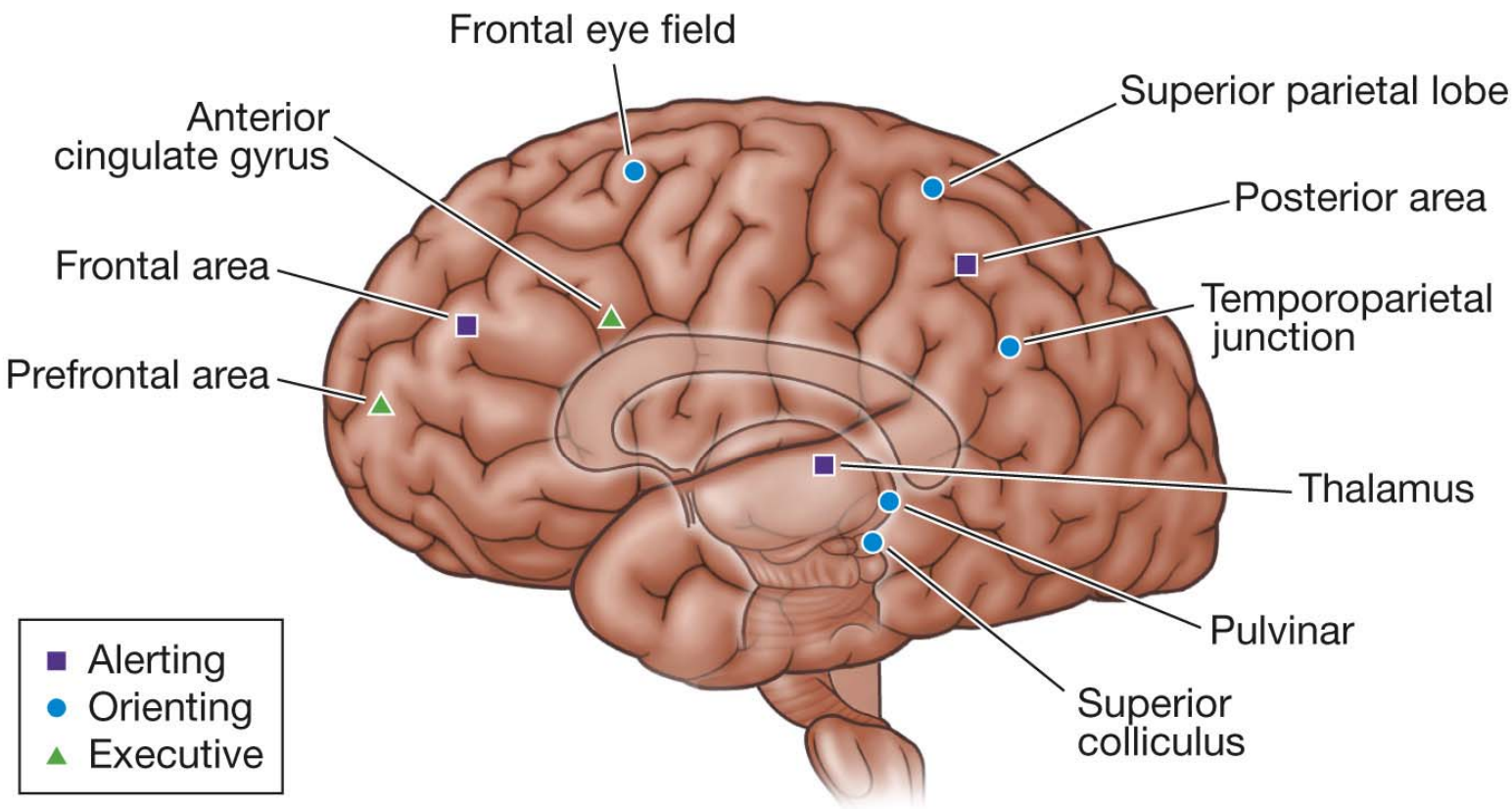
Cortical Networks for Shifts in Spatial Attention



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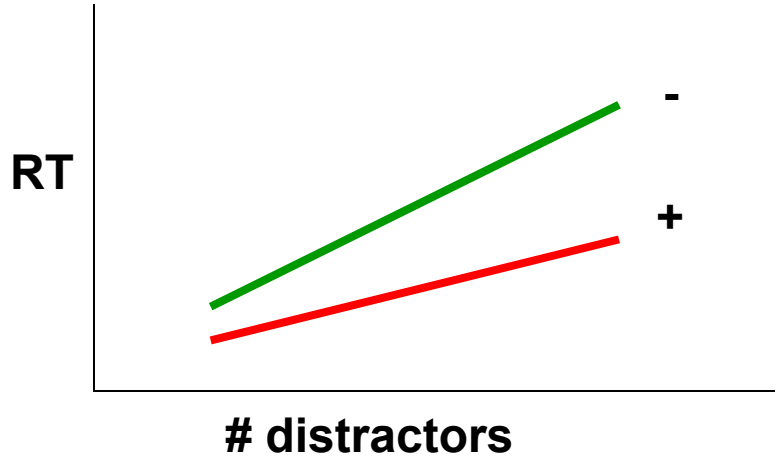
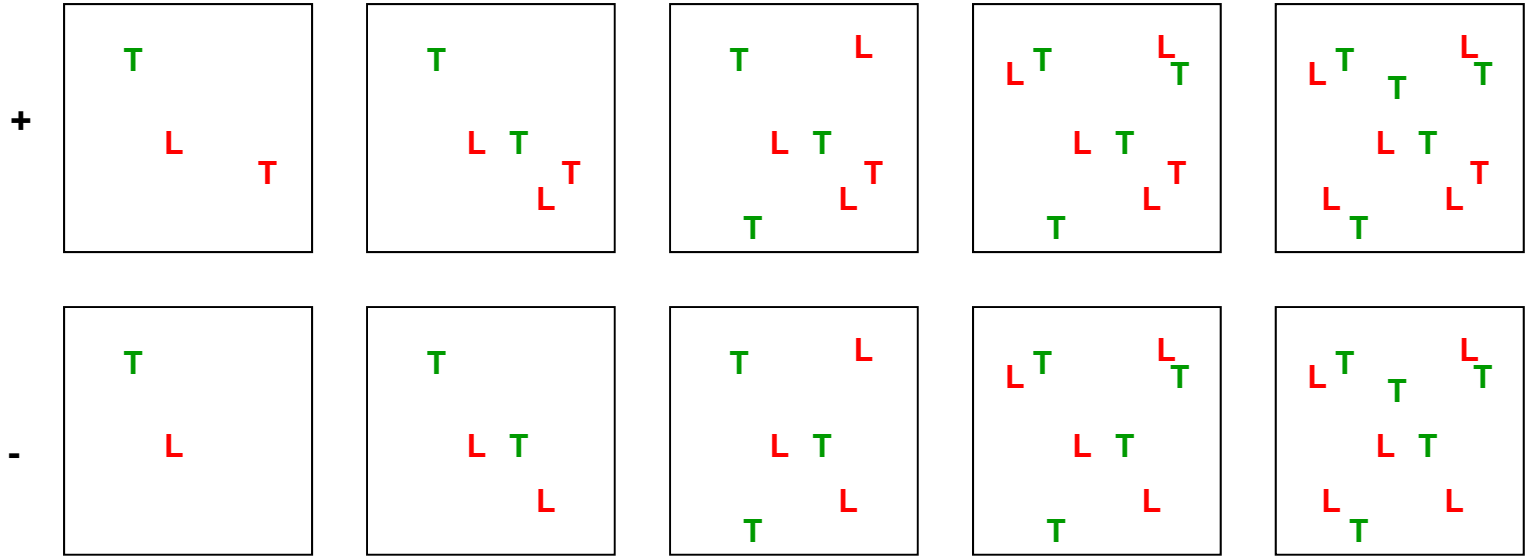
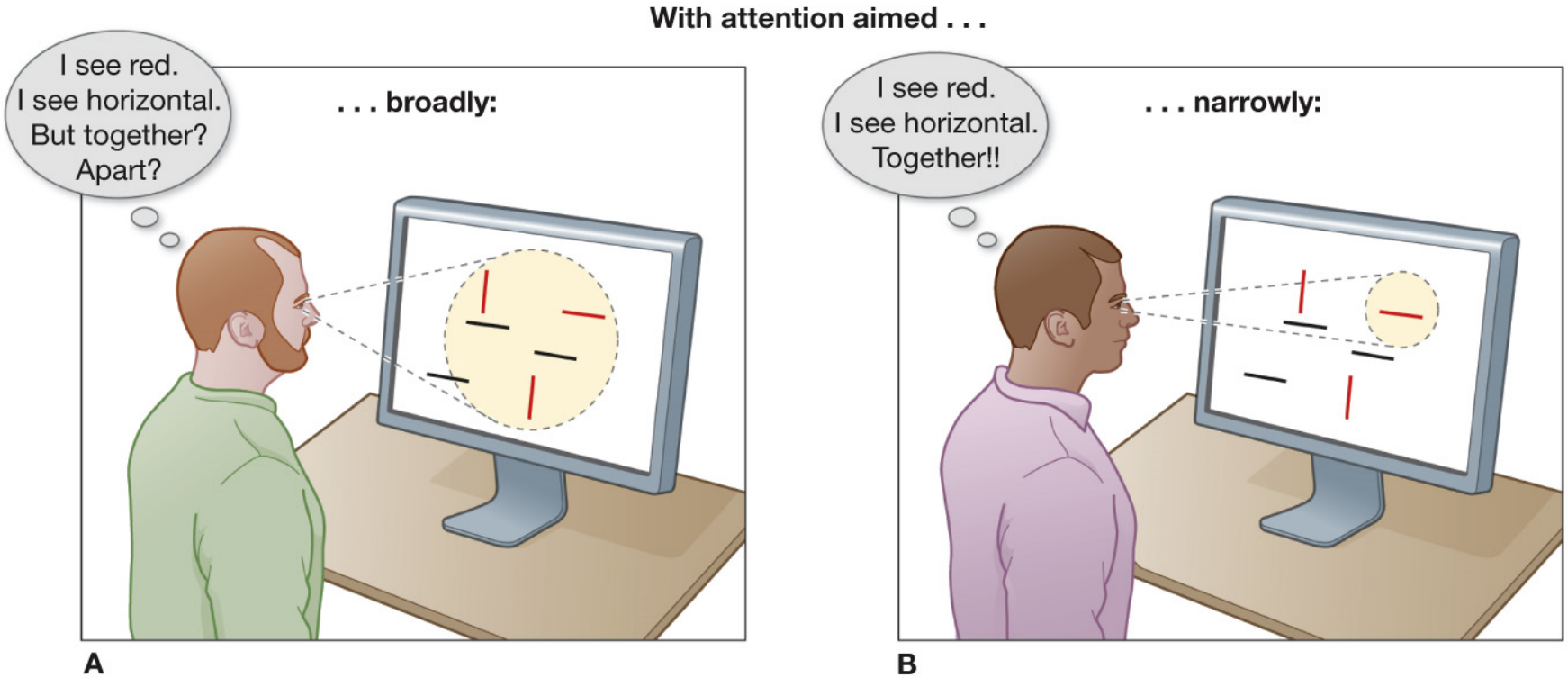
Visual Search (Treisman & Gelade, 1980)

- attention is required to process *conjunctions*
  - when a single feature (e.g., color or shape) distinguishes **targets** from **distractors**, the target 'pops out'
    - reaction time (RT) independent of # distractors
    - **parallel search**
  - When the target is a conjunction, RT increases with display size
    - slope of target absent (-) trials is twice target present (+) trials
    - **serial search**





Distributed vs. Focused



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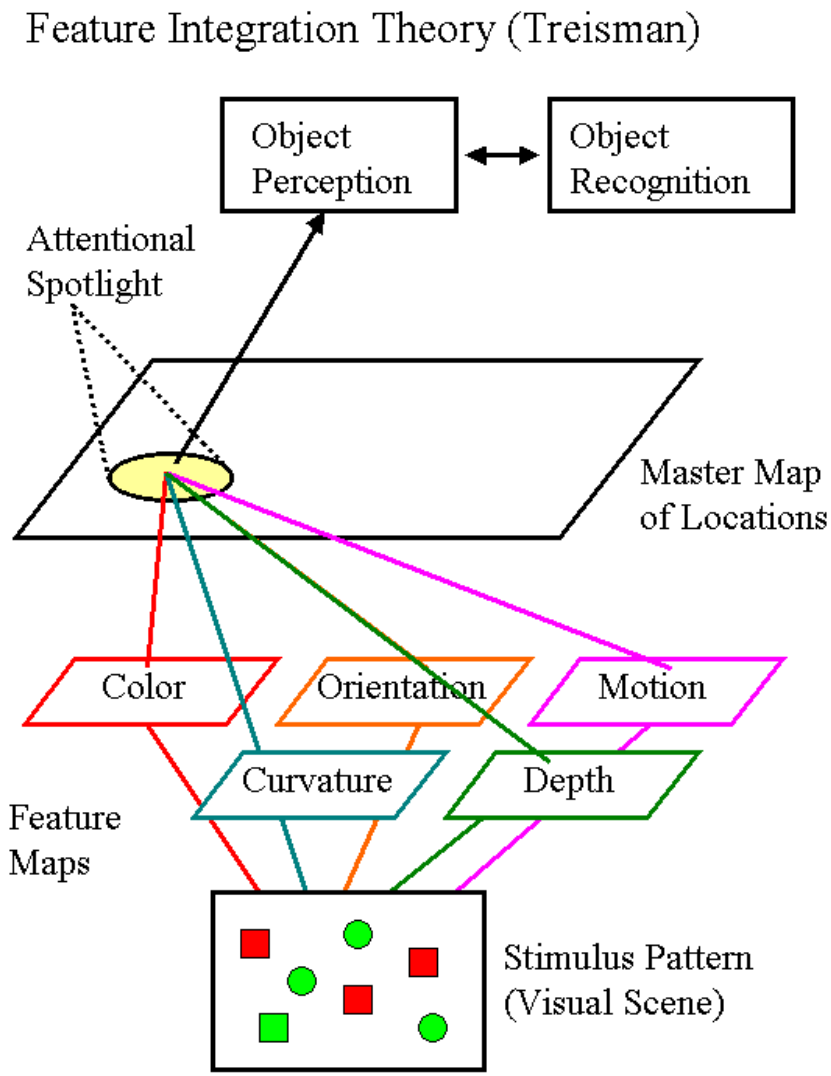
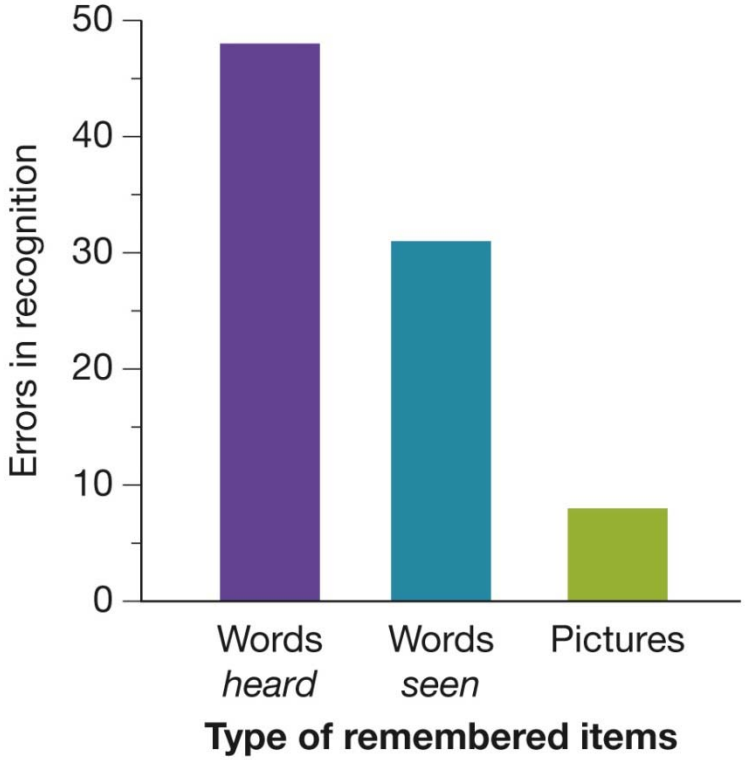
Feature Integration Theory (Treisman)

- **Distributed attention** can easily identify simple perceptual features
  - Fast parallel search
- The combining of features requires **focused attention**
  - Slow serial search
  - attention as a gluing together process (binding problem)
- Without focused attention, features may incorrectly combine - **illusory conjunctions**
  - this occurs with
    - brief displays
    - a second task



Divided Attention – Can We Multitask?

- What things can you do at the same time? What can't you do at the same time? What does this tell us about attention?
  - If two tasks share resources, they will interfere
  - however, some resources are general (central executive)



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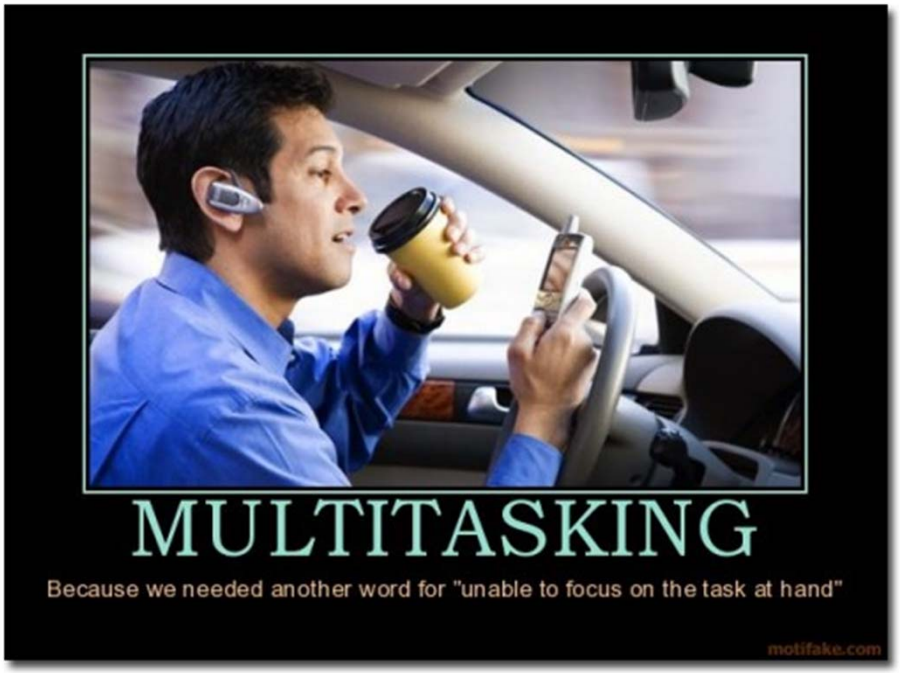
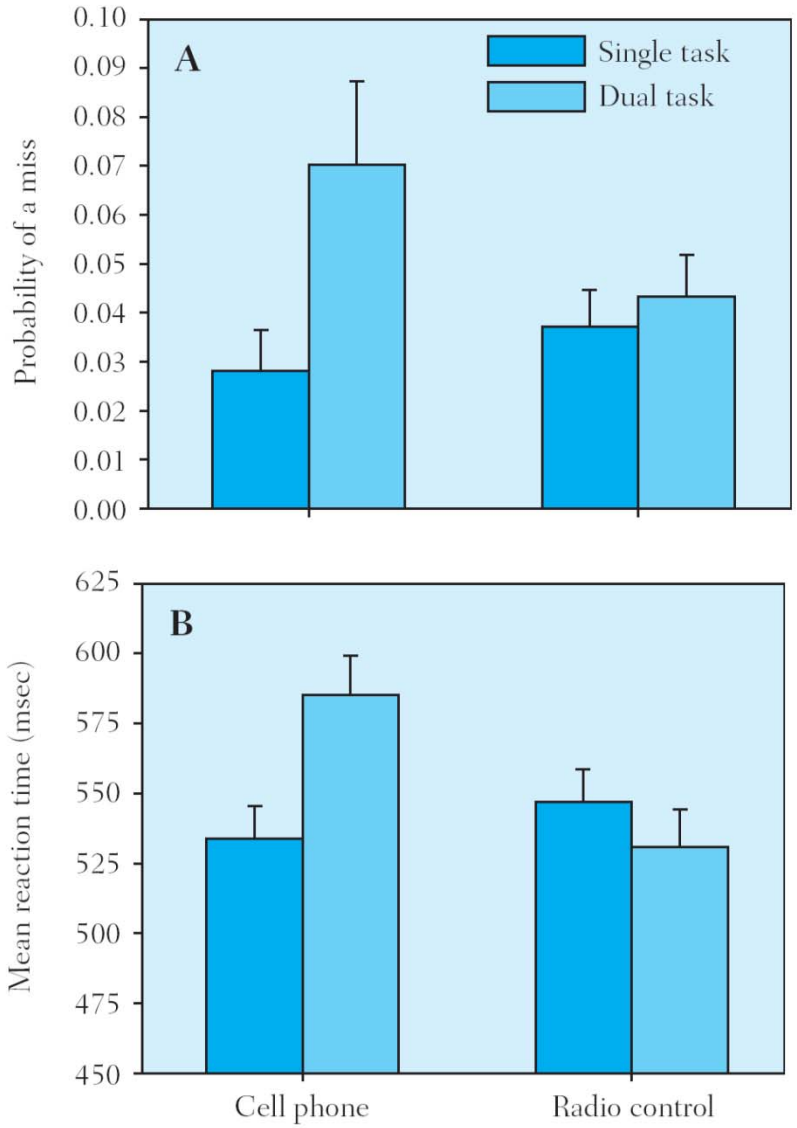


Applied Cognitive Psychology
(dual-task: cell phones and driving)

- Simulated driving video game (Strayer and Johnston, 2001)
  - Compared listening (radio) versus cell phone conversation
  - Conversation impaired driving
- Additional studies found
  - No impairment
    - with shadowing
    - in-car conversation
    - cell phone conversation with someone who gets visual information of the road
  - Impaired driving with
    - with hands-free phone conversation
    - with actual driving
    - when someone else in the car is on their cell phone



Automatic vs. Controlled

- When first learning to drive, can't hold a conversation at the same time
  - controlled processing is needed
  - with practice, things become automatic, and it possible to multitask (usually)
  - however, automatic process are reflexive and can interfere

- The Stroop effect
  - Individual differences in Stroop performance correlate with cognitive control

Column A	Column B
ZYP	RED
QLEKF	BLACK
SUWRG	YELLOW
XCIDB	BLUE
WOPR	RED
ZYP	GREEN
QLEKF	YELLOW
XCIDB	BLACK
SUWRG	BLUE
WOPR	BLACK

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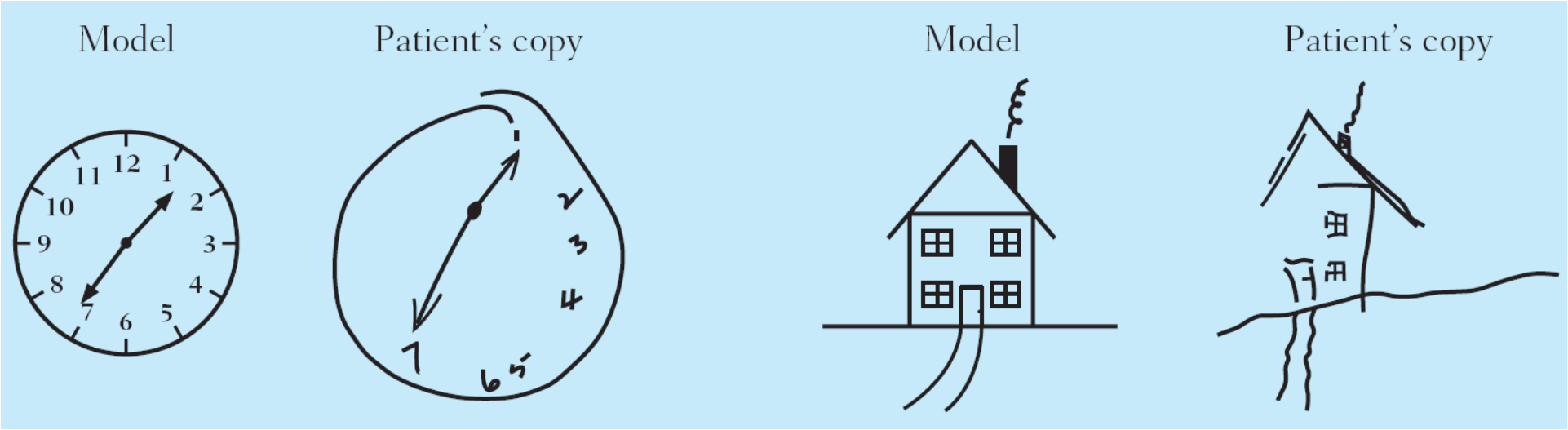
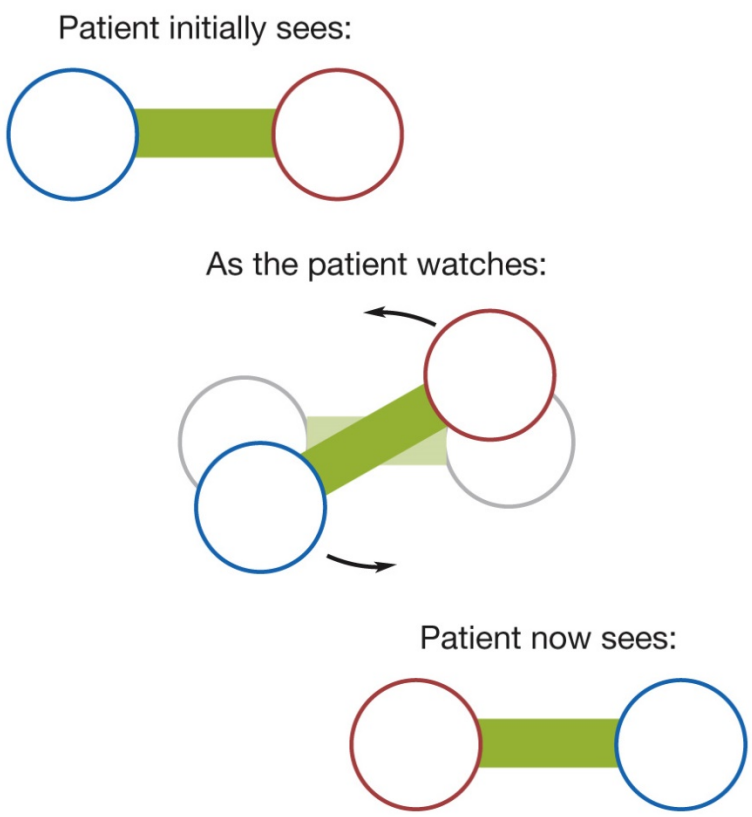
Neuropsychological Studies of Attention

- Prefrontal cortex and the ‘executive attention’
  - e.g., Stroop interference, ADHD, etc.
- Posterior parietal lobes and the ‘orienting attention’
  - **Unilateral Neglect**
    - ignore the **contralateral** (opposite) **visual hemifield**
    - this is always relative to the current focus of attention
    - even applies to words (read ‘BOTHER’ as ‘HER’)



Spotlight versus Object-based

- Is attention like a spotlight that illuminates whatever it shines on?



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