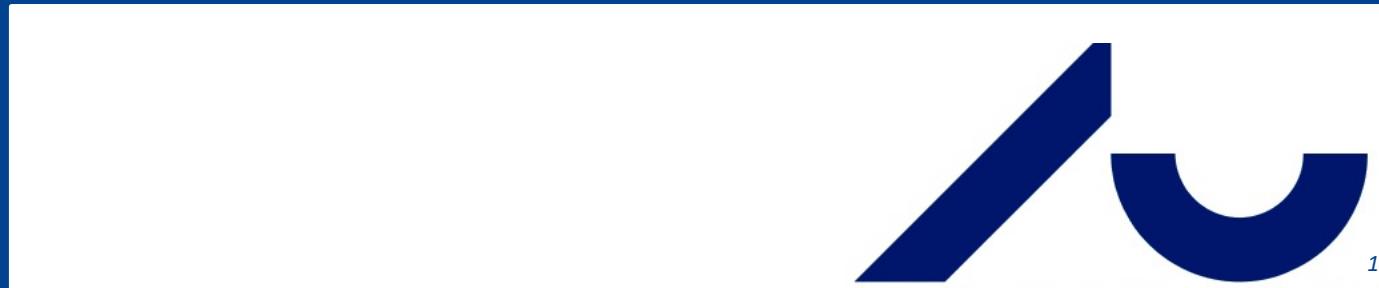




Attention



Today's agenda

- › *Preliminaries*
- › *Attention – core concepts*
- › *Effects of Emotion and Familiarity (aka Experience)*
- › *Individual Differences in Selective Attention*
- › *Your Questions*

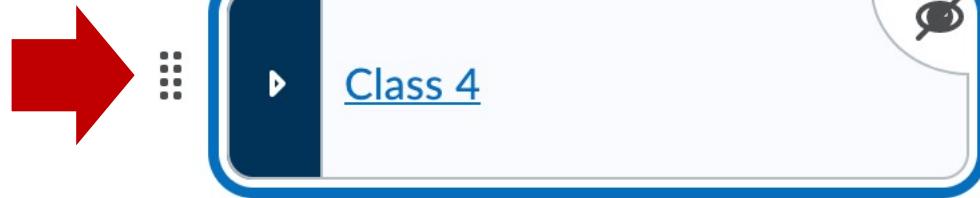


Preliminaries



Cabin trip

- › Thursday's Class materials and exercises will be online – please complete them!
- › Everything is in Class 4 on Brightspace
- › Available starting Thursday morning



No lecture or class next week

- › Week 39 - You'll attend Kristian Tylén's workshop instead! ☺
- › We'll resume as usual in Week 40

Class 5 (week 40) – Memory



Readings

- 1) **Textbook reading:** Goldstein, B., & van Hoof, J.C. (2021). Cognitive Psychology (2nd edition). Cengage. **Read Chapters 5 & 6 – Short-term and Working Memory & Long-term Memory: Structure**
- 2) **Individual differences reading:** Miller, A. L., Gross, M. P., & Unsworth, N. (2019). Individual differences in working memory capacity and long-term memory: The influence of intensity of attention to items at encoding as measured by pupil dilation. *Journal of Memory and Language*, 104, 25-42.

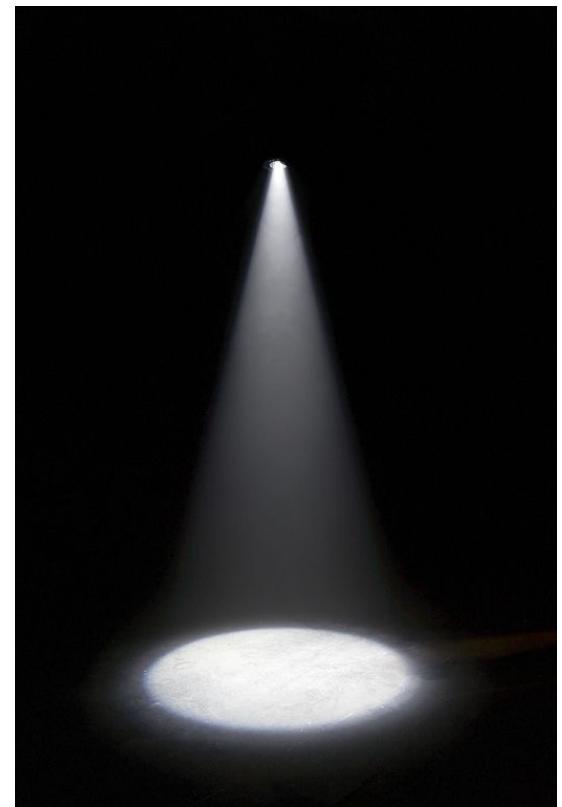


Attention



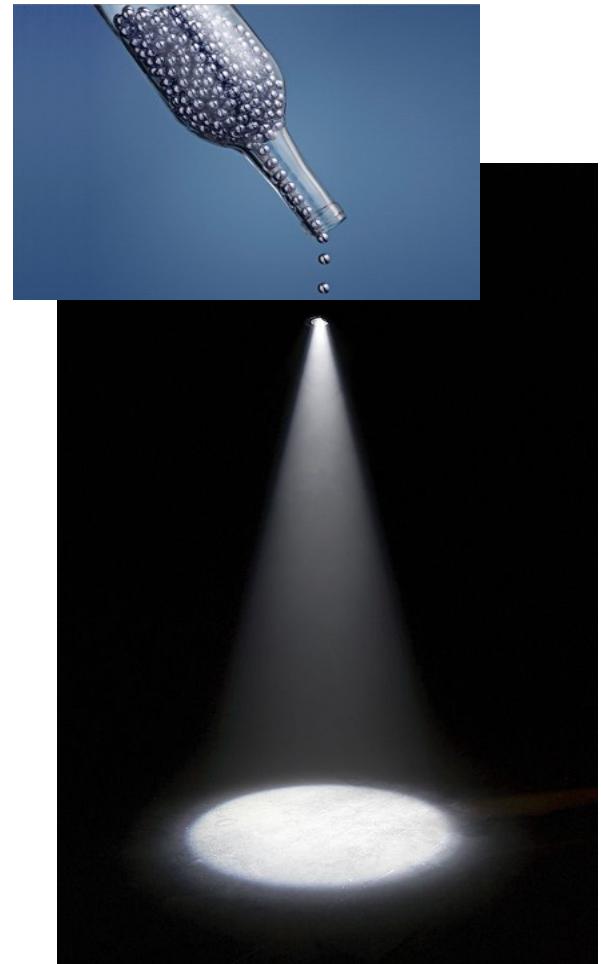
Attention – in cognitive science

- › *What is attention in broad terms?*
- › *The process by which certain information is selected for further processing and other information is discarded and the ability to focus on specific stimuli and locations*
- › *Spotlight analogy*



Types of attentional processes

- › *Selective attention*
 - › Paying attention to one thing while ignoring others
- › *Divided attention*
 - › Paying attention to more than one thing at a time
 - › Hard to do sometimes
 - › E.g., two conversations at once
- › *Attentional capture*
 - › Shift of attention to very salient stimuli (e.g., loud noise)
 - › Cocktail party effect



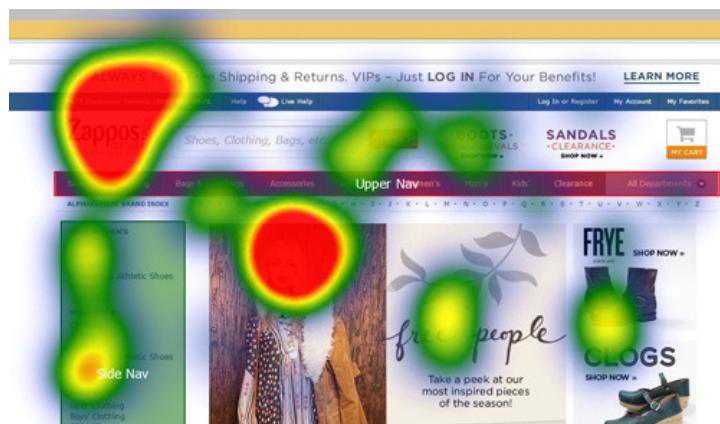
Types of visual attention

- › *Overt attention = shifting attention corresponds with eye movements*
- › *Covert attention = shifting attention without corresponding eye movements*



Visual scanning

- › *Movement of eyes from one situation to another*
- › *Also called a saccade*
- › *Always overt*
- › *Eye tracking is a method that studies overt visual attention*



Causes of visual scanning

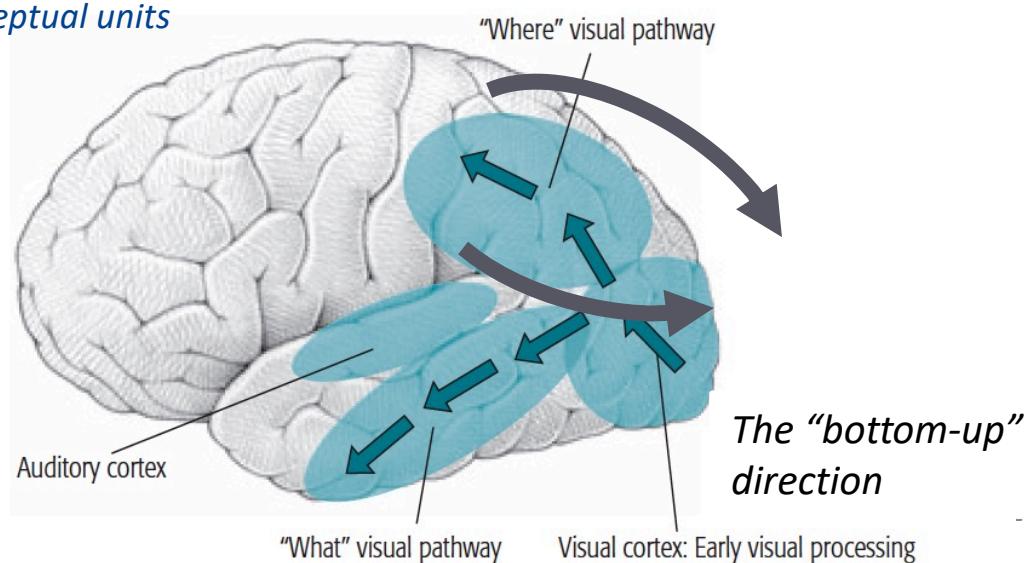
- › Cause 1: Stimuli salience = does it **standout?**
 - › Based on physical properties
 - › Bottom-up
- › Saliency map = identifying what stands out more or less
 - › Used in eye tracking studies, for example
- › Cause 2: Meaning and knowledge factors = is it's meaning / use significant?
 - › Based on semantic properties
 - › Top-down
- › Cause 3: Task demands = is it relevant to my goals?

Last time

- › Bottom-up processing
- › Top-down processing

› High-level general knowledge contributes to the interpretation of the low-level perceptual units

The “top-down” direction



Covert attention and cueing procedure

- › Attention to location = can be one type of covert attention

Endogenous – Active, top-down, goal-directed, intentional
e.g. “attend to the 4th sound in a sequence”

Exogenous - Passive, bottom-up, stimulus driven, incidental
e.g. an unpredicted change “catches” your attention: be be be be ba be

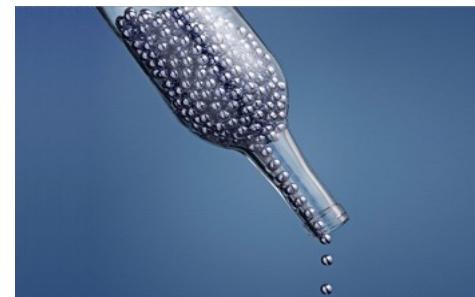
Attention – quantitative limits

- › *There are limits to the amount of information in the world that the mind can attend to and process simultaneously*
 - › *Unnecessary computational load*
 - › *Energy inefficient and maladaptive*
- › *Serial bottlenecks*
 - › *A point in the path from perception to action at which people cannot process all the information in parallel*
 - › *When do they occur?*
 - › *E.g. parties*



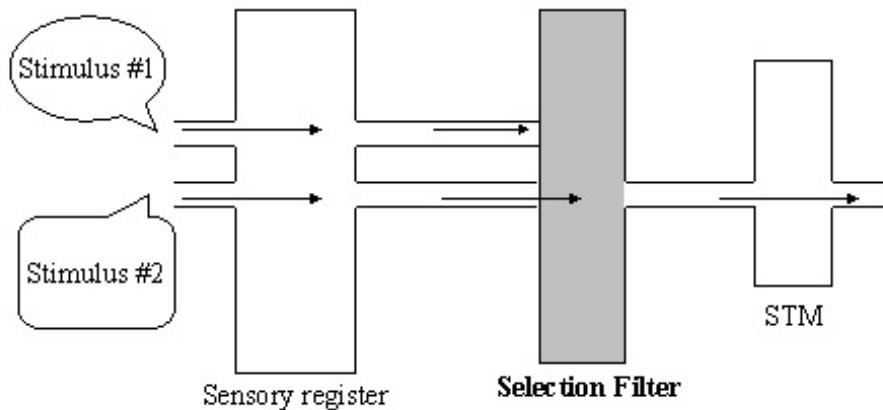
The study of attention and Serial Bottlenecks

- › *Early selection theories:*
 - › Filter occurs before we perceive the stimulus
- › *Late selection theories*
 - › Filter occurs after we perceive the stimulus
- › *What factors determine to what we attend?*
 - › Goal-directed factors (endogenous)
 - › Stimulus driven factors (exogenous)



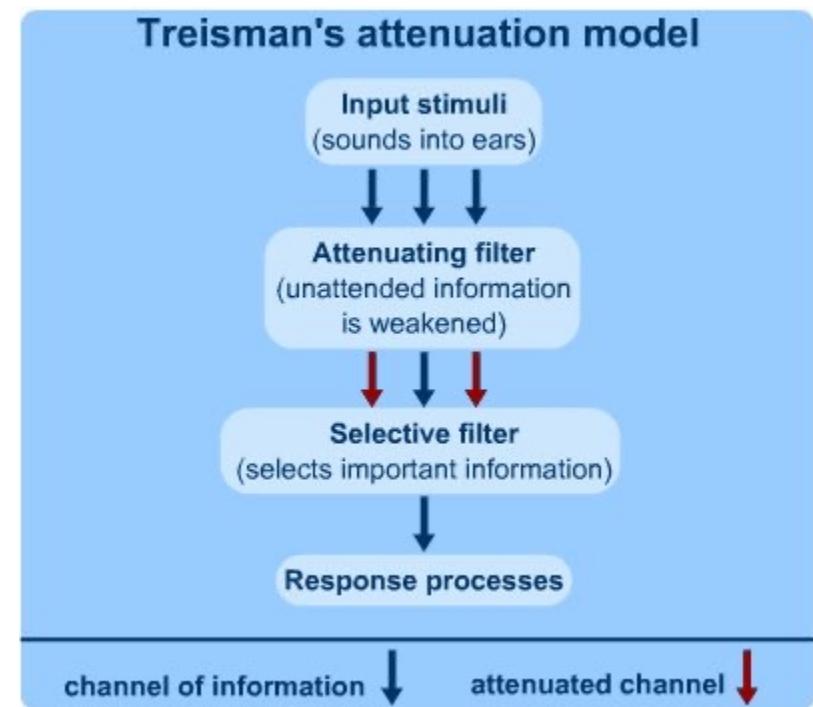
Broadbent's Filter Theory

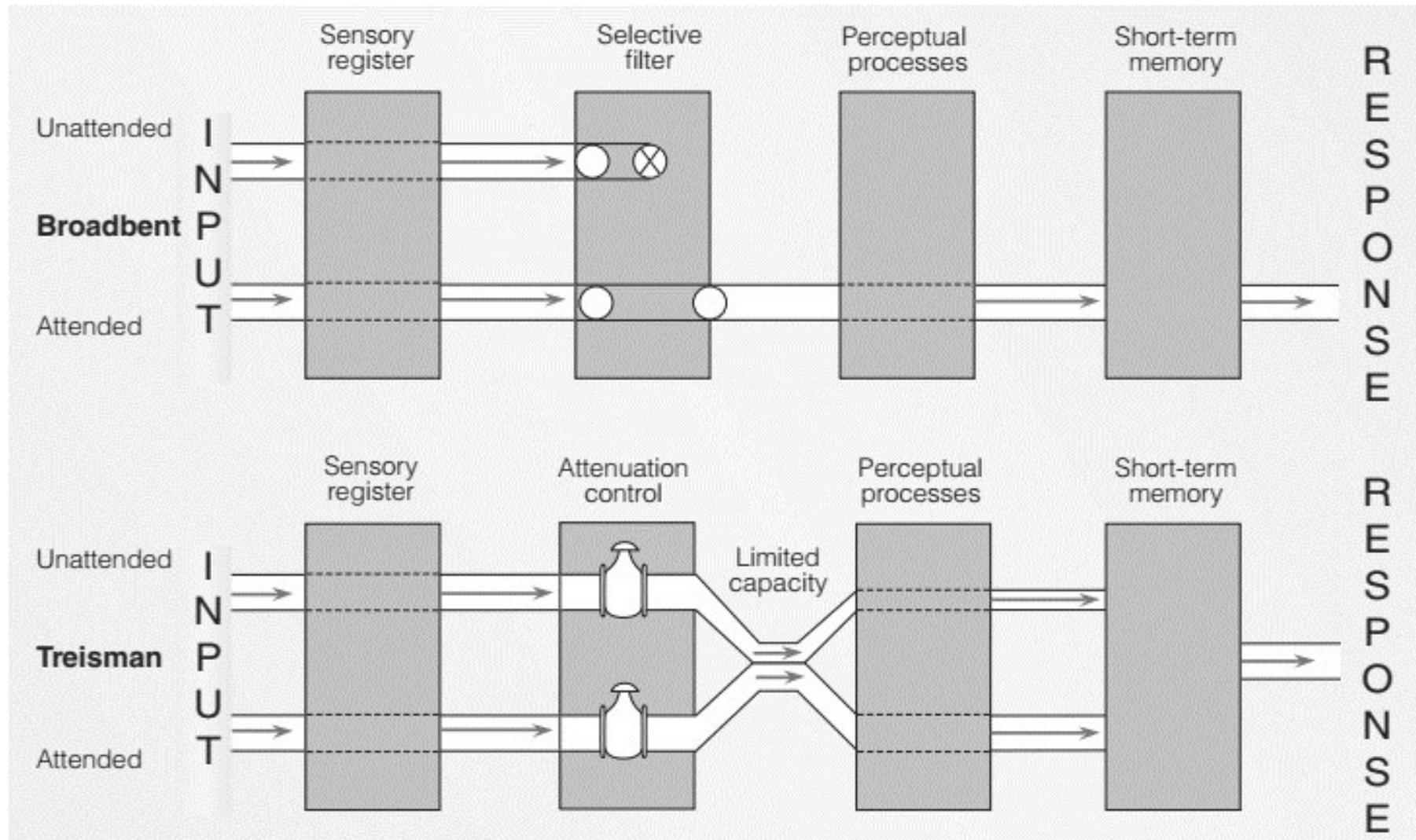
- › A filter lets some stimuli through and blocks others
 - › An early selection theory
- › Steps
 - › Sensory processes
 - › Filter
 - › High-level (late, "detector") processes
 - › Storage in memory



Treisman's Attenuation Model

- › Builds on Filter Theory
 - › Another early selection theory
- › “Cocktail Party Effect”
- › Steps
 - › Attenuator – a process that analyzes incoming stimuli & weakens irrelevant stimuli
 - › Dictionary unit – a process that identifies certain salient words
 - › Storage in memory
- › “Leaky Filter”

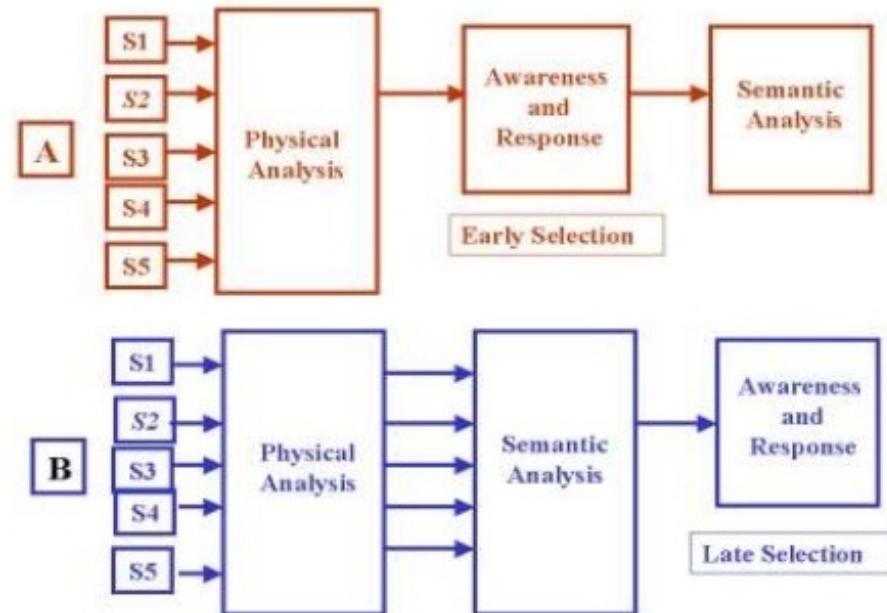




Late Selection Models

- › *Most of incoming stimuli is processed before attention occurs*
- › *Early vs Late – who's right?*
 - › *Actually, both occur some of the time*
 - › *Depends on task and type of stimuli*

Late- and Early Selection Compared



Processing capacity & perceptual load

- › Processing capacity = amount of information a person can handle
- › Perceptual load = relative difficulty of the perceptual task
 - › Low load = Easy to process
 - › High load = Harder to process
- › Harder tasks reduce attention to task-irrelevant stimuli

Congruent list:

| |
|--------|
| RED |
| GREEN |
| RED |
| BLUE |
| BLUE |
| YELLOW |
| GREEN |

Control list:

| |
|-------|
| XXXXX |

Incongruent list:

| |
|--------|
| BLUE |
| YELLOW |
| GREEN |
| RED |
| BLUE |
| GREEN |
| RED |

Cognitive control

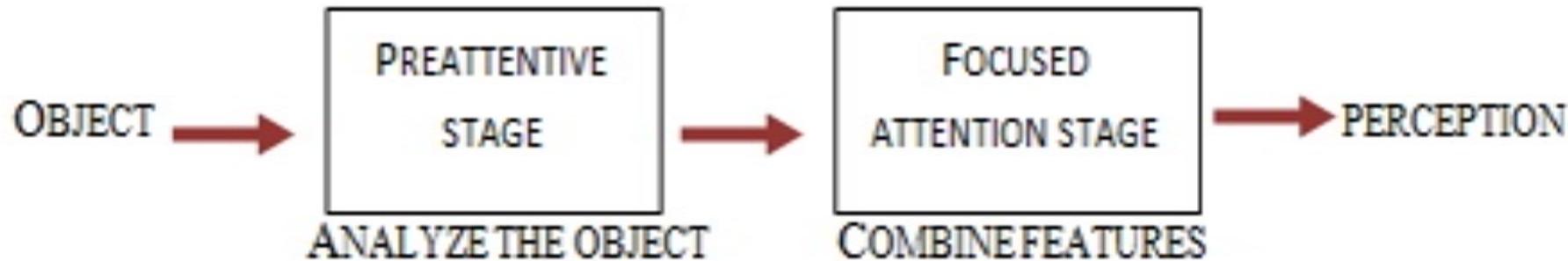
- › *The ability to control your cognitive functions (sometimes called “executive functions”), which include attention, memory, and other cognitive processes*
 - › Frontal lobe
- › *Cognitive load = relative difficulty of the cognitive task*
 - › Different from **perceptual load**
 - › Different from processing capacity because load refers to **how many resources** you’re using while capacity refers to **how much stimuli** you can take in
- › *Divided attention is more difficult when tasks are harder*
 - › Can be improved with practice

'Blindness'

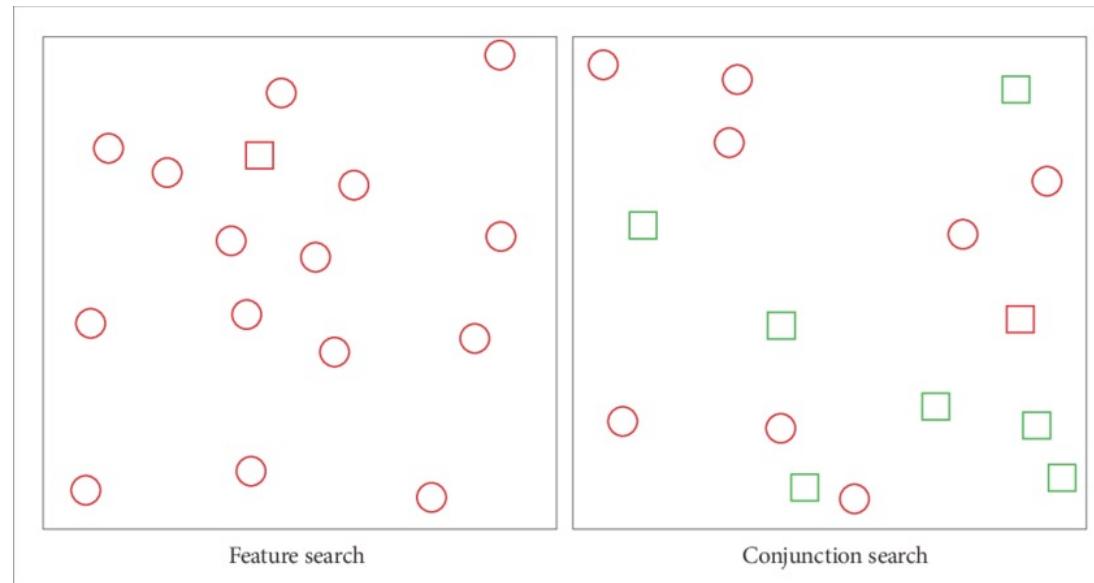
- › *Inattentional blindness = not noticing something that is clearly there when paying attention to other stimuli*
- › *Change blindness = not noticing changes to stimuli when paying attention to other stimuli*

Binding

- › *Binding = integrating the **sensations** of color, shape, texture, etc to perceive an object*
- › “The binding problem” = how are these sensations combined to create perception?
- › *Feature integration theory*



Feature search vs conjunction search



Find the red square



Effects of Emotion and Familiarity



4E Cognition

Cognition is embodied, embedded, extended, & enacted

- › *Embodied = other body processes affect cognition (includes emotion, which is a physiological process)*
- › *Embedded = social and environmental contexts influence cognition (includes culture)*
- › *Enacted = your actions are influenced by your cognitive processes (e.g., you don't remember something, so you ask me about it)*
- › *Extended = people influence each other's cognitive processes (e.g., you are paying attention to this slide because I'm talking to you – I'm directing your attentional processes)*

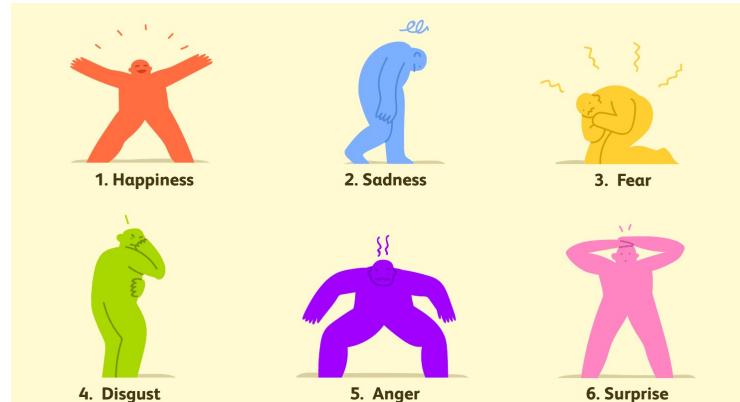
Fear and Attention

- › *Sense of threat guides our attention to source of threat and to protective resources*
 - › *E.g., If a lion enters the classroom, it will capture our attention and we will also pay attention to ways to stay safe, like doors we can exit the room through*
- › *Relating it to the 4Es*
 - › *Embodied = fear (a physiological response) directs our attention to the lion*
 - › *Embedded = we look for doors to exit through because of the shape of the room (i.e., it has doors) and because of our culture (i.e., doors are common in Denmark – we don't normally exit classrooms through cave holes or gates)*
 - › *Enacted = we try to leave the room because a lion caught our attention and so did a door to exit through*
 - › *Extended = maybe you don't notice the lion until I say "It's a LION!" I have directed²⁷ your attention to what I am paying attention to*

Attentional bias towards emotional stimuli

- › *The lion is an example of emotional stimuli*
 - › *It draws our attention by being a source of fear*

- › *Your romantic partner is an example of emotional stimuli*
 - › *You may pay more attention to them than other people*



Culture and Attention

The Development of Context-Sensitive Attention Across Cultures: The Impact of Stimulus Familiarity

Solveig Jurkat,^{1,*} Moritz Köster,² Relindis Yovsi,³ and Joscha Kärtner¹

► Author information ► Article notes ► Copyright and License information [Disclaimer](#)

Abstract

Go to: [▼](#)

Across cultures, there are marked differences in visual attention that gradually develop between 4 and 6 years of age. According to the social orientation hypothesis, people in interdependent cultures should show more pronounced context sensitivity than people in independent cultures. However, according to the differential familiarity hypothesis, the focus on the salient object should also depend on the familiarity of the stimulus; people will focus more on the focal object (i.e., less context sensitivity), if it is a less familiar stimulus. To examine the differences in visual attention between interdependent and independent cultures while taking into account stimulus familiarity, this study used an eye-tracking paradigm to assess visual attention of participants between 4 and 20 years who came from urban middle-class families from Germany ($n = 53$; independent culture) or from Nso families in a rural area in Cameroon ($n = 50$; interdependent culture). Each participant saw four sets of stimuli, which varied in terms of their familiarity: (1) standard stimuli, (2) non-semantic stimuli, both more familiar to participants from Germany, (3) culture-specific matched stimuli, and (4) simple stimuli, similarly familiar to the individuals of both cultures. Overall, the findings show that mean differences in visual attention between cultures were highly contingent on the stimuli sets: In support of the social orientation hypothesis, German participants showed a higher object focus for the culture-specific matched stimuli, while there were no cultural differences for the simple set. In support of the differential familiarity hypothesis, the Cameroonian participants showed a higher object focus for the less familiar sets, namely the standard and non-semantic sets. Furthermore, context sensitivity correlated across all the sets. In sum, these findings suggest that the familiarity of a stimulus strongly affects individuals' visual attention, meaning that stimulus familiarity needs to be considered when investigating culture-specific differences in attentional styles.

Attentional bias towards novel stimuli

- › *People look longer at novel stimuli*
- › *Culture determines what is novel*

Danish dining table



Japanese dining table

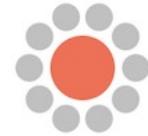
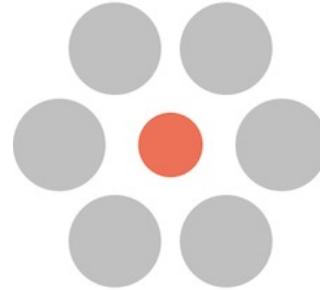


REVIEW

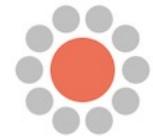
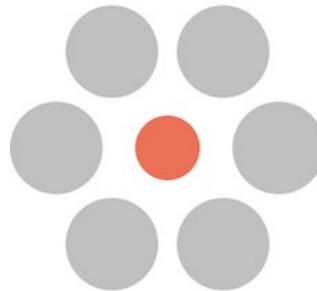
Culture and Perception

Ebbinghaus illusion

- › Processing styles
 - › Field-dependence = context-dependence = holistic processing style
 - › Field-independence = context-independence = analytical processing style
- › Many studies show that some South East Asian cultures are more context-dependent than some American/European cultures
 - › Being context-in/dependent may relate to social environment
 - › Individualism vs Collectivism
- › Caveat: Best to avoid East vs West thinking
 - › Is the “West” really the whole western part of the globe? Is the “East” really the whole eastern part? No.
 - › Himba live in North Namibia and share context-dependence



Attention is driven by processing style



- › *Processing styles*
 - › Field-dependence = context-dependence = holistic processing style
 - › Field-independence = context-independence = analytical processing style

- › *Applying processing styles to attention*
 - › Field-dependence = paying more attention to the background
 - › Field-independence = paying more attention to focal objects

Jurkat et al., 2020

- › *German urban middle-class families and Cameroon rural Nso families*
- › *4 stimuli sets:*
 1. *standard stimuli (more familiar to German participants)*
 2. *non-semantic stimuli (more familiar to German participants)*
 3. *culture-specific matched stimuli (Nso stimuli is most novel for Germans)*
 4. *simple stimuli*

OPTIONAL:

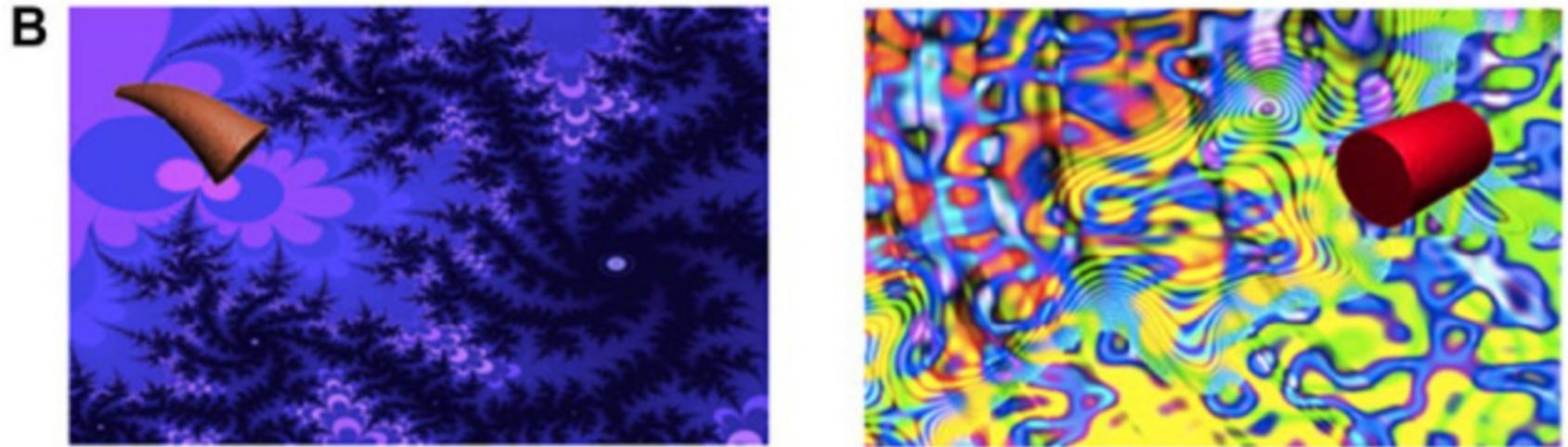
- 3) Jurkat, S., Köster, M., Yovsi, R., & Kärtner, J. (2020). The Development of Context-Sensitive Attention Across Cultures: The Impact of Stimulus Familiarity. *Frontiers in Psychology*, 11.

Standard stimuli

A



Non-semantic stimuli



Culture-specific matched stimuli

C



D



Simple stimuli

E



Jurkat et al., 2020

- › **RESULTS:**
 - › Culture-specific matched stimuli -> less familiar to German participants and they paid more attention
 - › Standard and non-semantic sets -> less familiar to Nso participants and they paid more attention
- › **CONCLUSION:**
 - › “In sum, these findings suggest that the **familiarity of a stimulus strongly affects individuals' visual attention**, meaning that stimulus familiarity needs to be considered when investigating culture-specific differences in attentional styles.”



Individual Differences in Selective Attention



Article

Seeing People, Seeing Things: Individual Differences in Selective Attention

Miranda M. McIntyre¹ and William G. Graziano¹

Personality and Social Psychology Bulletin
2016, Vol. 42(9) 1258–1271
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Abstract

Individuals differ in how they deploy attention to their physical and social environments. These differences have been recognized in various forms as orientations, interests, and preferences, but empirical work examining these differences at a cognitive level is scarce. To address this gap, we conducted two studies to explore the links among attentional processes and interests in people and things. The first study measured selective visual attention toward person- and thing-related image content. In the second study, participants were randomly assigned to describe visually presented scenes using either an observational or narrative story format. Linguistic analyses were conducted to assess attentional bias toward interest-congruent content. Outcomes from both studies suggest that attention and motivational processes are linked to differential interests in physical and social environments.

Background

- › Individuals differ in how they deploy attention to their physical and social environments. These differences have been recognized in various forms as orientations, interests, and preferences, but empirical work examining these differences at a cognitive level is scarce.



Methods

- › *Methods: To address this gap, we conducted two studies to explore the links among attentional processes and interests in people and things. The first study measured selective visual attention toward person- and thing-related image content. In the second study, participants were randomly assigned to describe visually presented scenes using either an observational or narrative story format. Linguistic analyses were conducted to assess attentional bias toward interest-congruent content.*

Results

- › *Outcomes from both studies suggest that attention and motivational processes are linked to differential interests in physical and social environments.'*

...That's it. No Discussion.

Breakdown of Introduction

Premise

- › Recently, police in West Lafayette, Indiana, investigated an assault. The police probably thought they were fortunate to have more than one witness. What they discovered was that the witnesses, despite being present at the same location at the same time, recalled different events, or at least different aspects of the event. One witness remembered vividly that the assailant had a gun but could not recall many details about the victim. Another witness recalled the victim, describing her frightened look and the way she sat on the ground after the assault. The second witness did not remember the gun. If the witnesses saw the same incident, why were their recollections so dissimilar?

Breakdown of Introduction

Research statement

- › *One potential explanation for these discrepant reports is that people differ in the way they orient toward their environments.*

Breakdown of Introduction

What we know

- › *Descriptions of social events are not random*
- › *Certain systematic tendencies vary across individuals*

- › *Social vs Physical envornment*
 - › *some individuals selectively orient toward their social environment, attending and responding acutely to the people around them (called “Person Orientation”)*
 - › *some people selectively orient toward the physical environment, attending and responding acutely to the objects around them (called “Thing Orientation”)*

Breakdown of Introduction

Process modelling

Building a Conceptual Process Model

The theoretical basis of this work draws from classic social-cognitive literature as well as the literature on interests. At their core, PO and TO imply differential responsiveness to the social and physical environments—in other words, selectivity of person or thing content. The information processing systems approach suggests that selectivity can take place at multiple stages along the cognitive stream (Carlston, 2013), such as attention, encoding, memory, or retrieval. Considering that PO and TO are conceptualized as interests in people and in things, a plausible starting place for such selective

Model designed based on logic and prior studies

- › Considering that PO and TO are conceptualized as interests in people and in things, a plausible starting place
- › Interests are regarded as motivational variables, reflecting an “enduring predisposition to re-engage” with or attend to interest-relevant content
- › As motivational variables, interests are linked not only to attentional responses but also to affective responses.

Breakdown of Introduction Process model shows their hypothesis

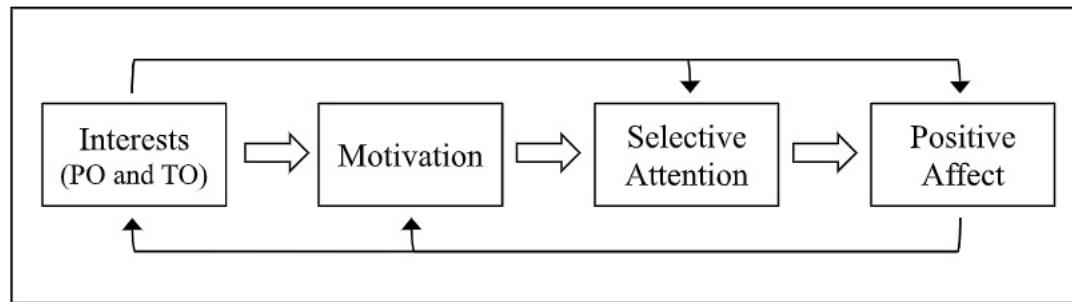
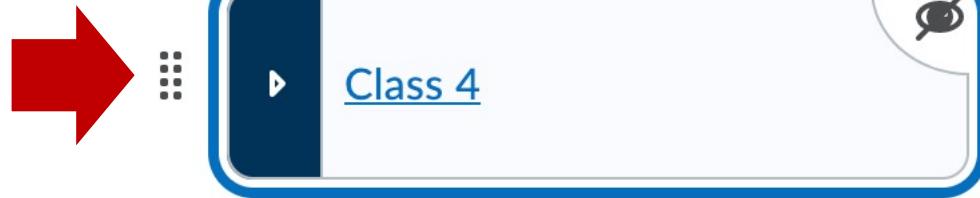


Figure 1. Conceptual process model representing the hypothesized relationships between individual differences in interest, motivation, selective attention, and affective responses.
Note. PO = Person Orientation; TO = Thing Orientation.

To be continued...by you!

- › Article discussion will be part of Class 4 Activities
 - › Discuss the Methods, Results, and Discussion with your study group
 - › Answer questions in corresponding worksheet
 - › I'll read your answers & provide feedback



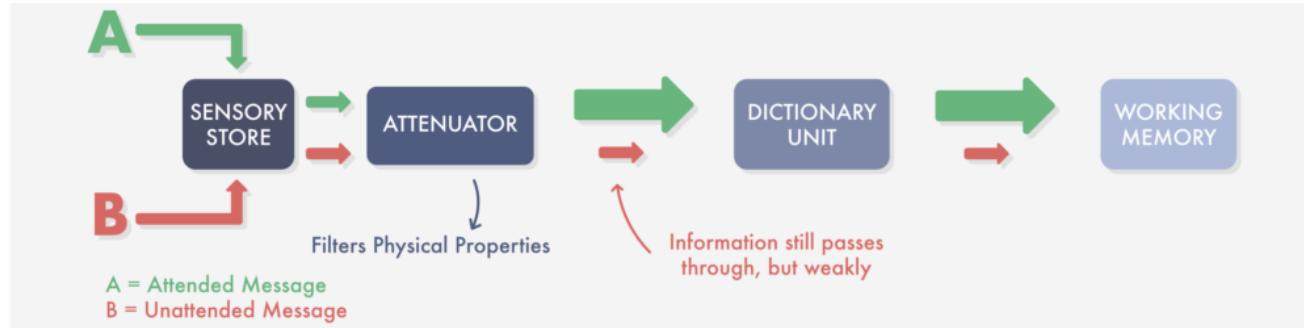


Your Questions



-
- › *Can the concepts of overt and covert attention be applied to other senses than sight? For example, actively listening on a conversation versus overhearing the background noise.*
 - › **Answer: Yes.** And you gave a good example.

- › The attenuation model of attention is characterized as an early selection models, but one of the terms that the attenuation is based on is " 3) its meaning". How come it is then presented as an early selection model when information is actually being interpreted before the attenuation happens?
- › **ANSWER:** Don't conflate selection with attenuation – these terms have different referents. What defines early selection is not meaning but timing. The selection occurs at the sensory store, which occurs very early in the process (first, in fact). Selected stimuli is then attenuated.



-
- › *I find it difficult to understand how the endogenous and exogenous cues each affect our attention differently. What is the difference of outcome when either the cue appears in the centre at the fixation point or when the cue appears at one of the locations? Also I do not understand why endogenous cues are manipulation of top-down attention and why exogenous cues are manipulation of bottom-up attention?*
 - › **ANSWER:** *Endogenous cues have meaning and are processed top-down. That's the definition of an endogenous cue. For example, differentiating between your name vs someone else's. Being in the center of a fixation point is just an example of an endogenous cue because of the way that you process this stimuli. If it's not a helpful example, then ignore it. Exogenous cues get your attention without relying on meaning. They are, by definition, cues that are processed bottom up. Explosions and red text will get your attention (they jump out at you) before you interpret their meaning.*

If you're still confused, then this article might help: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3539749/>

-
- › *Explain the flanker task*
 - › *ANSWER: It's a response inhibition task. To give a simplified example: If you are told to press the letter C on your key board enough times (press C, press C, press C, press C), you might hit it automatically instead of continuously listening for the prompt. If suddenly you're told 'press D', you might accidentally press C anyway because you're paying less attention to the prompt. It's the natural tendency. If you do press D, then you had good response inhibition.*

It's easiest to understand by trying it. Here's a fun version of the task:
<https://www.youtube.com/watch?v=IXVmSqfSML4>

Wikipedia has a really useful and simple explanation of the Flanker Task too:
https://en.wikipedia.org/wiki/Eriksen_flanker_task

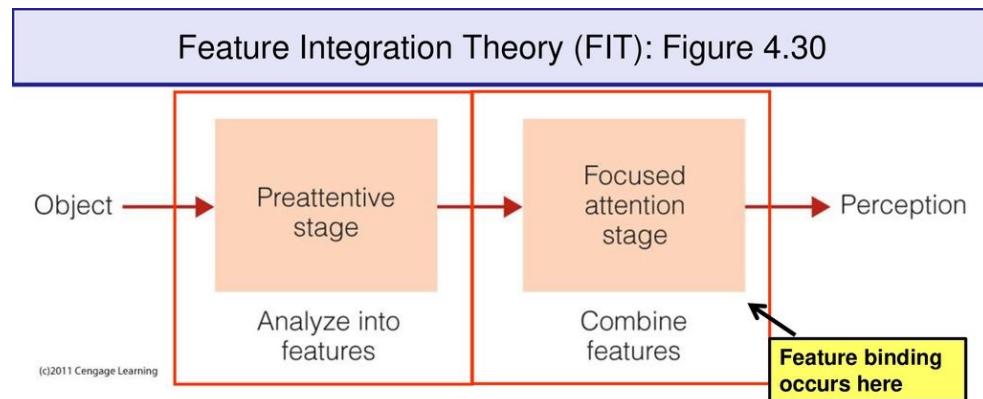
-
- › *What is the compatibility effect?*
 - › **ANSWER:** *In the example on the previous slide, you will be faster at pressing C because you've already been pressing C than at press D (or any other letter that's new)*

-
- › Explain Posner spatial cueing task.
 - › ANSWER: Spatial cueing relies on the tendency to process peripheral information bottom up first. It's easier to indicate **that** a shape appears in your periphery than to indicate that a **certain shape** appears.

You should try it. The first 1:17 of this video explains the effect while also giving you a chance to see why it's difficult (after 1:17, it's about one lab's specific research and less relevant to you): <https://www.youtube.com/watch?v=9gY18Eo9znQ>

› Explain feature integrated theory of attention.

› **ANSWER part 1:**



Anne Treisman hypothesized that attention plays a critical role in combining features into objects (binding features to objects).

Preattentive Stage

- ♦ Automatic; effortless; unaware of process; object's features are detected by the visual system.

Focused Attention Stage

- ♦ Attention plays key role; features are associated with (bound to) objects

- › Explain feature integrated theory of attention.

- › **ANSWER part 2:**

| a | Color Singleton | | | | b | Conjunction task | | | |
|---|-----------------|---|---|--|---|------------------|---|---|--|
| T | T | X | T | | X | X | X | T | |
| X | T | X | T | | T | T | X | X | |
| T | X | T | X | | T | X | T | T | |
| T | X | X | T | | X | T | X | X | |

Preattentive – easy to find blue T –
bottom up popout effect

Focused attention – more effortful
to find red T – must deliberately
search for it



See you in Week 40!

