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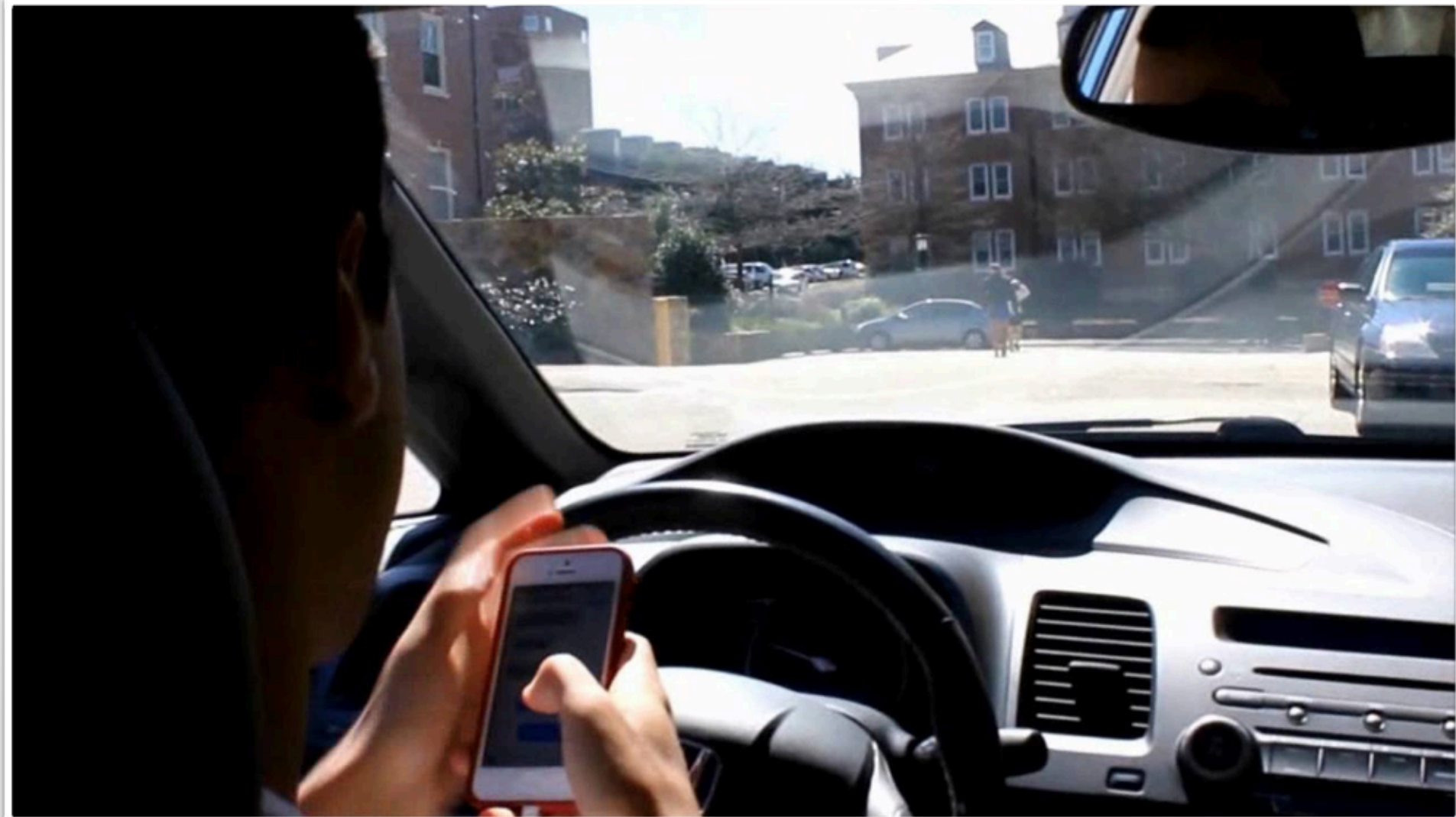
Course Title:

Basic Cognitive Processes

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Lecture 26: Attention - III

Divided Attention



- **Investigating Divided Attention in the Lab**
 - One of the early works in the area of divided attention had participants view a videotape in which the display of a basketball game on the display of a hand slapping game.
 - Participants could successfully monitor one activity and ignore the other; but they had great difficulty in monitoring both activities at once; even if the basket ball game was watched by one eye & the hand - slapping game by the other eye (Neisser & Becklen, 1975).
 - Neisser & Becklen hypothesised that the improvement in performance would have occurred as a result of practice & also that the performance of multiple tasks was based on skill resulting from practice.

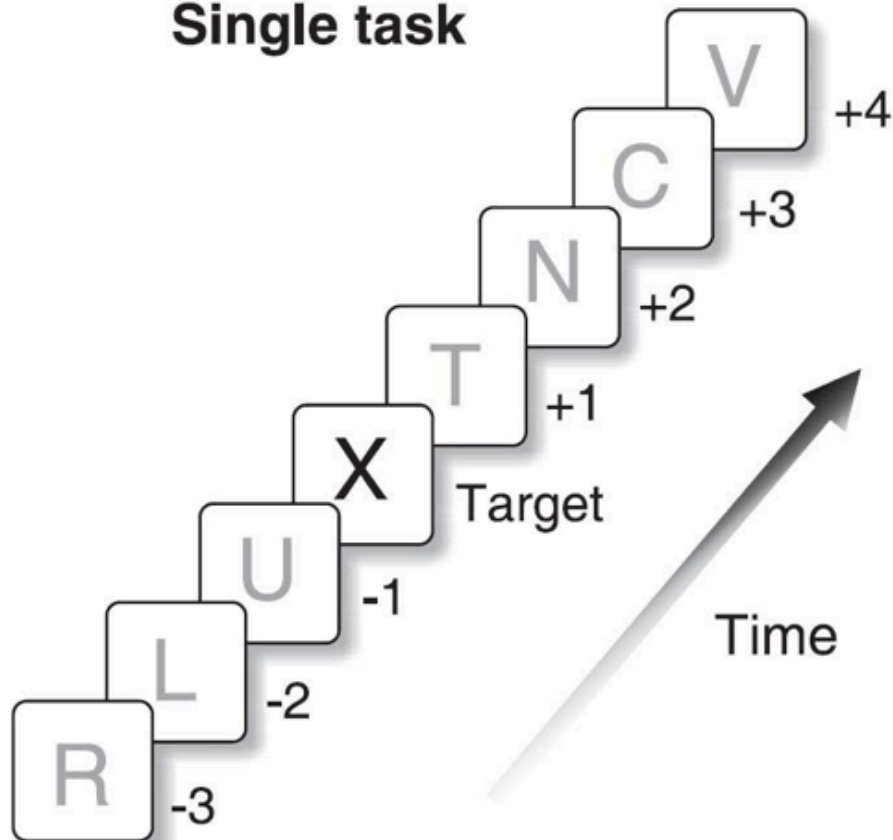
- the following year, investigators used a dual - task paradigm to study divided attention during the simultaneous performance of two activities: reading short stories and writing down dictated words (Spelke et al., 1976).
- the researchers would compare and contrast the response times and accuracy of performance in each of the three conditions.
- As expected, initial performance was quite poor for the two tasks, when they had to be performed at the same time.

- However, Spelke & colleagues had their participants practice to perform these two tasks 5 days a week for many weeks (85 sessions in all).
- To the surprise of many, the performance improved on both tasks after practice.
 - They showed improvements in their speed of reading and accuracy of reading comprehension, as measured by comprehension tests; also, they showed increases in their recognition memory for words they had written during dictation.
 - Eventually, participants performance on both tasks reached the same levels as when the participants had performed the tasks alone. They soon could perform both the tasks at the same time without a loss in performance.

- Speke and colleagues suggested that these findings showed that controlled tasks can be automatised so that they consume fewer attentional resources. Also, two discrete controlled tasks may be automatised to function together as a unit. However, they still continue to be intentional & conscious and involve high levels of cognitive processing.

- A rather different approach to study divided attention involves focussing on extremely simple tasks that require speedy responses.
- When people try to perform two overlapping speeded tasks, the responses for one or both tasks are almost always slower (Pashler, 1994).
- When a second task begins soon after the first task has started, speed of performance usually suffers; the slowing resulting from simultaneous engagement in speeded tasks; called the *psychological refractory period* effect, also called attentional blink.

Single task



Dual task

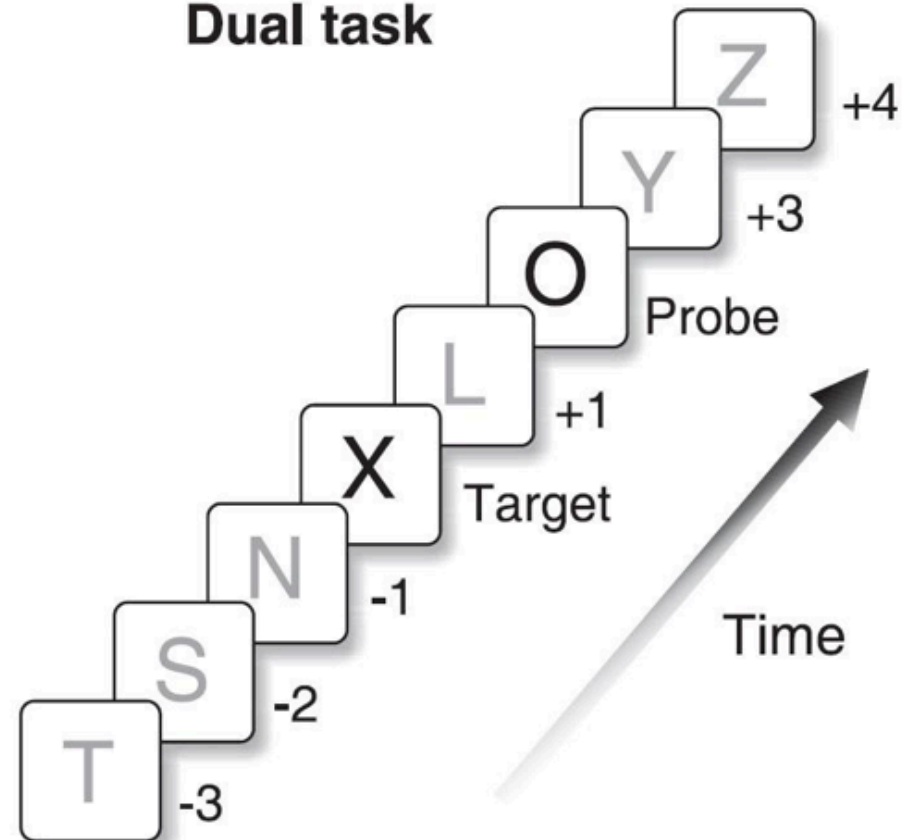


Image: Amador-Campos, Casanova, Bezerra, Torro-Alves & Sanchez (2015). Attentional Blink in Children With Attention deficit Hyperactivity Disorder. *Revista Brasileira de Psiquiatria*. 37 (2).

- Findings from PRP studies indicate that people can accommodate fairly easily perceptual processing of the physical properties of sensory stimuli when engaged in a second speeded task (Miller et al., 2009).
- However, they cannot readily accomplish more than one cognitive task requiring them to choose a response, retrieve information from memory, or engage in various other cognitive operations; one or both the tasks will show the PRP effect.

- **Theories of Divided Attention**

- a number of researchers have developed capacity models of attention to understand our ability to divide our attention.
- these models explain how we can perform more than one attention - demanding task at a time. they posit that people have a fixed amount of attention that they can choose to allocate according to what the task requires.
- there are two different kinds: one kind of model suggests that there is one single pool of attentional sources that can be divided freely, and the other model suggests that there are multiple sources of attention.



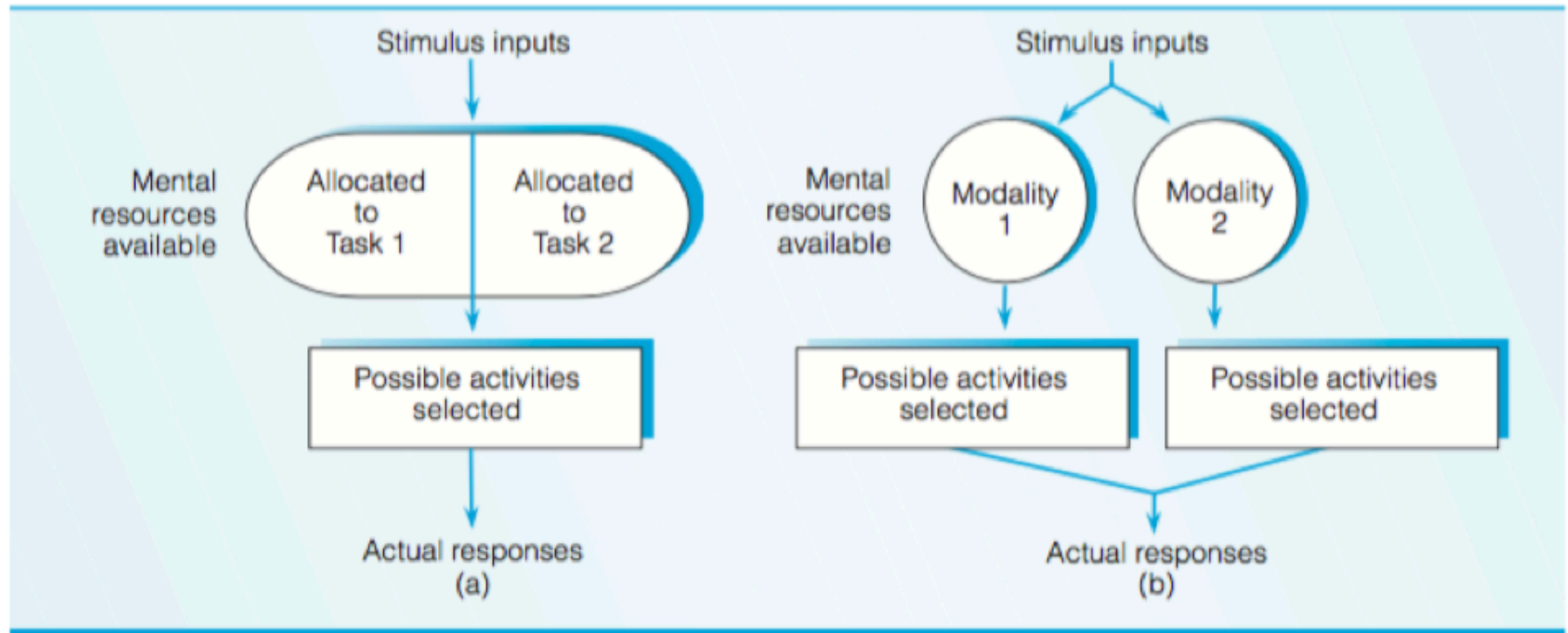


Figure 4.11 Allocation of Attentional Resources.

Attentional resources may involve either a single pool or a multiplicity of modality-specific pools. Although the attentional resources theory has been criticized for its imprecision, it seems to complement filter theories in explaining some aspects of attention.

- it now appears that such models represent an oversimplification.
- people are much better at dividing their attention when competing tasks are in different modalities. at least some attentional resources may be specific to the modality (e.g. verbal or visual) in which a task is presented. for example: most people easily can listen to music and concentrate on writing simultaneously (the two being different tasks modality - wise).

- But it is harder to listen to the news station and concentrate on writing at the same time. because both are verbal tasks.
- Similarly two visual tasks are more likely to interfere with each other than are a visual task coupled with an auditory one.

- attentional resources theory has been criticized heavily as being overly broad & vague (Navon, 1984).
- Resource theory seems to be a better metaphor for explaining the phenomenon of divided attention on complex tasks. in these tasks, practice effects may be observed.
- Acc. to this metaphor, as each of the complex tasks becomes increasingly automatized, performance of each task makes fewer demands on limited capacity attentional resources.

- **Factors that Influence Our Ability to Pay Attention**

- There are many other variables that have an impact on our ability to concentrate and pay attention:

- **Anxiety:** Being anxious, either by nature (trait - based anxiety) or by situation, (state - based anxiety) places constraints on attention (Reinholdt - Dunne et al., 2009).

- **Arousal:** One's overall state of arousal affects attention; being drowsy or drugged limits attention while being excited sometimes enhances attention (MacLean et al., 2009).

- **Task Difficulty:** Task difficulty particularly influences performance during divided attention.
- **Skills:** The more practiced & skilled one is in performing a task, the more one's attention is enhanced (Spelke et al., 1976).

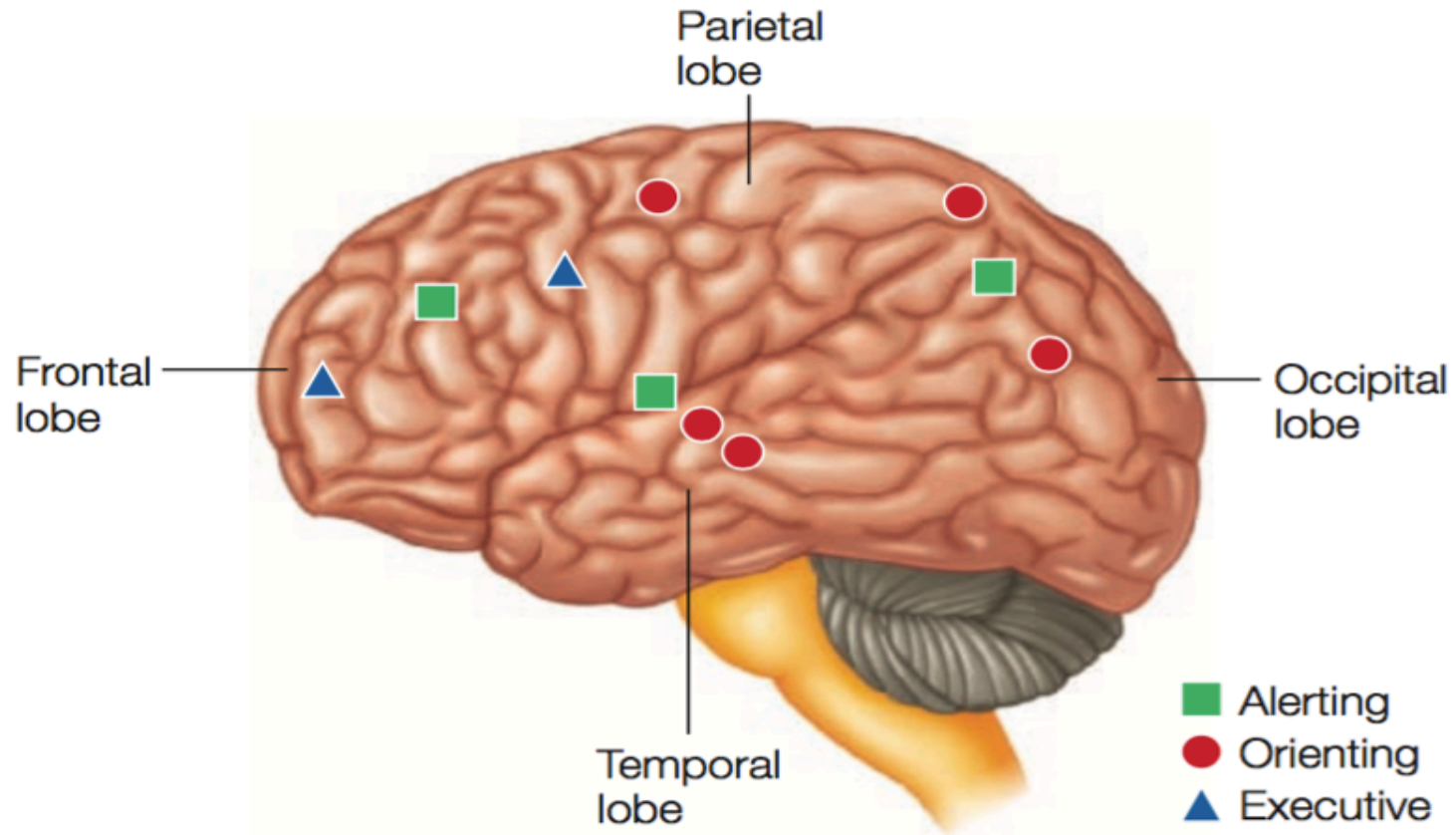
- **Neuroscience of Attention:**

- Acc. to Michael Posner, the attentional system in the brain “is neither a property of a single brain area nor of the entire brain” (Posner & Dehaene, 1994).
- Posner & Mary Rothbart in 2007, conducted a series of neuroimaging studies in the area of attention to investigate whether the many diverse results of studies conducted pointed to a common direction.
- They found that what at first seemed like an unclear pattern of activation could be effectively organised into areas associated with the three sub - functions of attention: alerting, orienting, and executive attention.

- **Alerting:** Alerting is defined as being prepared to attend to some incoming event, and maintaining this attention. Alerting also includes the process of getting to this state of preparedness.
 - The brain areas involved in alerting are the right frontal and parietal cortices as well as the locus coeruleus. The neurotransmitter norepinephrine is involved with the maintenance of alertness. If the alerting system does not work properly, people may develop symptoms of ADHD; in the process of regular raging dysfunctions of the alerting system may develop as well.

- **Orienting:** orienting is defined as the selection of stimuli to attend to. This kind of attention is needed when we perform visual search. The orienting network develops during the first year of life.
 - The brain areas involved in the orienting network are the superior parietal lobe, the temporal parietal junction, the frontal eye - fields, & the superior colliculus. The modulating neurotransmitter is acetylcholine.
 - Dysfunction with this system has been associated with autism.

- **Executive Attention:** executive attention includes processes for monitoring and resolving conflicts that arise among internal processes. These processes include thoughts, feelings, and responses.
 - The brain areas involved in this highest order of attentional processes are the anterior cingulate, lateral ventral, and prefrontal cortices; as well as the basal ganglia. The neurotransmitter most involved in executive attention is dopamine.
 - Dysfunction within this system is associated with Alzheimer's disease, borderline personality disorder, and schizophrenia.

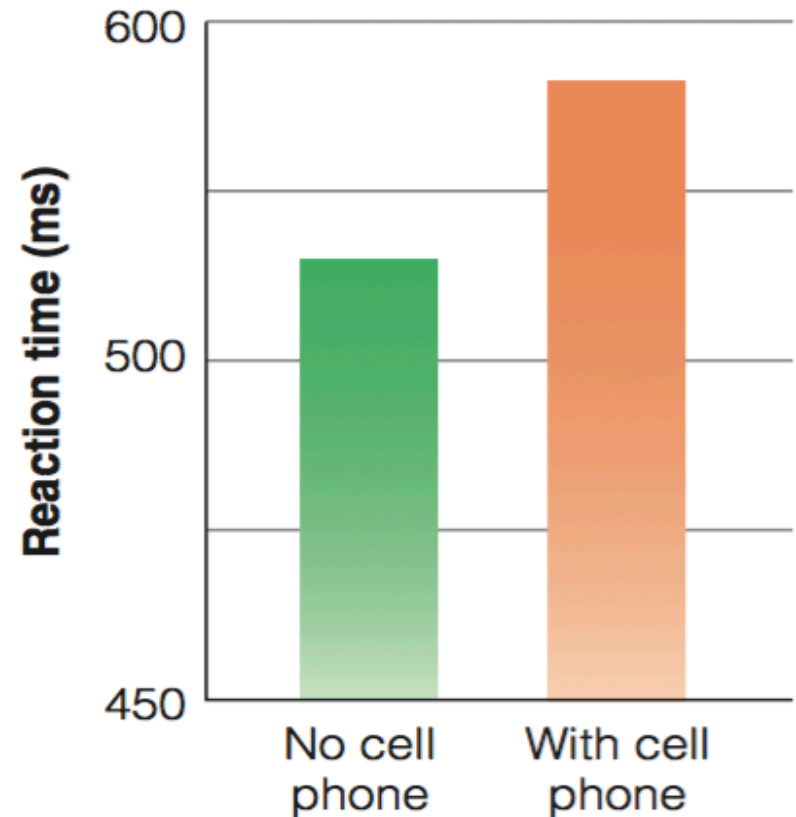
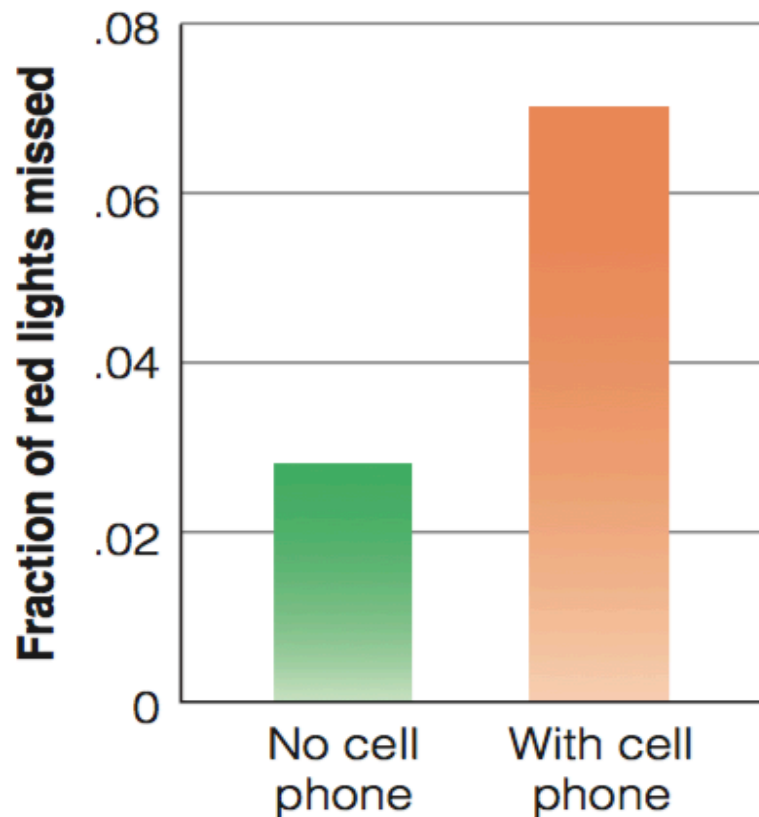


● **FIGURE 4.39** Areas that are associated with different kinds of attention. (Source: From M. I. Posner & M. K. Rothbart, "Research on Attention Networks as a Model for the Integration of Psychological Science," *Annual Review of Psychology*, 58, 1–23, Figure 2, p. 6, 2007. Reprinted by permission.)

Distractions While Driving

- Driving is one of the tasks that require constant attention; not being able to do the same due to fatigue or involvement in other tasks can have disastrous consequences.
 - in a naturalistic driving study (Dingus et al., 2006) video recorders in 100 vehicles documented records of both, what the drivers were doing & the outside view.
 - they found that in more than 80% (of 82) of the crashes & 67% (of 771) of the near crashes the driver was inattentive in some way 3 seconds before the crash.

- In a laboratory experiment on the effects of cell phones, Strayer, William & Johnston (2001) placed participants in a simulated driving task that required them to apply the brakes as quickly as possible in response to a red light.
- Doing this task while talking on a cell phone caused participants to miss twice as many of the red lights as when they weren't talking on the phone & also increased the time it took them to apply the brakes.



(a) (b)

● **FIGURE 4.16** Result of Strayer and Johnston's (2001) cell phone experiment. When participants were talking on a cell phone, they (a) missed more red lights and (b) took longer to apply the brakes.

- Strayer & Johnston concluded from this result that talking on the phone uses cognitive resources that would otherwise be used for driving the car (other studies include, Haringey & Western, 2001; Lambie et al., 1999; Spence & Read, 2003; Violanti, 1998)

To Sum Up.

References

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- Goldstein E. b. (2010). Cognitive Psychology_ Connecting Mind, Research and Everyday Experience. *Wadsworth Publishing*. 3rd Ed.