

Methods in Cognitive Psychology

- What is cognition?
- How can we explain how cognition works?
 - Mental representations & mental processes.
- Research Methods (see Galotti, pp. 19-23).
 - Observation, Introspection, Experiments, Brain Studies.
- Experimental Methods in Cog Psych.
 - Reaction Time (RT) & Donders' Subtraction Method.
 - The Role of Baseline Conditions.
 - Accuracy & Signal Detection Theory.
- Excel Tutorial & Lab 1

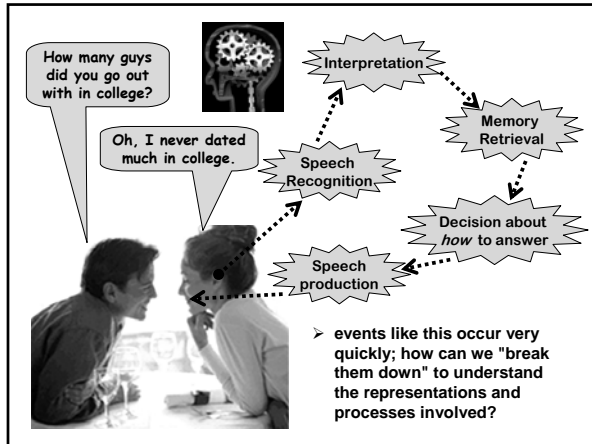


Mental Representations


- A representation is a physical state (e.g., marks on a page, magnetic fields in a computer, neural connections in the brain) that stand for something.
- Representations have two characteristics: A format (how it's realized) and a content (what it stands for).
- A lot of work in cognitive psychology is devoted to understanding the nature of mental (and/or neural) representations.
- Examples of mental representations include...
 - Memory traces.
 - Words in our "mental lexicon" (mind's dictionary).
 - Concepts.
 - Images.

Mental Processes

- Representations don't do anything unless they are processed (or interpreted).
- A process is the transformation of an input (e.g., a representation) into an output (e.g., speech).
- Much work in cog psych is devoted to discovering mental processes and understanding how they work.
- Most interesting cognitive activities reflect the operation of multiple processes.
- Examples of mental processes include...
 - Visual search.
 - Short-term memory.
 - Selective Attention.
 - Executive functions (planning, inhibition, etc.).




Reaction Time (RT)



- the time it takes to respond to something; usually the time between some stimulus (S) and some response (R).
- sometimes referred to as "mental chronometry".
- many cognitive processes occur very quickly and thus are measured in milliseconds (ms); 1 ms = 1/1000th of a second.

Reaction Time (RT)

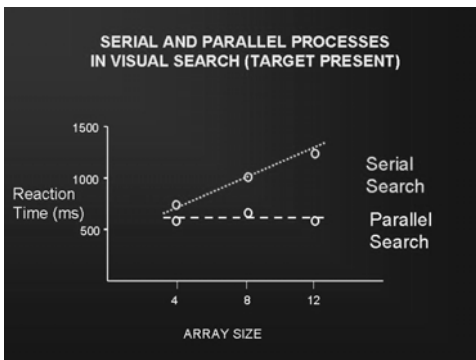
Is Visual Search Serial or Parallel?



Do we search the world serially, examining one item at a time?

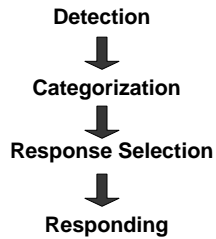
Or do we search in parallel, simultaneously examining all the objects in our visual field?

Reaction Time (RT)

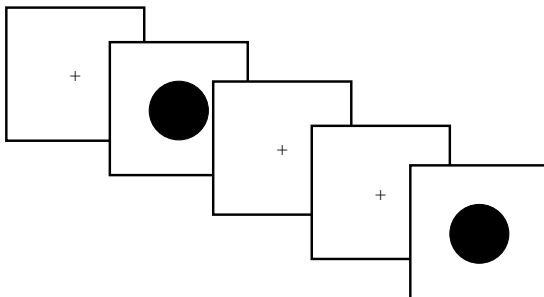


Reaction Time (RT)

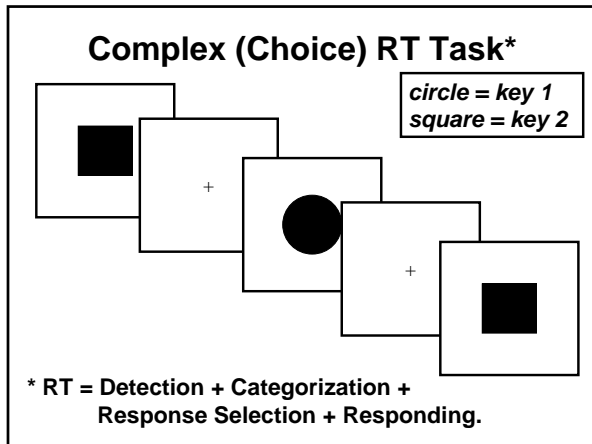
Processing stages and
Donder's (1868) subtraction method

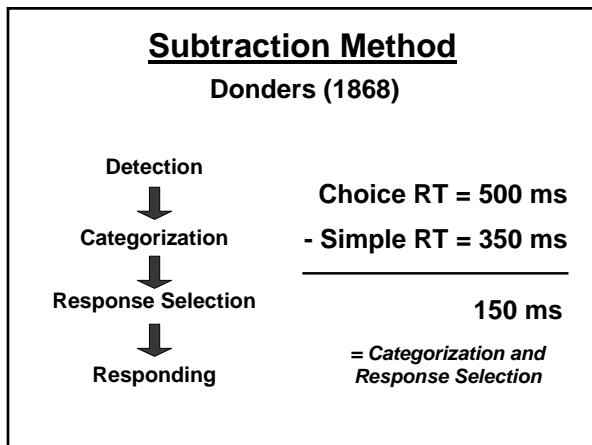


Simple RT Task*



* RT = Detection + Responding.





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The Role of Baseline Conditions

<u>Amount of sleep</u>	<u>Memory performance</u>
1 hour	65%
8 hours	68%

Baseline condition

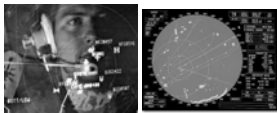
Take-Home Message: You can't learn much from an expt without an appropriate baseline or comparison condition.

The Role of Baseline Conditions

Imagine you want to test a person's memory. To do so, you show them a list of 50 words and then, after a delay, show them those words again and ask if they remember seeing any on the previous list (saying "yes" if they did, "no" if they didn't).

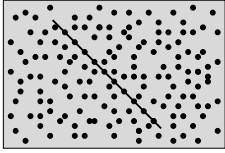
	<u>Studied words</u> (% "yes")	<u>Unstudied words</u> (% "yes")
Subject A	85%	75%
Subject B	65%	15%
	↑ Hits	↑ False Alarms

Accuracy in Detecting Signals



		<u>Stimulus Present?</u>	
		Yes	No
<u>Subject's Response</u>	"Yes"	HIT	FALSE ALARM
	"No"	MISS	CORRECT REJECTION

Signal Detection Theory



Does the "star field" to the left contain a set of 10 equidistant dots arranged in straight line that slants downward from left to right?

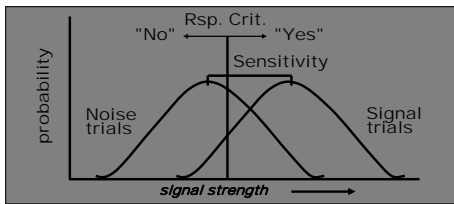
Stimulus Present?

	Yes	No
"Yes"	HIT	FALSE ALARM
Person A:	90%	50%
Person B:	60%	20%

Signal Detection Theory

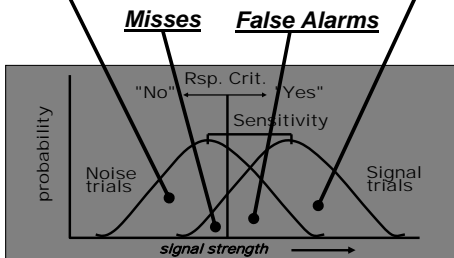
Assumes that detection reflects 2 processes.

1. **Sensitivity** - Person's true ability to discriminate targets (signal) from non-targets (noise).
2. **Response Criterion (Bias)** - Person's tendency to claim they have detected a signal ("yes").



Signal Detection Theory

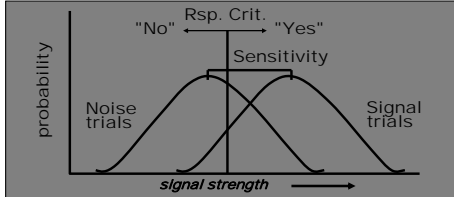
Correct Rejections



Signal Detection Theory

➤ Applies to....

- **Memory**
 - **Medical Decisions**
 - **Radar Operators**
 - **Baseball**
- etc. etc. etc...



Signal Detection Theory

Situation A:
Hit = +\$10
FA = -\$1

Situation B:
Hit = +\$1
FA = -\$10

Stimulus Present?

	Yes	No
"Yes"	HIT	FALSE ALARM

Situation A:	90%	70%
Situation B:	45%	5%

Type I & Type II Errors

- Type I & Type II errors have many real-world consequences...

		True state		
		Null is true (no operation needed)	Null is false (operation is needed)	
Decision	Reject null (operate on patient)	Type I error False Alarm	Correct decision	➤ In the hospital.
	Accept null (don't operate)	Correct decision	Type II error Miss	

		True state		
		Null is true (innocent)	Null is false (guilty)	
Decision	Reject null (find guilty)	Type I error False Alarm	Correct decision	➤ In court decisions...
	Accept null (find innocent)	Correct decision	Type II error Miss	
