Attention

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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. . . It implies withdrawal from some things in order to deal effectively with others, and is a condition which has a real opposite in the confused, dazed, scatterbrained state.

William James (1890) *Principles of Psychology*

Varieties of Attention

Focus on one task to exclusion of others
- Selectivity
- Inhibition of irrelevant information
- Ability to *shift* attention (disengage from one task and engage with another task)

Taking possession by the mind in clear and vivid form (maintaining focus)
- Vigilance – sustained attention to one task

Division of effort across multiple tasks
- Multitasking: Division of attention or allocation of processing resources to multiple tasks

Vigilance

Sustained attention

Example: Radar screen operators

Problems with boredom and distractibility

Lapses

- Missed signals
- Observers periodically disengage from tasks to monitor the environment
- Neurological aspects of periodicities in attention (Aue, Arruda, Kass, & Stanny, 2009)

Selective Attention Tasks

Ability to focus attention

- Cocktail party effect (Moray, 1959)
- Shadowing task (Cherry, 1953)
- Other dichotic listening tasks (Gray & Wedderburn, 1960)
- Stroop Task

Selection of one stimulus source, task, or response

Inhibition of other stimulus sources, tasks, or responses

Shadowing Tasks (Cherry, 1953)

Cocktail party effect (Moray, 1959)

Different messages delivered to each ear

Task : Repeat (shadow) the message in ***one*** ear

Dichotic Listening Task (Broadbent, 1954)

Two sets of digits (one set delivered to each ear)

- Participant reports by *time of arrival*
- Participant reports by *location* (left ear, right ear)

Evidence for Broadbent's idea of an attention ***bottleneck***: cost of reporting by location or switching channels to report by time of arrival

Late Selection Models: Evidence from Gray & Wedderburn (1960)

The cost of switching from one "channel" to another is less than predicted by an early selection model if switching can be based on *meaning*

Filter Model of Attention (Broadbent)

Attenuation Model of Attention (Treisman)

Divided Attention

Division of attention across multiple tasks

Questions:

Can attention be divided without loss in quality of performance on tasks?

What is the ***effect of practice*** on our ability to maintain task performance when attention is divided?

Stroop Task

Two cognitive tasks elicited by these stimuli:

- Read the word
- Name the ink color

Stimulus in third condition activates competing responses:

- Color name generated by reading
- Color name generated by perception of color

Must inhibit response to the irrelevant information to make the correct response for the task demands

Attention as Processing Resource

Attention as an allocation of capacity or resources for processing information

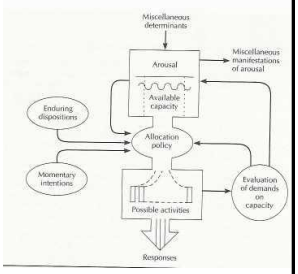
Kahneman (1973)

Attention and Effort

Role of arousal

Effects of practice

Potential for multitasking



Divided Attention

Shiffrin & Schneider (1977)

Automatic and Controlled Processing

Effects of practice

Demonstration of Shiffrin & Schneider task

What is the effect of practice?
Automatic & Controlled Processing

Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977

Controlled Processing

- Attentional processing
- Sequential, slow, flexible, requires resources
- Bottlenecks likely to occur during multi-tasking

Automatic Processing

- Distributed processing
- Parallel, fast, inflexible, requires few resources
- May be able to multi-task automatic processes

Multitasking while Driving

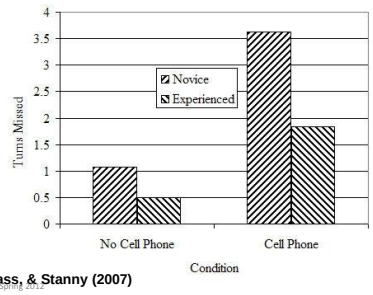
Driving task is inherently a multi-tasking problem

Shift from controlled to automatic processing for some aspects of the driving task (novice drivers vs. experienced drivers)

Distracted Driving

Impact of introducing additional tasks (radio, eating, cell phone, GPS, computers/texting)

Multitasking Application:
Driving while talking on a cell phone



Cole, Kass, & Stanny (2007)

Change Blindness (Inattention Blindness)

Cognition and Magic

Color Changing Card Trick

Basketball

Consequences of Divided Attention

Driving: ***Response times are slower*** when we multitask
Talking on a cell is equivalent to .08 BAL (Strayer et al.)

Advertising on web pages disrupts anagram solutions

- Delay beginning to work on anagram solutions
- More likely to skip solving any anagrams
- Take longer to read and comprehend web material
- Added effects of animated ads

Irrelevant content in textbooks

- Memory and understanding of main points in text is worse when irrelevant cartoons and side bars are present
- ***Relevant*** photos, cartoons, and other materials aid learning; irrelevant materials just distract

Feature Integration Theory

Treisman & Gelade (1980)

Distributed attention

- Process stimulus features in ***parallel***
- Processing is ***distributed*** across the spatial array
- Visual search process is dominated by feature detection

Focused attention

- Process stimuli ***serially***
- Attention is allocated to a ***specific spatial location*** to accurately integrate the features for stimulus in that location

Eye Movements and Attention

Focusing attention by directing eye movements toward attended areas

Focusing attention without eye movements

- Attending to a spatial location
- Attending to specific objects

Neurological Correlates of Attention

Orienting attention network

- Parietal lobe; active during visual search tasks & when attending to spatial locations
- Visual neglect when this area is damaged

Executive attention network

- Frontal lobe; inhibits automatic responses when task produces conflicting responses (e.g., Stroop)
- Top-down control of attention

Alerting attention network

- Orienting responses to novel stimuli

Disorders of Attention

Obsessive-Compulsive Disorder

Attention Deficit Disorder

Blindsight

- Damage to visual cortex, sub-cortical visual areas intact

Hemineglect

- Damage to parietal cortex
- Most case studies are right parietal cortex and left hemineglect; left parietal cortex damage may also include aphasia