Chapter 4

Attention

Review of Ch 3

- Models:
  - Template
  - Feature Detection (Pandemonium)
  - Connectionist (PDP, Neural Network)
- Top Down vs. Bottom Up
- Clinical Evidence
  - Visual Object Agnosia
  - Facial Agnosia (face-blind, prosopagnosia)

Definitions

- "Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization, concentration of consciousness are of its essence. It implies withdrawal from some things in order to deal effectively with others." — James, 1890

Attention

- What is it?

Common Definitions

- Input Attention
  - Alertness, arousal
  - Orienting reflex or response
  - Spotlight attention & Search
  - Hemi-neglect
- Controlled Attention
  - Selective Attention
  - Mental resources, conscious processing
  - Supervisory attentional system (similar to working memory: Chapter 5)

Four Principles

- More information exists than needed
- Limits to processing
- Some tasks require almost no attention
- Effortful tasks can become automatic with practice

Basics of Attention

- Attention as mental process
- Attention as limited resource

Attention as a Mental Process

- concentrating effort or focus on
  - stimulus or
  - mental event

Priming

- Attention shows both Top-Down and Bottom-up Features

Attention as a Limited Resource

- mental “energy”
- limited amount or “capacity”

- Examples
  - driving while texting
  - note-taking in this class

Input Processes

- Alertness, arousal…
- Orienting reflex or response…
- Spotlight attention & Search…

Alertness / Arousal

- Amount of “consciousness”
- Range
  - Zero (deep coma)
  - Some (sleep, sedation)
  - Reduced (sleepy, tired, fatigued)
  - Normal
  - Above average (hyperarousal)

Sustained Attention

- aka Vigilance
- Examples
  - air traffic controller
  - assembly line inspector
  - studying for a midterm
- Typical
  - 20-35 minutes, attention wanes

Not all tasks require attention?

- Explicit (conscious)
- Implicit (non-conscious)

- Bonebakker et al. (1996)
  - patients under anesthesia presented lists of words
  - could recall more words
    - word-stem completion task
  - effect was small (6% to 9% more)

Orienting Reflex

- aka “Attention Capture”
- reflexive redirection of attention towards unexpected stimulus
- Biological responses (respiration, heart rate…)
- Location-finding: Where
  - also “What”
- Mental Focus
  - can include physical focus (eyes, head, body…) but not necessary

Orienting Reflex - Semantic

- Stimuli can be semantic
  - Estes et al. (2008): meaning of cue word directs attention, “hat” upwards, “boot” downwards

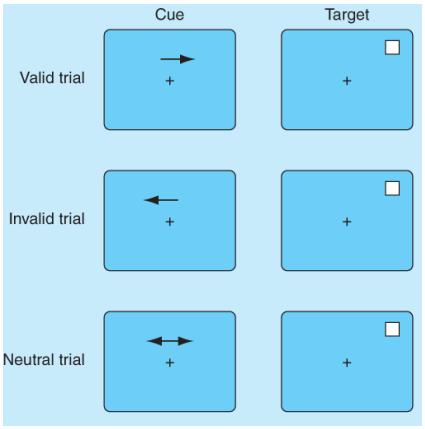
Novelty of stimuli

- Unexpected more important than New
  - why?
  - habituation

Spotlight Attention / Visual Search

- e.g. CogLab 3
- can be purely cognitive (without movement of eyes)

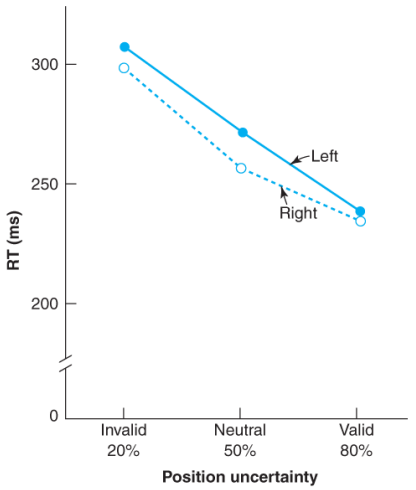
Spatial Cueing Task



- Posner et al. (1978)
- 80% of arrows were valid, 20% invalid
- DV: Reaction Time

Spatial Cueing Task

- Speedup
  - "benefit" or "facilitation"
- Slowdown
  - "cost"

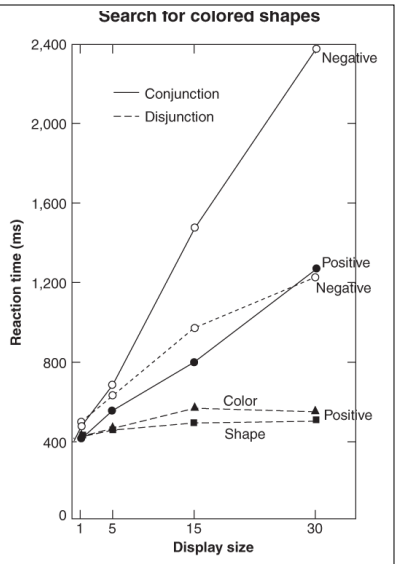


The "Spotlight" metaphor

- Attentional focus jumps (rather than sweeps) - similar to saccades
- Size of spotlight can be altered depending on task

Visual Search

- "pop out" effect (suggests Parallel search)



Visual Search

- Inhibition of Return
  - avoid re-searching locations you already searched
  - seen in search tasks
- Facilitation of Return
  - more likely to repeat locations
  - seen when memorizing

Review

- **Input Attention**
  - **Alertness, arousal**
  - **Orienting reflex or response**
  - **Spotlight attention & Search**
- Controlled Attention
  - Selective Attention
  - Mental resources, conscious processing
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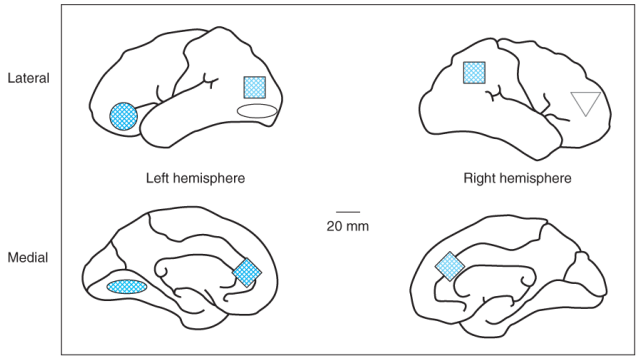
Input vs. Controlled Attention

- Input Attention
  - fast, automatic, parallel, effortless, "implicit"
- Controlled Attention
  - slow, conscious, serial, effortful, "explicit"

Input vs. Controlled Attention

- Posterior areas: automatic spotlight attention
- Frontal areas: controlled attention



Controlled/Voluntary Attention

- Selective Attention and the Cocktail Party Effect..
- Models of selective attention…

Limited Attentional Capacity

- Examples:
  - driving and talking / texting
  - taking notes in a classroom
- We must be able to select what's important (to the situation)

Selective Attention

- Filtering out what's not important (distractors)
- Visual Attention is easy
  - move eyes
  - move attentional spotlight
- Auditory Attention
  - can't move ears
  - must hear everything
  - can we filter and focus internally?

Cocktail Party Effect

- Focus on one auditory stimuli and ignore others
- Implies filtering or internal attention processes

Dual Task Methods

- Overload (too much information)
- One task captures most / all attention
- Second task performance suffers

Auditory Shadowing

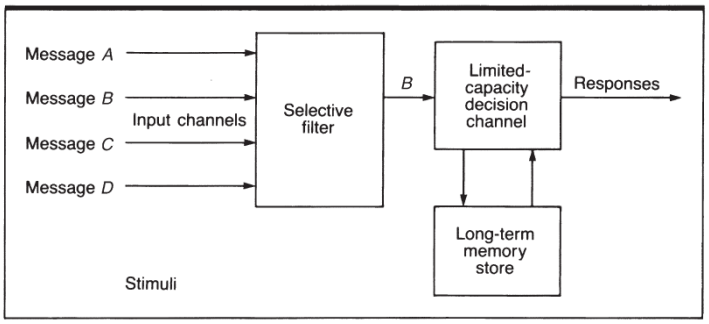
- Shadowing
  - to repeat words immediately
- Experiment
  - Shadow voice in one ear
  - Voice in other ear is manipulated
- Non-shadowed stimuli is barely perceived:
  - Speech vs. music: yes
  - Male vs. female : yes
  - Reversed speech? no
  - Content? no
    - a word presented 35 times was not recalled

Models of Selection

- Big question: where (at what level) selection happens?
- Early vs. Late
  - e.g. what level or stage of processing?
    - bottom up vs. top-down
  - What properties are selected?
    - physical (tone, loudness)
    - semantic (content, meaning)

Broadbent (1958)'s Early Selection Theory

- Messages are selected / filtered early by physical characteristics
- Only one message passes filter



Evidence against Early Selection

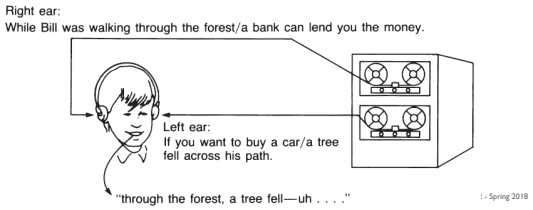
- Shadowing experiments
  - can't hear word presented 35 times
  - can hear your name presented once
  - can report gender of voice, etc.

Treisman (1960) Late Selection Theory

- Experiment:
  - Method: Shadowing when both voices are same person.
  - Results: success
  - Conclusion: can not be early selection

Treisman (1960) Late Selection Theory

- Experiment
  - Method: shadowing, content switches ears mid-sentence
  - Result: subjects switched (unconsciously) to other ear.
  - Conclusion: non-attended ear must be processed too



Early vs. Late?

- Evidence for both
- Physical stimuli can be selected
- Content can be selected

Inhibition and Negative Priming

- Inhibition - to suppress mental representation of salient (noticeable) but irrelevant information
- Suppress info that is "Strong but Wrong"
- Priming: facilitation (better performance)
- Negative Priming (reduced performance)

Attention as a Mental Resource

Attention as a Mental Resource

- Evidence
  - everyday limitations
  - dual task paradigms
  - shadowing
  - psychological refractory period (aka Attentional Blink) : short delay before next item can be processed

Automatic vs. Conscious Attention

Automatic	Conscious
without intention or decision	deliberate decision
not open to awareness or introspection	introspection
doesn't use resources	uses resources
usually fast (< 1 second)	slower (> 1 second)

Practice and Memory

- With training, conscious processes improve and become automatic
- From Explicit to Implicit

- Is memory required?
  - theory: automatic processing requires information to be stored in long term memory.

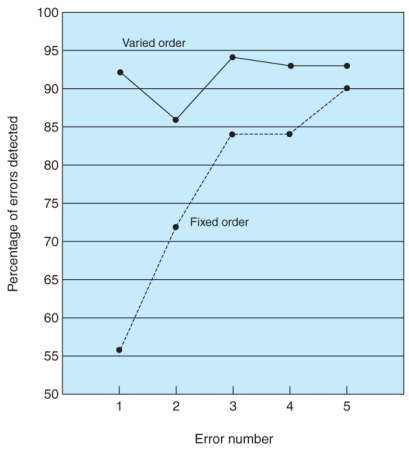
Attention and Automaticity

- Conscious tasks require resources
- E.g. average person limits: one demanding task or perhaps two less demanding tasks.

- Pros:
  - Automatic tasks require few resources
  - Automatic tasks aren't easily forgotten
- Cons:
  - Action Slips: accidental mistakes, often triggered when environment or situation is unexpectedly different.
  - Automatic behavior in wrong situation.

Proofreading

- Barshi & Healy (1993)
- Proofreading arithmetic problems
- Fixed order vs. Varied order



Mind Wandering

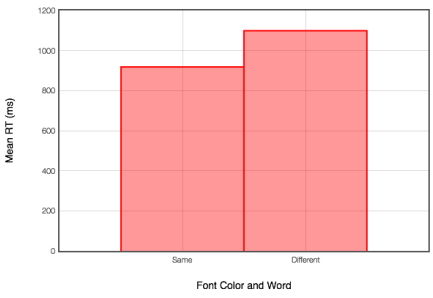
- Interesting finding : people with Higher working memory capacity are more prone to wandering mind

- Why?

CogLab 4: Stroop Effect

- Methods:
  - identify color of word
  - ignore word itself
- Theory
  - automatic processing (word reading)
  - facilitation
  - inhibition

Stroop Effect: Global Data



Stroop (1935)

- Reaction time data : similar to our CogLab data

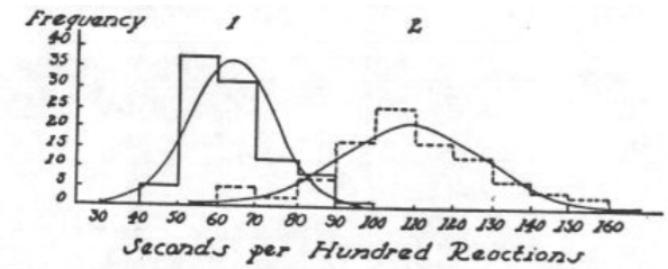
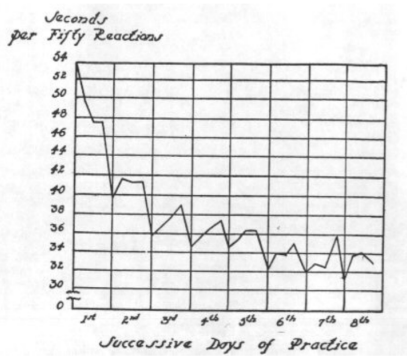


Fig. 1. Showing the effect of interference on naming colors. No interference (1); interference (2).

Stroop (1935)

- Effects of practice show clear improvement over 8 days of practice



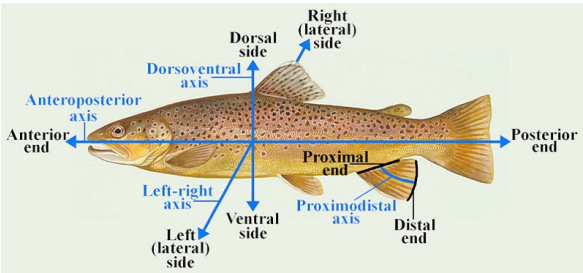
Stroop Effect

- Debriefing
  - Methods?
    - speaking words rather than pressing keys
  - Predictions
    - Inhibition when automatic process and conscious process interfere
  - Robust? Limitations?

Clinical Evidence

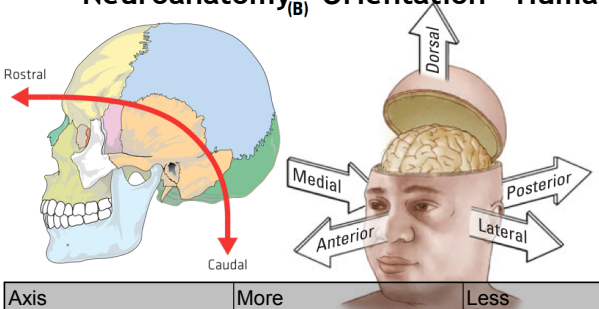
- Terminology:
  - lateral: side
  - ipsilateral: same side
  - contralateral: opposite side
  - bilateral: both sides
  - hemi: half
  - neglect: failure to attend to

Neuroanatomy - Orientation - Fish



Axis	More	Less
up/down	dorsal / superior *back / above*	ventral / inferior *belly / below*
front/rear	rostral / anterior *beak/nose*	caudal / posterior *tail*
left/right	medial *middle*	lateral *to the side*

Neuroanatomy - Orientation - Human



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Orientation - Other Terms

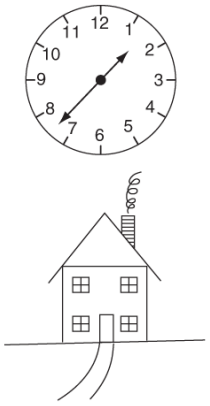
Topic	Description
symmetry	ipsilateral - same side contralateral - opposite sides bilateral - both sides
direction	afferent - toward efferent - away
front-rear relationship	pre- : in front of post- : behind
up-down relationship	superior - above medial - middle inferior - below

Hemineglect

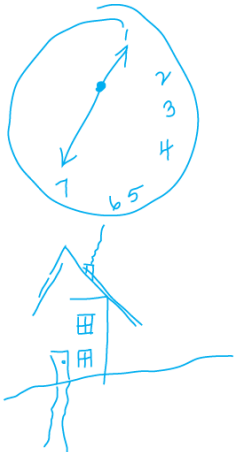
- See Sacks, Ch 8, “Eyes Right”
- Tends to be in Parietal lobes
- Aka “contra-lateral neglect”, “visual neglect”
- Not same as hemianopsia
  - (half - lack of - vision)
  - hemianopsia patients know they are missing something

Drawing Test

Model



Patient’s copy



Review for Midterm