



# Indian Institute of Technology Kanpur

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# National Program on Technology Enhanced Learning (NPTEL)

# Presents



Course Title:

# Basic Cognitive Processes

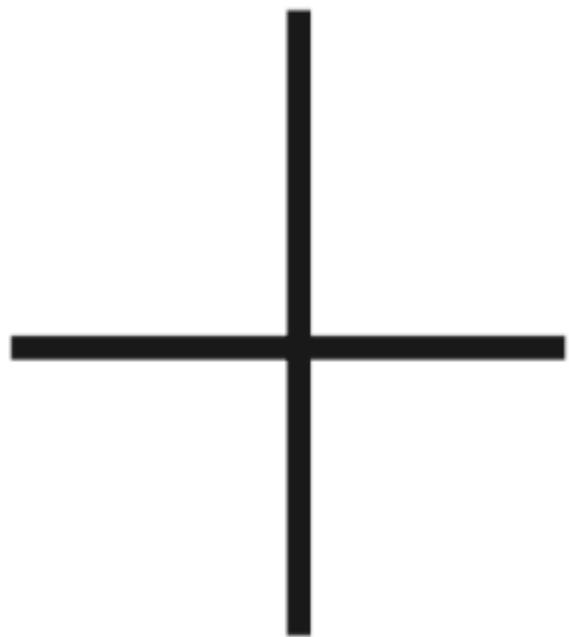
By: Dr. Ark Verma,  
Assistant Professor of Psychology,  
Department of Humanities & Social Sciences,  
IIT Kanpur

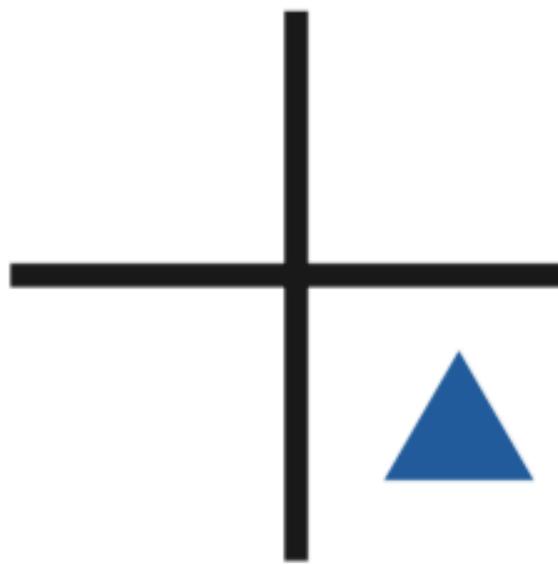
# Lecture 27: Attention - IV



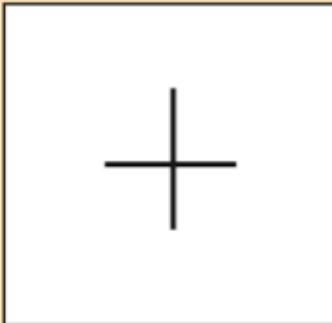
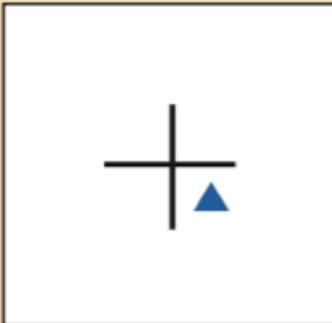
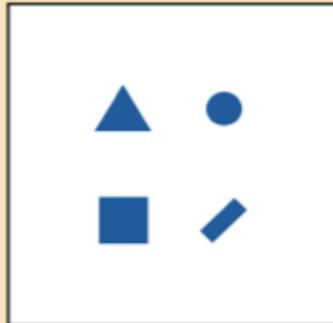
# Attention and Visual Perception

- **Inattentional Blindness:** Mack & Rock (1998) created a situation in which a person's attention is focused on one task and then determined whether the person perceived an easily visible nearby stimuli.
- The observer's task was to indicate which arm of the cross was longer, the horizontal arm or the vertical arm.
- Then, on one trial, a small test object, which was within the observer's field of clear vision, was added to the display.
- When observers were then given a recognition test in which they were asked to pick the object that had been presented, they were unable to do so.







<b>Subject sees</b>		3–4 more trials .....		Inattention trial		Recognition test
<b>Subject's task</b>	Indicate longer arm: horizontal or vertical?		Which arm is longer?		Which object did you see?	

● **FIGURE 4.17** Inattentional blindness experiment. (a) On each trial, participants judge whether the horizontal or vertical arm is longer. (b) After a few trials, the inattention trial occurs, in which a geometric object is flashed along with the arms. (c) In the recognition test, the participant is asked to indicate which geometric object was presented. (Source: From E. B. Goldstein, *Sensation and Perception*, 8th ed., Fig. 6.9, p. 139. Copyright © 2010 Wadsworth, a part of Cengage Learning. Reproduced with permission. [www.cengage.com/permissions](http://www.cengage.com/permissions).)

- Paying attention to the vertical and horizontal arms apparently made observers “blind” to the unattended test object. The phenomenon is termed **inattentional blindness**.
- Mack & Rock demonstrated inattention blindness using rapidly flashed geometrical stimuli; but other research has shown that similar effects can be achieved in more natural scenarios as well.

- Simons & Chabris (1999) created a situation in which one part of a scene is attended and the other is not. They created a 75 second film that showed two teams of 3 players each; & the one in white passing a basketball around. The other dressed in black was not handling the ball.
- Observers were told to count the number of passes, a task that focused their attention on the team in white.

- After about 45s, an event that took 5 seconds occurred, i.e. one of these events was a person dressed in a gorilla suit, walking through the scene.
- After seeing the video, observers were asked whether they had seen anything unusual happen or whether they see more than six players.
- Nearly half - 46% - of the observers failed to report having seen the event, even though it was clearly visible.



● **FIGURE 4.18** Frame from the film shown by Simons and Chablis in which a person in a gorilla suit walked through the “basketball” game. (Source: D. J. Simons & C. F. Chabris, “Gorillas in Our Midst: Sustained Inattentional Blindness for Dynamic Events,” *Perception*, 28, 1059–1074, 1999. Figure provided by Daniel Simons.)

Image: E. B. Goldstein, *Cognitive Psychology\_ Connecting Mind, Research and Everyday Experience*. Wadsworth Publishing. 3<sup>rd</sup> Ed. Fig. 4.17., (p. 95)

Further ...



Bruce Goldstein

● **FIGURE 4.19** Look at this picture for about a second, cover it, and look at Figure 4.20 (at the top of the next page).

Image: E. B. Goldstein, *Cognitive Psychology\_ Connecting Mind, Research and Everyday Experience*. Wadsworth Publishing. 3<sup>rd</sup> Ed. Fig. 4.17., (p. 96)





Bruce Goldstein

● **FIGURE 4.20** What is different in this picture?

Image: E. B. Goldstein, *Cognitive Psychology\_ Connecting Mind, Research and Everyday Experience*. Wadsworth Publishing. 3<sup>rd</sup> Ed. Fig. 4.17., (p. 97)

- **Change Detection:** Could you detect the change in the picture?
  - Rensink & colleagues did a similar experiment; where the pictures were alternated in the same way until observers were able to determine what was different about the two pictures and found that the pictures had to be alternated back & forth a number of times before the difference was detected.
  - This difficulty in detecting changes in scenes is called **change blindness** (Rensink, 2002).
  - But when Rensink added a cue indicating which part of the scene had been changed, participants detected the changes much more quickly (Rensink, 2002).

- It's not always we miss out on such changes in the environment, there are cues to help us orient attention to such stimuli in the environment. These cues automatically attract our attention & increase the detection accuracy & speed.
- Automatic attraction of attention by a sudden visual or auditory stimulus is called **exogenous attention**.
- Attentional orientation that occurs when one consciously decides to scan the environment, to find a specific stimulus or just to track the environment is called **endogenous attention**.

- Both these types of attention can involve **overt attention**, i.e. shifting attention by moving the eyes (Carrasco, 2010).



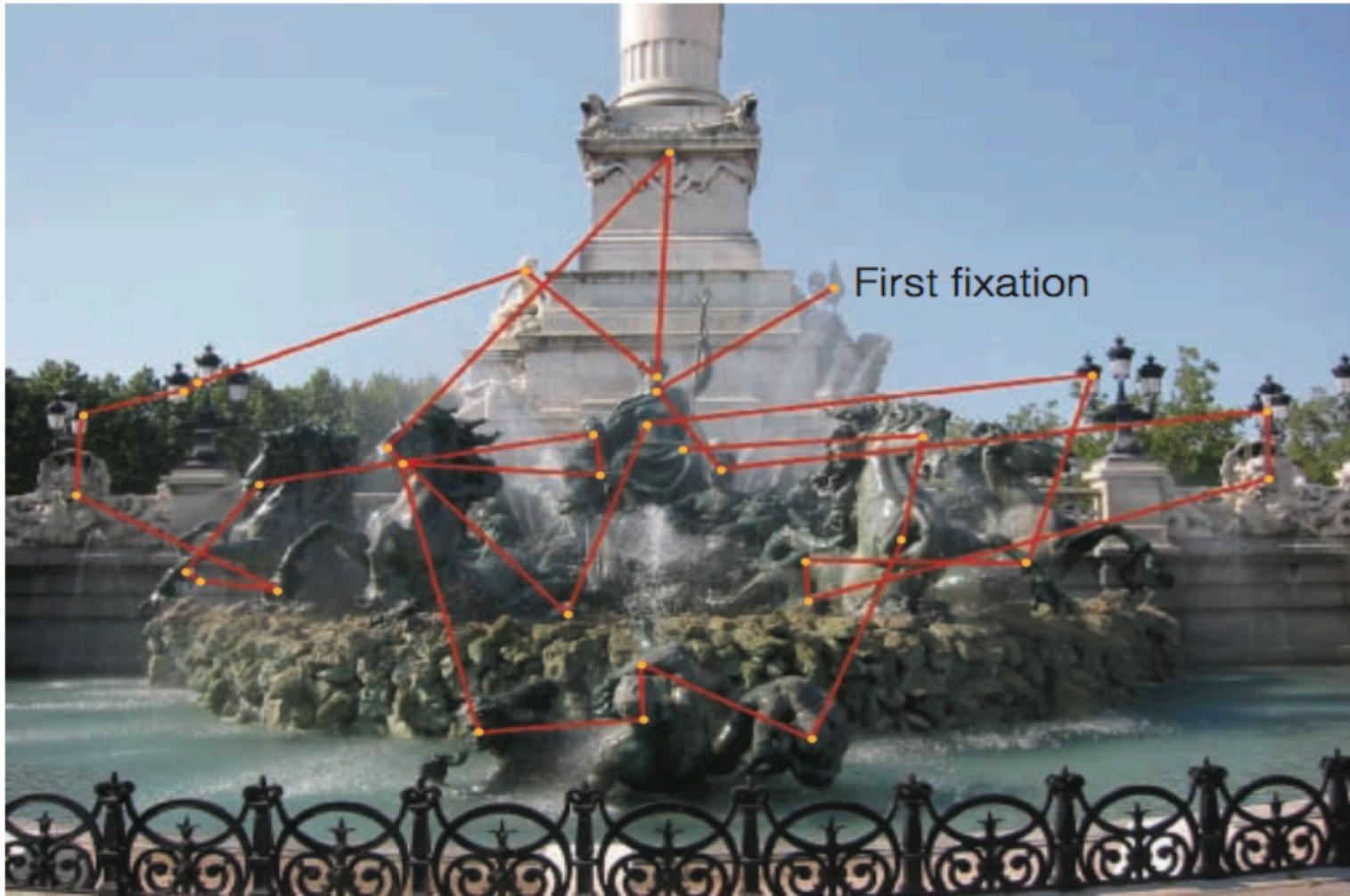
Michael Ochs Archives/Getty Images

● **FIGURE 4.22** Find Bob Dylan's face in this group.

Image: E. B. Goldstein, *Cognitive Psychology\_ Connecting Mind, Research and Everyday Experience*. Wadsworth Publishing. 3<sup>rd</sup> Ed. Fig. 4.17., (p. 99)

# Overt Attention with Eye - Movements

- In order to look for Dylan's face, you would have had to move your eyes across the picture from face to face to see each one clearly.
- The shifting of eyes can be measured by using a device called an eye tracker, which tracks the movement of the eyes from one point to another.



Courtesy of John M. Henderson, University of Edinburgh

● **FIGURE 4.23** Scan path of a person viewing a fountain in Bordeaux, France.

Image: E. B. Goldstein, *Cognitive Psychology\_ Connecting Mind, Research and Everyday Experience*. Wadsworth Publishing. 3<sup>rd</sup> Ed. Fig. 4.17., (p. 100)

- the small dots indicate **fixations**, places where the eyes briefly paused.
- the lines indicate **saccadic eye - movements**, i.e. movement of the eye from one fixation to the next.
- Typically, people make about 3 fixations per second when viewing an unfamiliar scene.

- Two kinds of factors determine how people shift their attention by moving their eyes:
  - **bottom - up**, based primarily on the physical characteristics of the stimulus &
  - **top - down**, based on the relation between the observer and the scene - i.e. what the person knows about the scene and the demands of a task that involves the objects in the scene.

- **Top - Down Determinants**
- **Scene Schemas** - an observer's knowledge about what is contained in physical scenes.
  - For e.g. when Vo & Henderson (2009) showed observers pictures like the ones (next slide), observers looked longer at the printer than the pan.



Image: E. B. Goldstein, *Cognitive Psychology\_ Connecting Mind, Research and Everyday Experience*. Wadsworth Publishing. 3<sup>rd</sup> Ed. Fig. 4.17., (p. 100)



Image: E. B. Goldstein, *Cognitive Psychology\_ Connecting Mind, Research and Everyday Experience*. Wadsworth Publishing. 3<sup>rd</sup> Ed. Fig. 4.17., (p. 100)

- the fact that people look longer at things that seem out of place in a scene means that attention is being affected by their knowledge of what is usually found in the scene.

# Covert Attention: Without Eye - Movements

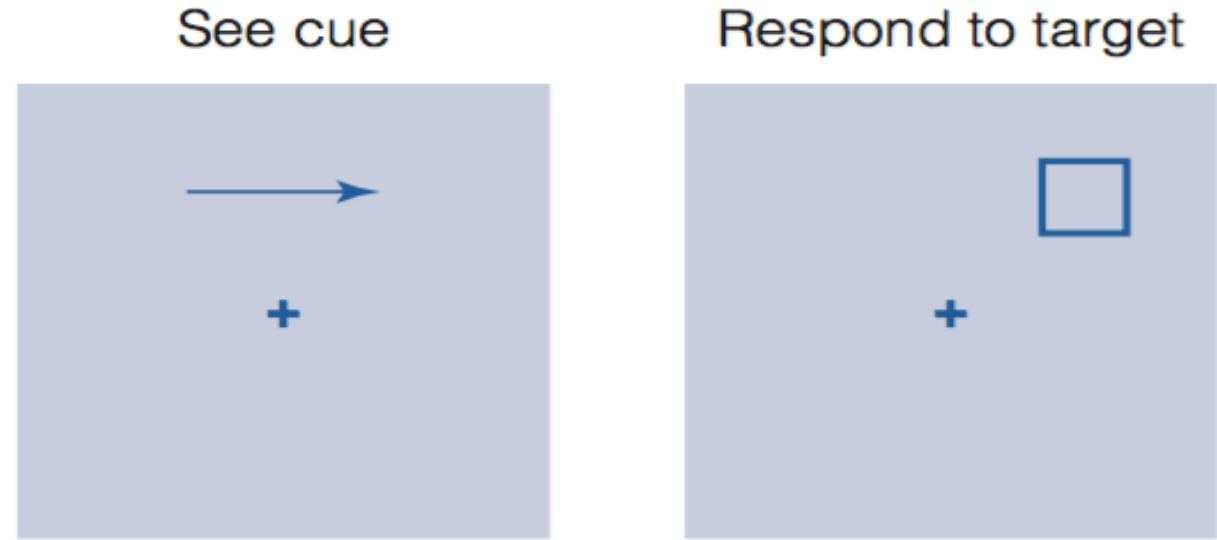
- **Covert Attention** has been studies using a procedure called pre cueing, in which the participant is presented with a cue that indicates ahwer stimulus is most likely to appear.

- Pre cueing has been used to study two kinds of attention:



- **Location - Based Attention:** Michael Posner & colleagues were interested in answering the following question: Does attention to a specific location improve our ability to respond rapidly to a stimulus presented at that location?

(a) Valid trial



(b) Invalid trial



Image: E. B. Goldstein, *Cognitive Psychology\_ Connecting Mind, Research and Everyday Experience*. Wadsworth Publishing. 3<sup>rd</sup> Ed. Fig. 4.17., (p. 102)

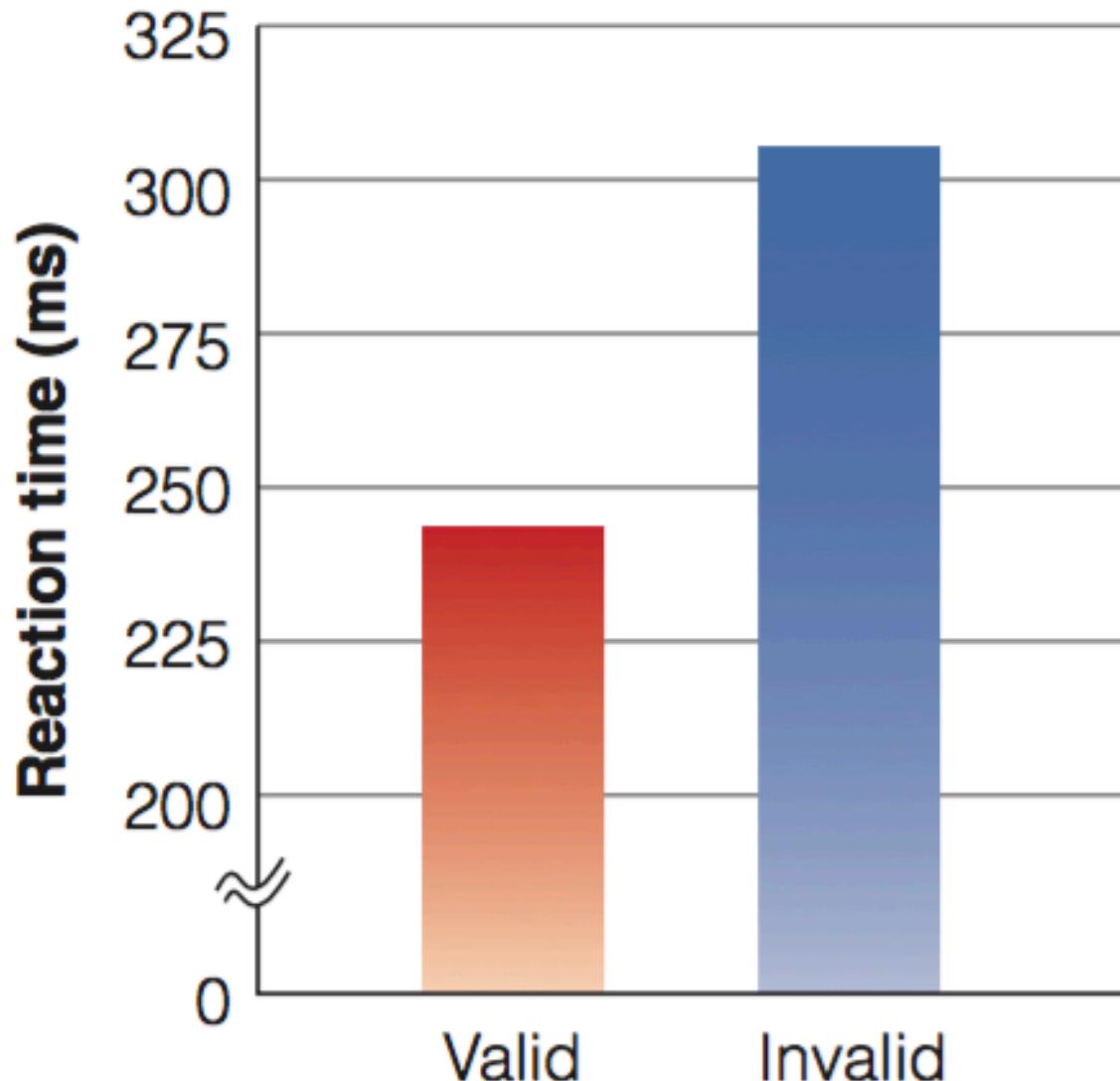
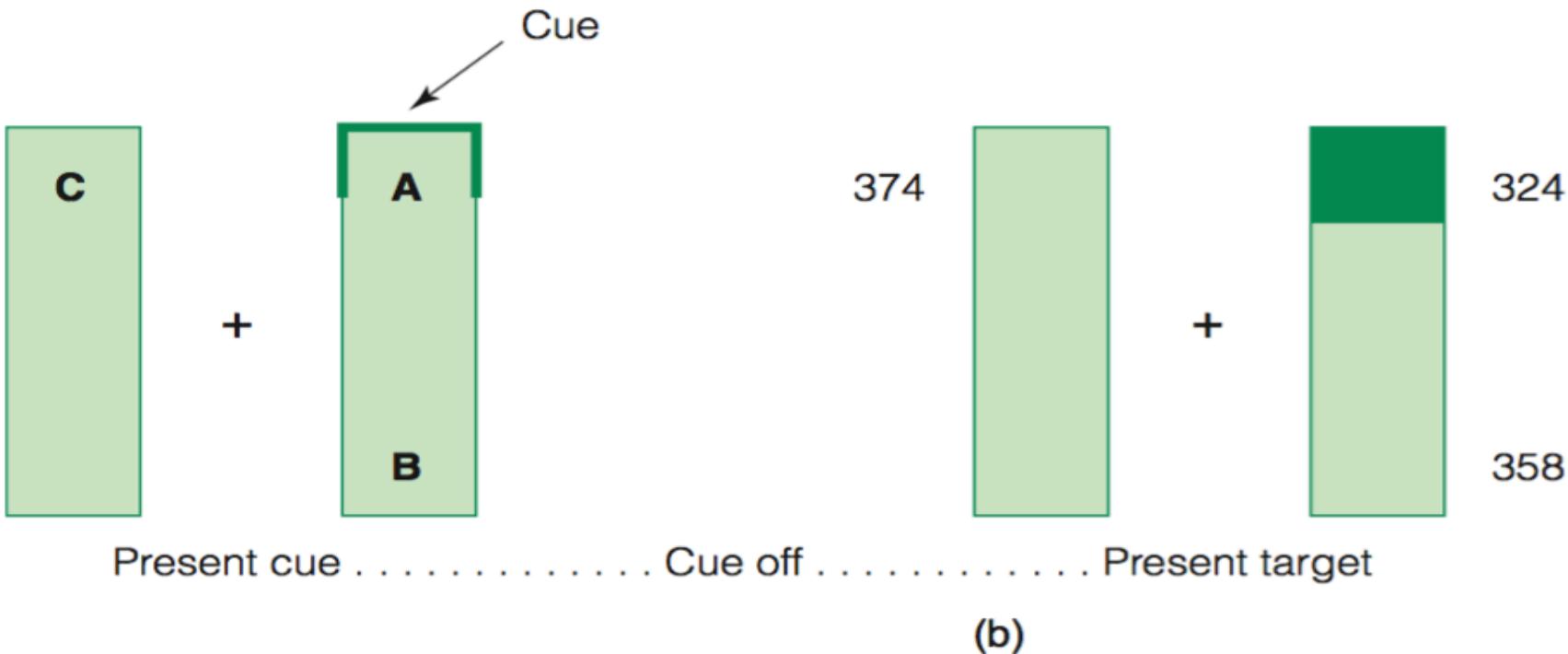


Image: E. B. Goldstein, *Cognitive Psychology\_ Connecting Mind, Research and Everyday Experience*. Wadsworth Publishing. 3<sup>rd</sup> Ed. Fig. 4.17., (p. 102)

- The results of the experiment indicate that observers reacted more rapidly on valid trials than on invalid trials, leading to the conclusion that information processing is more effective at the place where attention is directed.
- These & similar results gave rise to the idea that attention is like a spotlight lens that improves processing when directed towards a particular location (Marino & Scholl, 2005).

- **Object - Based Attention:** Experiments have also shown that attention can also be associated with specific objects.
- Experiments studying object - based attention have shown that when attention is directed to one place on an object, the enhancing effect of this attention spreads throughout the object..
  - For e.g. Egly et al., (1994) asked participants to keep their eyes on the +, then one end of the rectangle was briefly highlighted.
- This was the cue signal that indicated where a target, a dark square would appear.
-

- The participant's task was to press a button when the target appeared anywhere on the display.
- Reaction Times were fastest when the target appeared where the cue signal predicted it would appear.
- However, the most important finding is that participants responded faster when the target appeared within the same rectangular object location B than when it appeared at another location C. Note that B & C are same distance from A.
- Apparently, the enhancing effect of attention had spread within the rectangle, so even though the cue was at A, some enhancement occurred at B as well, this is the **same object advantage**.



**FIGURE 4.29** Stimuli for Egly et al.'s (1994) object-based attention experiment. (a) The cue signal, darkened lines, appears at the top or bottom of one of the rectangles to indicate where the target will probably appear. The letters were not present in the display viewed by participants. (b) The target, a darkened square, appears at one end of one of the rectangles. Numbers indicate how long it took, in milliseconds, to respond to targets presented at positions A, B, and C when the cue had appeared at position A.

Image: E. B. Goldstein, *Cognitive Psychology\_ Connecting Mind, Research and Everyday Experience*. Wadsworth Publishing. 3<sup>rd</sup> Ed. Fig. 4.17., (p. 103)

# Location and Object Based Attention

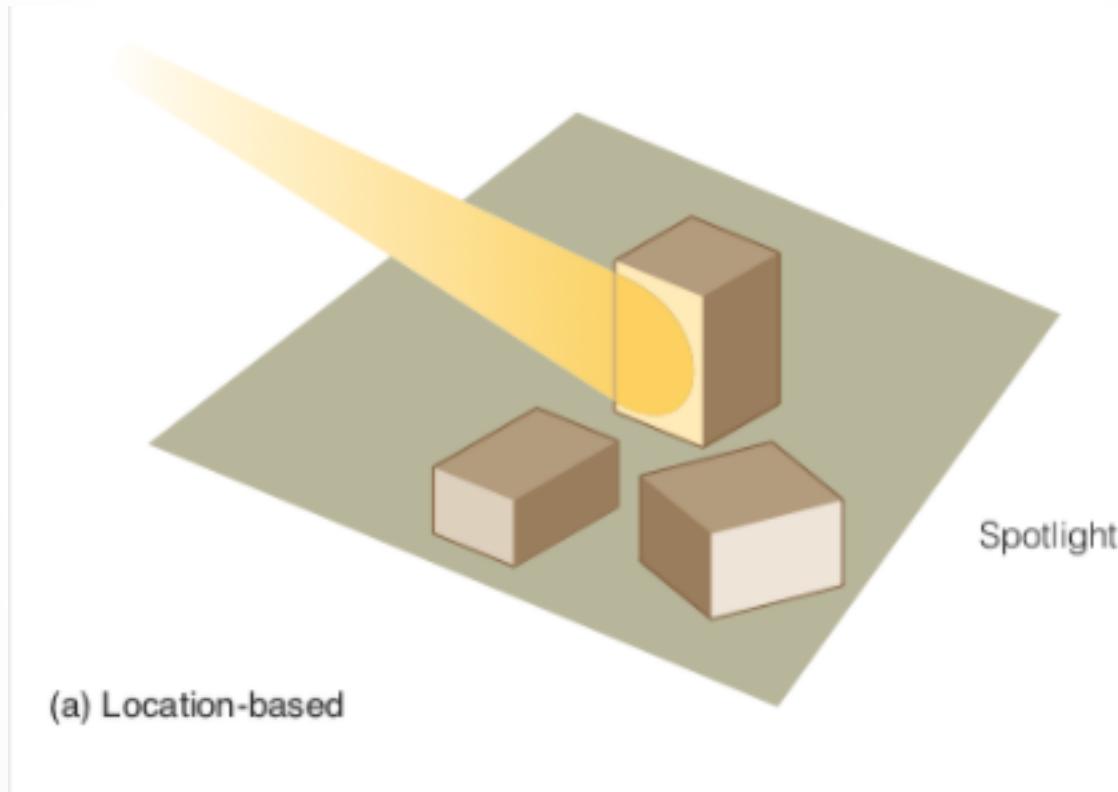


Image: E. B. Goldstein, *Cognitive Psychology\_ Connecting Mind, Research and Everyday Experience*. Wadsworth Publishing. 3<sup>rd</sup> Ed. Fig. 4.17., (p. 103)

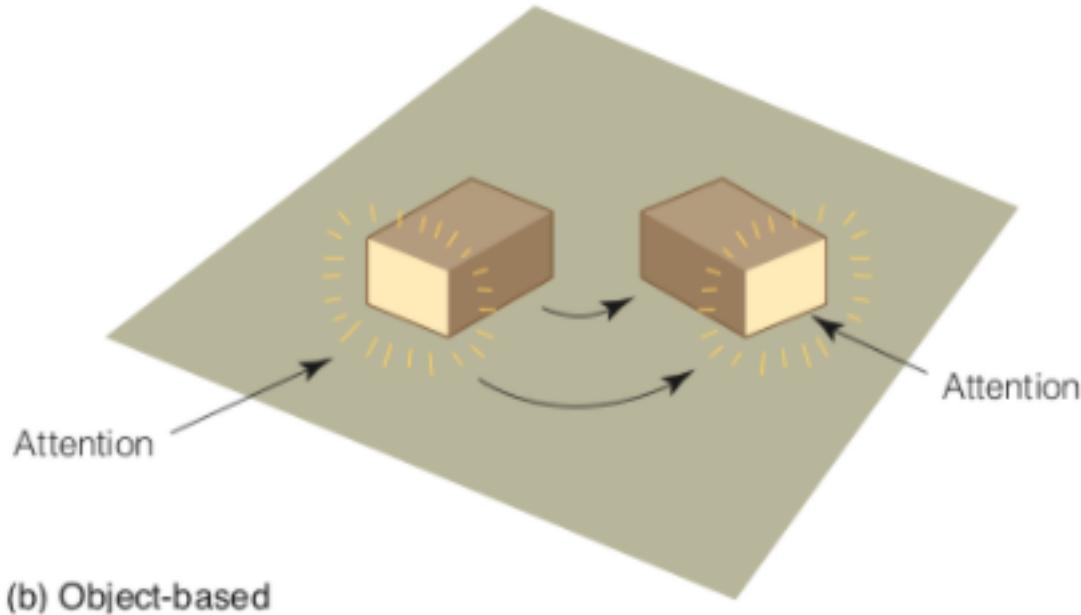


Image: E. B. Goldstein, *Cognitive Psychology\_ Connecting Mind, Research and Everyday Experience*. Wadsworth Publishing. 3<sup>rd</sup> Ed. Fig. 4.17., (p. 103)

# To Sum Up



# References

- E.B. Goldstein (2010). Cognitive Psychology Connecting Mind, Research and Everyday Experience. *Wadsworth Publishing. 3<sup>rd</sup> Ed.*