Week 6.1
Attention

10/1/2018
Roadmap

• Arousal level
• Schema theory
• Inattentional blindness
• Divided attention
• Automaticity
• Attentional capture
• Localization of attention in brain
Factors affecting arousal level

• Kahneman (1973)
  ➢ Task difficulty
  ➢ Level of interest
  ➢ Amount of sleep
  ➢ Time of the day
Schema theory
Schema theory vs. Filter theory vs. Attenuation theory

- Schema theory: unattended information does not enter the processing at all.

- Filter theory: unattended information is filtered out through the bottleneck

- Attenuation theory: unattended information is tuned down → lowered threshold to be attended to.
Inattentinal blindness

• Why didn’t you see the gorilla in the video?
  ➢ Gorilla: black
  ➢ When asked to count the passes made by people in WHITE, 44% reported seeing the gorilla.
  ➢ When asked to count the passes made by people in BLACK, fewer than 44% reported seeing the gorilla.
Inattentional blindness: Another example

- [https://www.youtube.com/watch?v=FWSxSQsspIQ](https://www.youtube.com/watch?v=FWSxSQsspIQ)

- How would you manipulate the experiment to make the pedestrian more likely to be aware of the change?
  
  Work with your neighbors and come up with 3 possible manipulations
Inattentional blindness: Another example

• Only 50% of people noticed the change

• Students more likely to notice than change than old adults
  → Working memory capacity (Hannon & Richards 2010)

• But when the interviewers wearing workers clothing, < 50% of students noticed the change
Can we do more than one task at the same time?

• Divided attention

  ➢ Spelke et al. (1976)

  o Participants trained to do dual tasks for 17 weeks
  o Reading stories and write dictated words
  o After ~ 6 weeks of training, performance on reading comprehension close to doing the reading task only.
  o Participants even able to categorize dictated words without sacrificing reading comprehension
Possible accounts for dual-task performance

• Alternating attention between tasks
• Automatic processing of one of the tasks
• Learned to combine two tasks
Did they really alternate attention between tasks?

• Counter evidence found by Hirst et al. (1980)
  o Same task as Spelke et al. (1976)
  o Group 1 read short stories; Group 2 read encyclopedia entries (more attention required)
  o After both groups reach normal reading performance as they did in single-task condition, task switched: Group 1 read encyclopedia entries, and Group 2 read short stories
Did they really alternate attention between tasks?

• Counter evidence found by Hirst et al. (1980)
  ○ Reading comprehension and word copying not quite impacted after switch
  ○ If alternating attention between tasks, performance should be impacted after switch
Is one of the tasks automatically performed?

Copying words is an automatic process?

• Participants aware of the word being dictated
• Participants intended to copy the words

→ Violate the criteria for automaticity: lack of intention and lack of awareness
Did participants learn to combine the two tasks through repeated practice?

• Possibly...

• Can you learn to do dual-tasking efficiently through practice?
Why “practice makes perfect”? 

Attention hypothesis of automatization

• Practice what to learn and what to remember
  Fair amount of attention needed in this phase

• Enough practice ➔ become familiar with the task automatize the process
Dual-task performance in real-world application

- Strayer and Johnson (2001)
  - Simulate driving condition
  - Dot tracking task: green (go) vs. red (stop)
  - Dual task: either
    - Listen to radio OR
    - Talk to someone over the cell phone

→ Listening to radio DID NOT have much negative impact on the dot tracking task
→ Cell phone use DID!
Dual-task performance
• Strayer and Johnson (2001)
Dual-task performance: the content matters!

• Strayer and Johnson (2001)
  
  ➢ Still use cell phone as one of the tasks
  
  ➢ Word shadowing (repeat what they heard) or word generation task (say words beginning or ending with a particular letter)

  ➔ Word shadowing DID NOT negatively impact dot tracking performance
  
  ➔ Word generation DID!
Stroop task
• Stroop (1935)
Name the color of the words as quickly as possible
Which letter “pops out”?

• Schneider & Shiffrin (1977)

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<th>B</th>
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<tr>
<td>2 5 4 9</td>
<td>T R P Q</td>
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<tr>
<td>0 3 4 B</td>
<td>G 9 H J</td>
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<tr>
<td>7 1 5 8</td>
<td>X M C E</td>
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<tr>
<td>4 2 7 0</td>
<td>W V L N</td>
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(a) Single target-present

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<tr>
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<tr>
<td>Z F G L</td>
<td>N Q W O</td>
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(b) Single target-absent

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(c) Single target-present

<table>
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(d) Multiple targets-present
What is exactly “automatic processing”?  
• Posner & Snyder (1975)  
• Three criteria  
  1. Processing occur without intention  
  2. Without conscious awareness  
  3. Not interfere with other mental activity
What is exactly “automatic processing”? 

• Schneider & Shiffrin (1977) 
  ➢ Visual search task 
  ➢ Four independent variables 
    1. Varied vs. consistent mapping 
    2. Frame size: # of letters/numbers in each display 
    3. Frame time (duration): 20 – 800 ms 
    4. Number of targets
What is exactly “automatic processing”? 

• Posner and Snyder (1975)
  ➢ Consistent mapping: presumed to require “automatic processing”
    ➔ Supposed to be easier (little effort required)
  
  ➢ Varied mapping: presumed to require “controlled processing”
    ➔ Supposed to be harder (more effort required)
Which letter in the graph “pops out”? 
Feature integration theory

• Treisman: two stages of perception and attention

  ➢ Pre-attentive (automatic)
    ➔ Requires little mental effort

  ➢ Features glued by attention
    ➔ Requires more mental effort
Attentional capture

• Stimulus that causes involuntary shift of attention

• May be influenced by working memory capacity (Fukuda & Vogel 2011)

• Top-down or bottom-up process?
Name the letter in the grey circle
Name the letter in the grey circle
Attentional capture

• Theeuwes et al. (1998)
  ➢ Decide if the letter in the grey circle contains a C or a reversed C
  ➢ 50% of trials: a new circle appeared
  ➢ Slowed down RT

• If Ss are asked to stare at the location where the grey circle will be, the new circle won’t affect their attention (Theeuwes 2000).
Localization of attention in brain

• Parietal lobe damage $\rightarrow$ sensory neglect (hemineglect)

• Damage to the right parietal lobe $\rightarrow$ ignore sensory information to the right

• Frontal lobe
Localization of attention in brain
Evidence from ERP

• Pashler (1998)
Evidence from fMRI

• Zimmermann et al. (2012)