

Automatic Processes

- Fast
- Require no attentional resources
- Outside of consciousness
- Obligatory

Stroop Effect

BLUE	GREEN	WHITE
RED	YELLOW	BROWN
PINK	BLACK	ORANGE

Stroop Effect

- Experiment I: Say the word.

<i>Incongruent</i>	<i>Congruent</i>
GREEN	BLUE
43.3 secs	41.0 secs (100 words)

- Experiment II: Say what color the word is printed in.

<i>Incongruent</i>	<i>Congruent</i>
GREEN	BLUE
110.3 secs	63.3 secs (100 words)

Kahneman & Henik



- Fixate in the middle, name ink color in circle
- Fixate in the middle, name ink color in rectangle
- Attention Matters
 - Reading is not completely obligatory

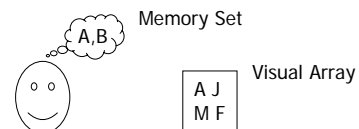
Automatic

- Without intention
- Not subject to introspection
- Few, if any, attentional resources
- Rapid (1 second or less)
- Inflexible

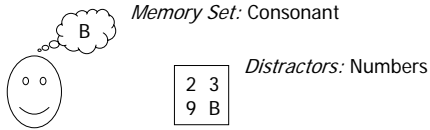
Controlled

- With intention
- Subject to introspection
- Uses most, if not all attentional resources
- Relatively slow (several seconds)
- Flexible

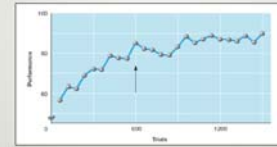
Memory Search Task (S&S)



Consistent Mapping

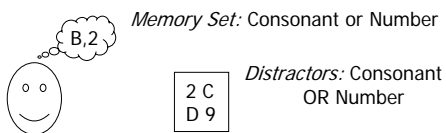


SCHNEIDER & SHIFFRIN (1977)



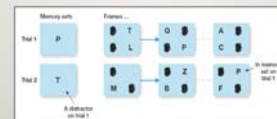
- Participants reported the task became **automated** after about 600 trials
- occurs without intention
- uses few cognitive resources

Varied Mapping



VARIED MAPPING

- Sometimes divided attention is not possible, and the person must rely on **controlled processing**
- Schneider & Shiffrin's **varied mapping condition**
- Letter could be distractor or in memory set



Schneider & Shiffrin

- Consistent Mapping (diff cat. distr.)
 - Memory Set Size (no effect)
 - Distractor Set Size (no effect)
 - 80 ms/trial for 95% accuracy
- Varied Mapping (same cat. distr.)
 - Memory Set Size (more is harder)
 - Distractor Set Size (more is harder)
 - 400 ms/trial for 95% accuracy
- Letter/Number distinction automatic: fast and done in parallel

Table 4.1 SUMMARY OF RESULTS INVOLVING CONSISTENT MAPPING AND VARIED MAPPING

Condition	Memory Set and Distractor Set	Processing	Effect of Increasing Memory or Distractor Sets
Consistent mapping	Always different because if one is numbers, the other is letters.	<ul style="list-style-type: none"> • Difficult at the beginning, during learning. • Becomes automatic processing after practice. 	No effect.
Varied mapping	Both are letters. A particular letter can be in the memory set in one trial, and then switch to the distractor set in a later trial.	Controlled processing.	Slower presentation needed. Performance decreases, even for slower presentation.

Problems w/S & S

- Redescription of data w/o explanation

Cheng

- Quantitative Effects
- Qualitative Effects
 - Restructuring

$$2+2=4$$
$$4+2=6$$
$$6+2=8$$
$$8+2=10$$
$$10+2=12$$
$$12+2=14 \dots$$
$$18+2=20$$

$2+2+2+2+2+2+2+2+2=?$

$2 \times 10 = 20$

Instance Theory of Automaticity (Logan)

- Each time stimulus encountered, traces stored in memory
- Practice
 - More info about stim and what to do w/it
- Practice
 - Rapid retrieval of info in response to stim

Instance Theory

- Race between memory & procedure
- $12+5=?$
 - If solved before, remember “17”
 - If not, calculate
- Needle Analogy
 - When needles easy to find, search works
 - When needles hard to find, make a new needle

Explains Characteristics

- Fast
 - Retrieve old solutions
 - (Don't compute anew)
- No Effect on Processing Capacity
 - Retrieval of overlearned material
- Unconscious
 - No processes intervene



Neisser; Simons

- Pick the white or black team
- Count the number of times their basketball is exchanged



Neisser; Simons

- Result:
 - over half the observers do not see the person in the gorilla suit
- **inattention blindness:**
 - Failure to see objects in the center of gaze due to allocation of attentional resources elsewhere
- Instead of a complete, detailed world, we only see a small part of it
 - the part we are attending to!

Related Phenomena

Change-blindness

- Occurs when attention is broadly distributed over a visual scene
- Can happen even when subject knows there will be a change
- Reflects
 - sparse nature of visual representation
 - need for focal attention to perceive objects

Inattention-blindness

- Requires focused attention on an engaging task
- Does not happen when subject is aware that an anomalous event might occur
- Reflects
 - role of top-down factors in perception
 - need for focal attention to perceive objects

Research Questions

- Does conversing on a cell phone interfere with driving?
- What are the sources of the interference?
- How significant is the interference?



Why Do Cell Phones Cause Interference?

- From earlier studies, no interference from:
 - Radio broadcasts (audio input)
 - Books on tape & recorded conversations (audio/verbal input)
 - Simple shadowing (audio/verbal input, verbal output)
- Implies active engagement in conversation necessary
- Impairments from both hand-held and hands-free units
 - Implies central / cognitive locus
 - Inattention-blindness (Neisser, Simons)

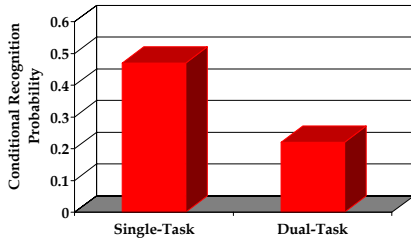


Experiment 1a: Inattention-Blindness

- Test for evidence of cell-phone induced inattention blindness
 - High-fidelity driving simulator
 - Hands-free cell phone
 - Naturalistic conversation with confederate
 - Eye tracker
- Two phases to the study:
 - Phase 1: Single & dual-task driving
 - Phase 2: Recognition memory tests for objects encountered while driving



Recognition Memory Given Fixation



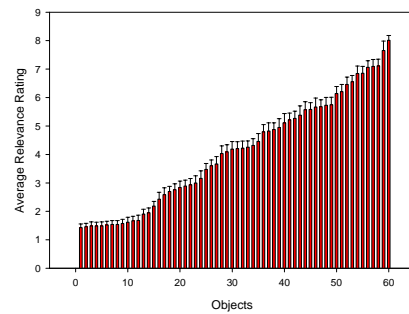
Experiment 1a: Summary

- 50% drop in recognition memory from single to dual-task, consistent with inattention blindness interpretation
- What about items more relevant to safe driving?
- Do drivers divert attention from processing items of low task relevance (e.g., billboards), but protect high task relevance items (e.g., pedestrians)?

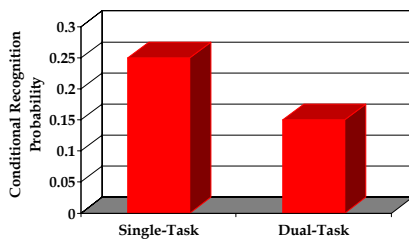
Experiment 1b: Effects of Traffic Relevance

- Phase I: Single & dual-task driving
 - Interstate driving (with traffic)
 - Hands-free cell phone, naturalistic conversations
 - Unique items placed in single & dual-task scenarios
- Phase II: Surprise 2AFC recognition memory test
 - Single-task items (driving only)
 - Dual-task items (driving & phone)
 - Control items (not seen while driving)

Driving Safety Relevance Ratings



2AFC Recognition Memory Given Fixation (Corrected for Guessing)



Cell Phones: Summary

- Cell phone conversations create inattention blindness for traffic related events/scenes
- Cell phone drivers look but fail to see up to half of the information in the driving environment
- No evidence that cell phone drivers protect more traffic relevant information
- Attention plays a critical role in seeing and remembering information in dynamic naturalistic environments



Selective Attention

- Visual attention needed for perception of objects (feature binding)
- Auditory attention needed for full processing of meaning
- Partial Selection Occurs Early
- Not Simple Physical Filter
 - Attenuates unattended information
 - Amplifies attended information
- Sensitive to:
 - Past Experience
 - Context
 - Arousal
- Late selection can also occur but requires more central processing resources

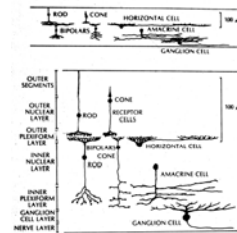
Resource Allocation

- Difficulty of dual task performance depends on
 - Task Similarity (multiple resources)
 - Task Difficulty (engagement of central processing resources)
 - Practice
- Practice doing two tasks together
 - Learn optimal strategies for switching tasks
 - Maximize use of multiple resources
- Practice doing each task individually
 - Automaticity
- Performance of multiple tasks is a complex process of:
 - allocating limited resources
 - using automatized routines



Sensory Register/Sensory Store

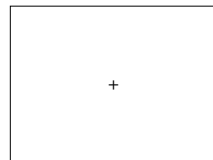
- Sensory Receptors
- Sensory Register (a.k.a. sensory store)
 - Iconic memory (vis)
 - Echoic memory (aud)
- Sensory Trace



Function

- Maintain input as perceptual processes extract its meaning

Capacity of Iconic Memory



- How much info can people extract from brief presentations?
- Visual Report Technique

Capacity

X	M	R	J
C	N	K	P
V	F	L	B

- Visual Report Technique
- Whole Report
 - 3-6 (usually 4 or 5)
 - People Complained!
- Partial Report
 - $\frac{3}{4}$
 - $3 \times 3 = 9$

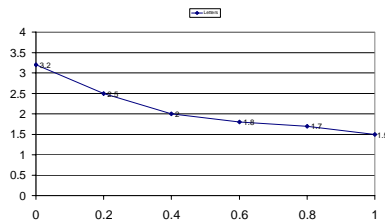
Duration of Iconic Memory

- How long does info stay in iconic memory?
- Visual Report Technique
- Vary time between offset of visual display and onset of partial report cue
- Time when partial report advantage no longer apparent is upper limit on duration

X	M	R	J
C	N	K	P
V	F	L	B

Duration of Iconic Memory

- Visual Report w/Variable Delay



“Forgetting” in Sensory Register

- Decay
- Displacement (new info overwriting old)
 - 1 sec for bright display
 - 5 secs for dark display
- Vary color of visual field after display
- Follow one display by another

Sensory Register is Precategorical

- Visual Report Technique
 - Array of Letters and Numbers
 - Partial Report
- Tone indicates whether letters or numbers to be reported
- No partial report advantage ☹️

What is the sensory register for?

- “Reading in a lightning storm.” Haber
- Perceptual continuity
 - Saccades
 - 24-100 ms
 - No visual input taken in during this time
 - Phenomenological Experience
 - Continuous world



Auditory Sensory Register

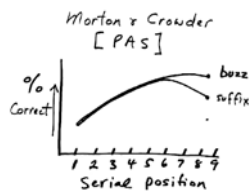


- Echoic Memory
- Darwin, Turvey, & Crowder (1972)
- Partial Report
 - Advantage 2-4 secs

Modality Effect

- Items at end of list remembered better if list is presented in auditory modality
- Echoic memory has longer duration than iconic memory

Suffix Effect



- Present list of 9 TBR words
- 10th word "go"
 - Signals list is over
- Error rates higher for recall of words 7-9 w/suffix than w/o
- Speech-specific?

Sensory Register

- Capacity
 - Complete
- Accuracy
 - Veridical
- Duration
 - Iconic: 1 second
 - Echoic: 2-4 seconds
- Forgetting Mechanisms
 - Rapid Decay
 - Displacement by new information
- Pre-Categorical
 - Advantage for size, color, brightness cues
 - Not for "conceptual" cues, word vs. number