

9.6 Variable Minds

Variability in Processing

- Only recently has large variation been treated as something other than “noise”
- Theories tested on commonalities, not differences
- Background like age and first language affect performance in tasks
- Observing shortcomings and successes of those with damage in specific areas can inform about that brain region’s purposes

Memory Span

- Many researches believe memory span determines understanding of difficult sentences (ex. Garden path sentences)
 - Should be able to predict performance on difficult sentences by their working memory span

A capacity theory of comprehension: Individual differences in working memory (Marcel Just and Patricia Carpenter (1992)

- Compared performance in language processing between subjects with high and low memory spans
- Measured using the Reading Span Test (developed by Meredyth Daneman and Patricia Carpenter in 1980)
 - Participant is given cards with one sentence on each and is then prompted by a blank card to recall the last word in each sentence in order. The number of sentence cards is increased until participant fails to recall a word.
- Subject with low memory span were significantly slower at reading object relative clauses (ex. He is the jogger who ran here.) while those with high memory span slowed down less
- Researches debate if object relative clauses are difficult because they require more processing or because they don't occur often

Experience Based Argument for Sentence Comprehension

- Maryellen MacDonald and Morten Christiansen (2002) criticized the reading span test for not considering if performance is linked to experience in reading
 - Better readers don't need to expend as many resources to recall the last word of a sentence because they trained the skill through exposure
 - People with more experience in reading are more likely to have come across more object relative clauses, especially because uncommon structures is more used in written language than spoken
- Reading Span Test is also criticized for being based on the wrong idea of memory (Amount of information given vs. complexity of information given)

Cognitive Control

- also called executive function, the cognitive processes that decides what to focus on and influences reactions to stimuli
- Differentiate between background chatter and conversation
- Help ignore unproductive impulses (ex. Drive your car into a tree)

Left Inferior Frontal Gyrus (LIFG) Damage

- Prefrontal cortex seems largely responsible for cognitive control, as damage to region negatively impacts performance on cognitive control tests such as the Stroop Test
- Participants in a Stroop Test are asked to name the font color of a word while ignoring the word meaning
- Patients with LIFG damage also struggle with garden path sentences and deciding between meanings of words with multiple possible definitions

Example of a Stroop Test:

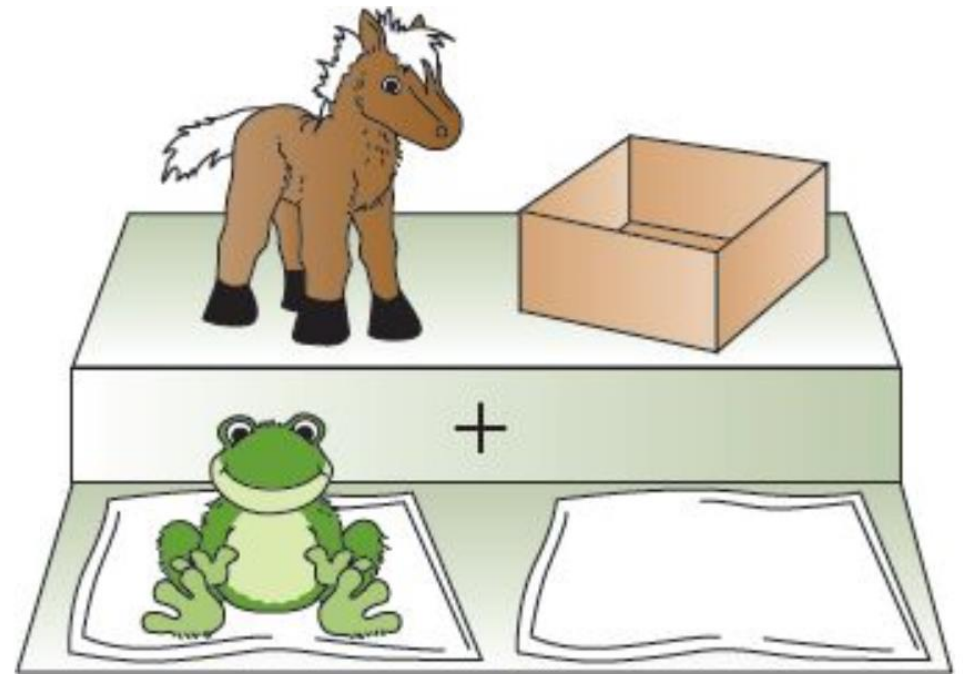
Red yellow blue orange red
Brown purple yellow black

Example of multi-meaning word:

The woman *chewed* the man out.

The kindergarten-path effect: Studying on-line sentence processing in young children (Trueswell 1999)

- Children have less developed prefrontal cortexes that cause them to have lesser cognitive control when compared to adults
- To test this, Trueswell conducted an experiment where 5-year-olds followed instructions given in a garden path sentence
 - When tasked to “put the frog on the napkin into the box,” they often moved the frog to a different napkin than to the box, suggesting they had difficulty disregarding their prior understanding of the sentence
 - When adults were confronted with the same test, their path of vision would originally follow frog->napkin->box before quickly correcting to frog->box



N-Back Test

- The n-back test is a memory test that requires participants to view a series of symbols and determine if the current symbol is the same as the symbol a set amount prior. This test can also be performed with lures, distractor symbols that are similar to the current symbol

(A) Low-conflict training (4-back version without lures)

----- s -----	r -----	P -----	v -----	S -----	M -----	q -----	v -----	T -----	n -----	Q -----	R -----	L -----	b -----	w
NO	NO	NO	NO	YES	NO	NO	YES	NO	NO	YES	NO	NO	NO	NO

(B) High-conflict training (4-back version without lures)

----- p -----	t -----	W -----	P -----	n -----	T -----	r -----	t -----	Q -----	B -----	r -----	S -----	m -----	q -----	C
NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO	NO

Memory and Language Improvements Following Cognitive Control Training (Hussey 2017)

- Hussey conducted both the low-conflict and high-conflict versions
- Found a reduced garden path effect in ambiguous sentences for subjects who practiced with the high-conflict task instead of the low-conflict task, and no difference for object relative vs. subject relative clauses
 - Ex. While the thief hid the jewelry that was elegant and expensive sparkled brightly (ambiguous) vs The jewelry that was elegant and expensive sparkled brightly while the thief hid (unambiguous) (pg. 389)
- Performance was improved on the interpretation speed of the garden path sentence because of its similarity to the n-back test, but was too specific to affect other sentence types

Sources

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