Cognitive Neuroscience of Language:

18: Memory and language

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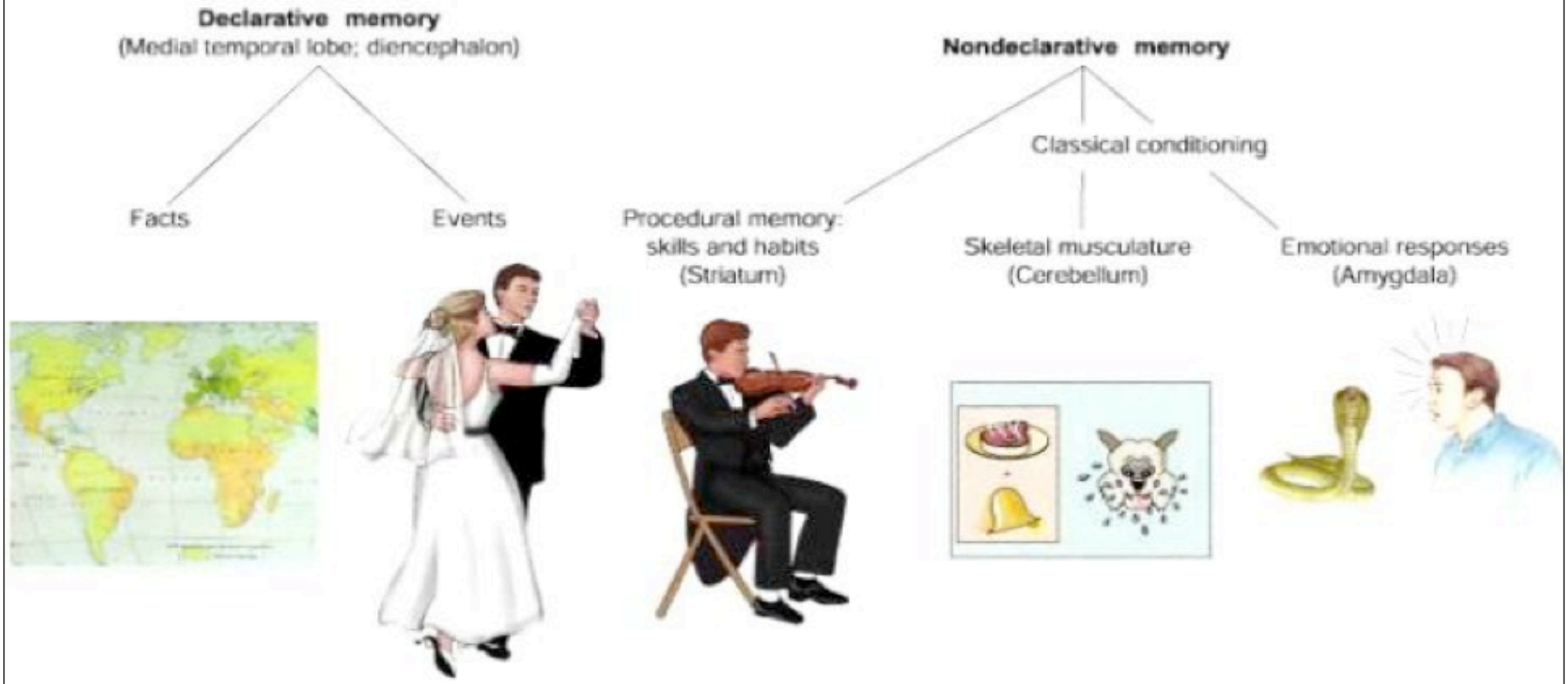
Goals

Look at language representation and processing with respect to different kinds of memory, and consider how much is language specific

Reading

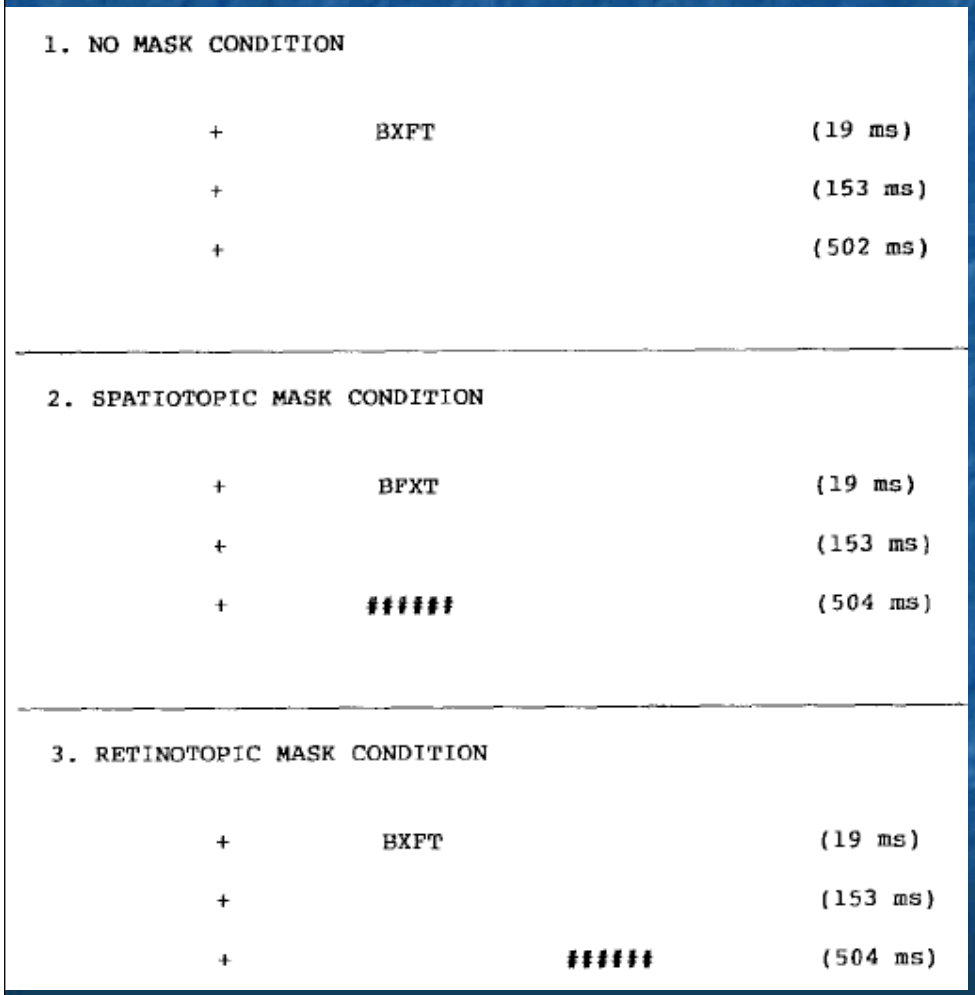
Jonides, J. & Smith, E.E. (1997). The architecture of working memory. In (M.D. Rugg, Ed.) *Cognitive Neuroscience*. Psychology Press; Hove.

Types of memories



Sensory memories

Sperling (1960)



Iconic memory: immediate 100–250 msec visual stores, including afterimages, as shown by a partial report paradigm. McRae *et al.* (1987) show both retinotopic and spatiotopic components.

Sensory memories

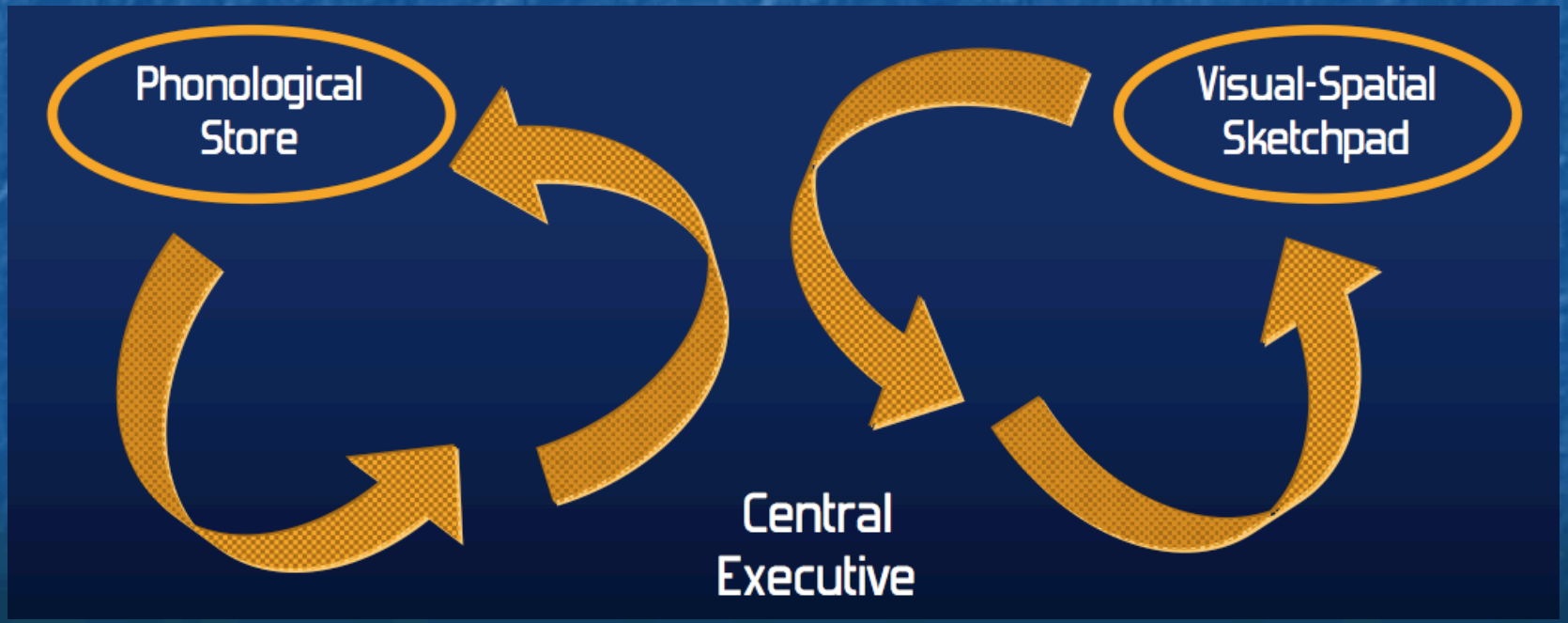
Echoic memory: immediate <1 s and 2–10 s auditory stores, including afterimages Cowan (1984)

Mismatch negativity (MMN) (Näätänen *et al.*, 1978) – an ERP signature, with strong frontal components, of cortical detection of stimulus change, not attention-dependent

Kujala *et al.* (2003): some dyslexics show reduced MMN over LH and elevated effects of backward masking

Short-term memory

Short-term memory dissociates from long-term storage, but does not seem unitary (Baddeley & Hitch, 1974)



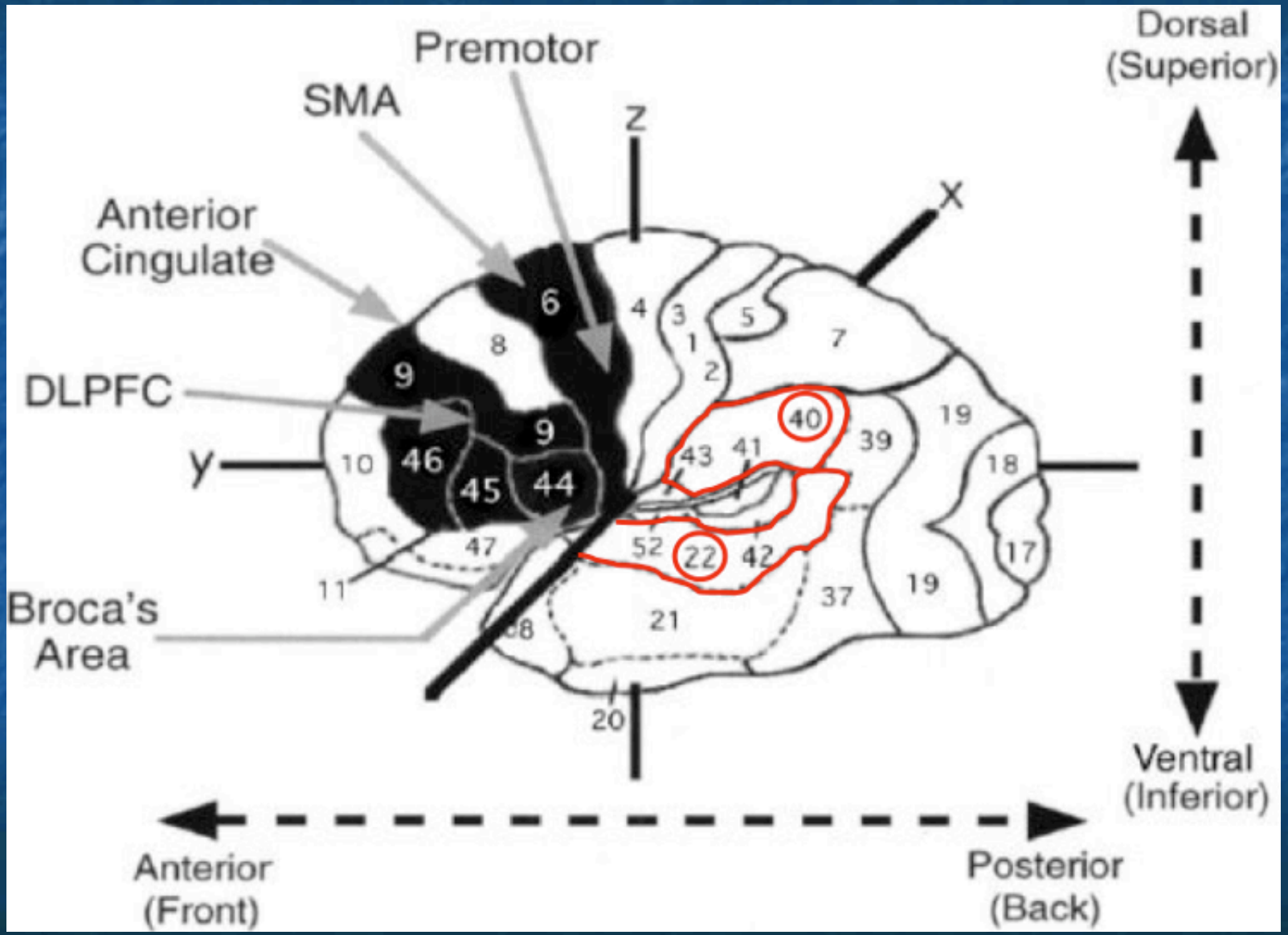
Verbal working memory

Short-term verbal memory dissociates into storage and rehearsal, where rehearsal is equivalent (but not identical with) subvocal rehearsal

Left posterior parietal cortex is implicated in storage

Left prefrontal cortex (inferior frontal gyrus, premotor cortex, supplementary motor area) is implicated in rehearsal

WM and Brodmann Areas



Storage *vs.* rehearsal

Awh *et al.* (1996)

A PET study showing the dissociation of storage and rehearsal

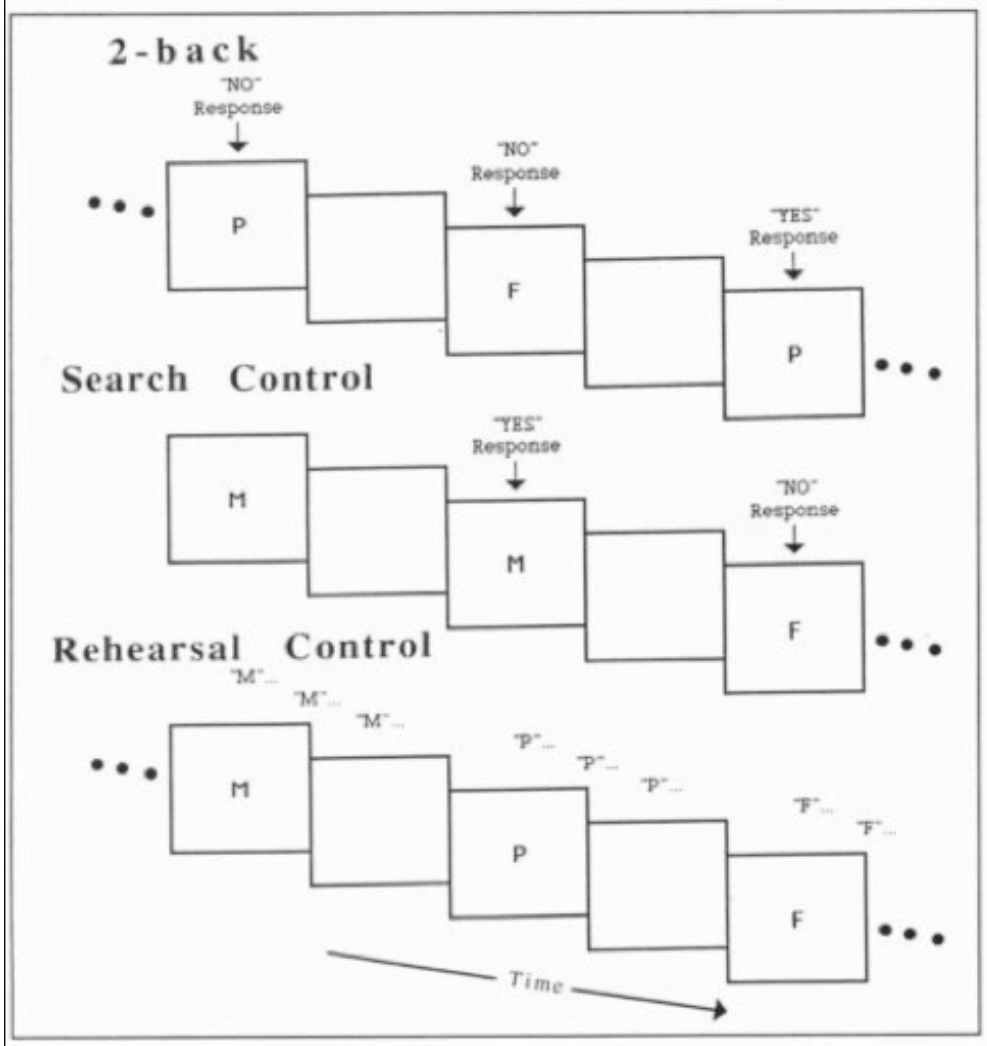
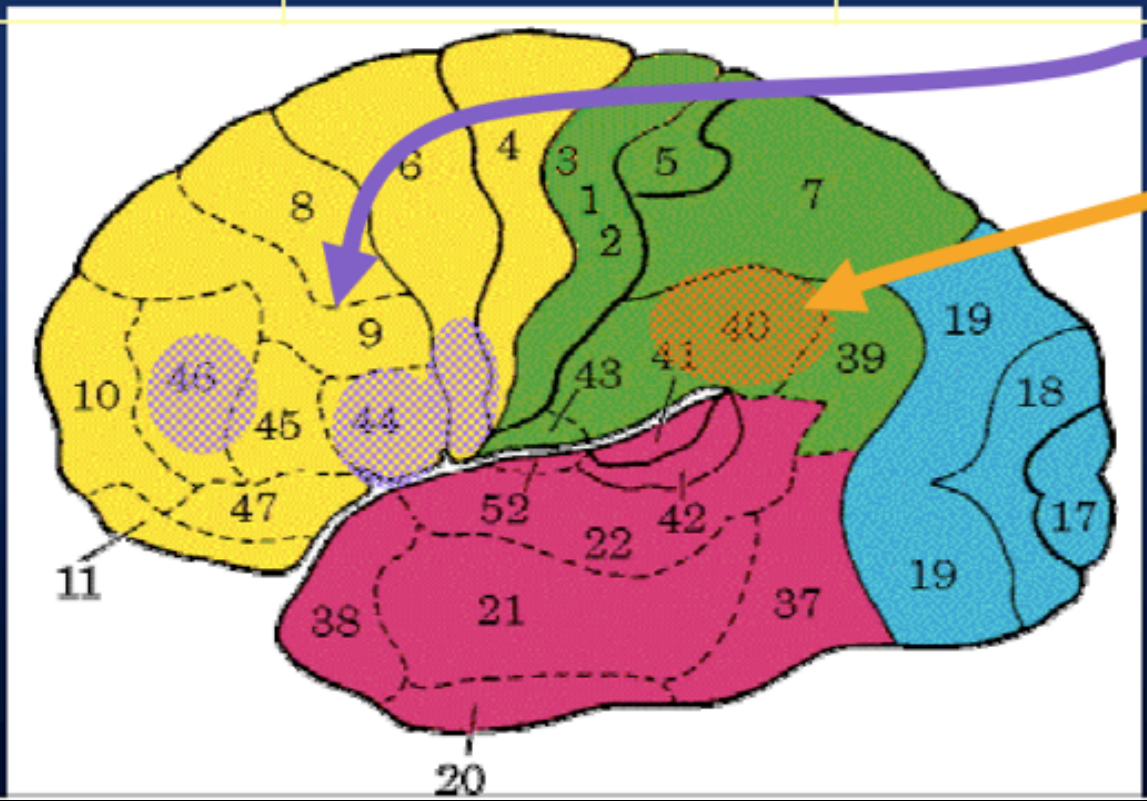


Fig. 2. Sequence of events and appropriate response for each item in sample series from the 2-back condition, search control condition, and rehearsal control condition in Experiment 2.

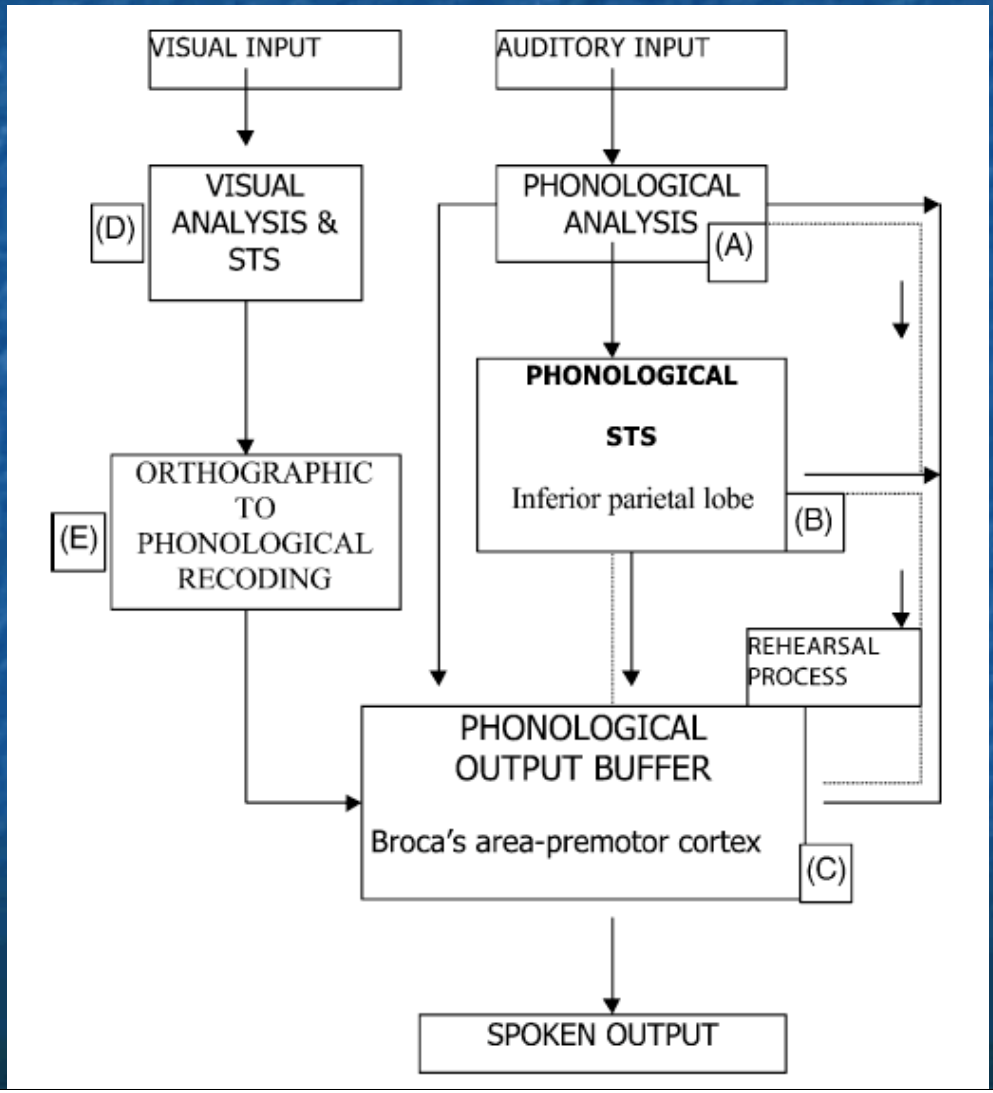
Neuroanatomical evidence

Phonological Short-term Mem.	*Cortical Area*	*Hemisphere*	*Brodmann Areas*
Storage	Posterior paretial	Left	40
Rehearsal	Broca's area Premotor cortext	Left Left	44,6 6



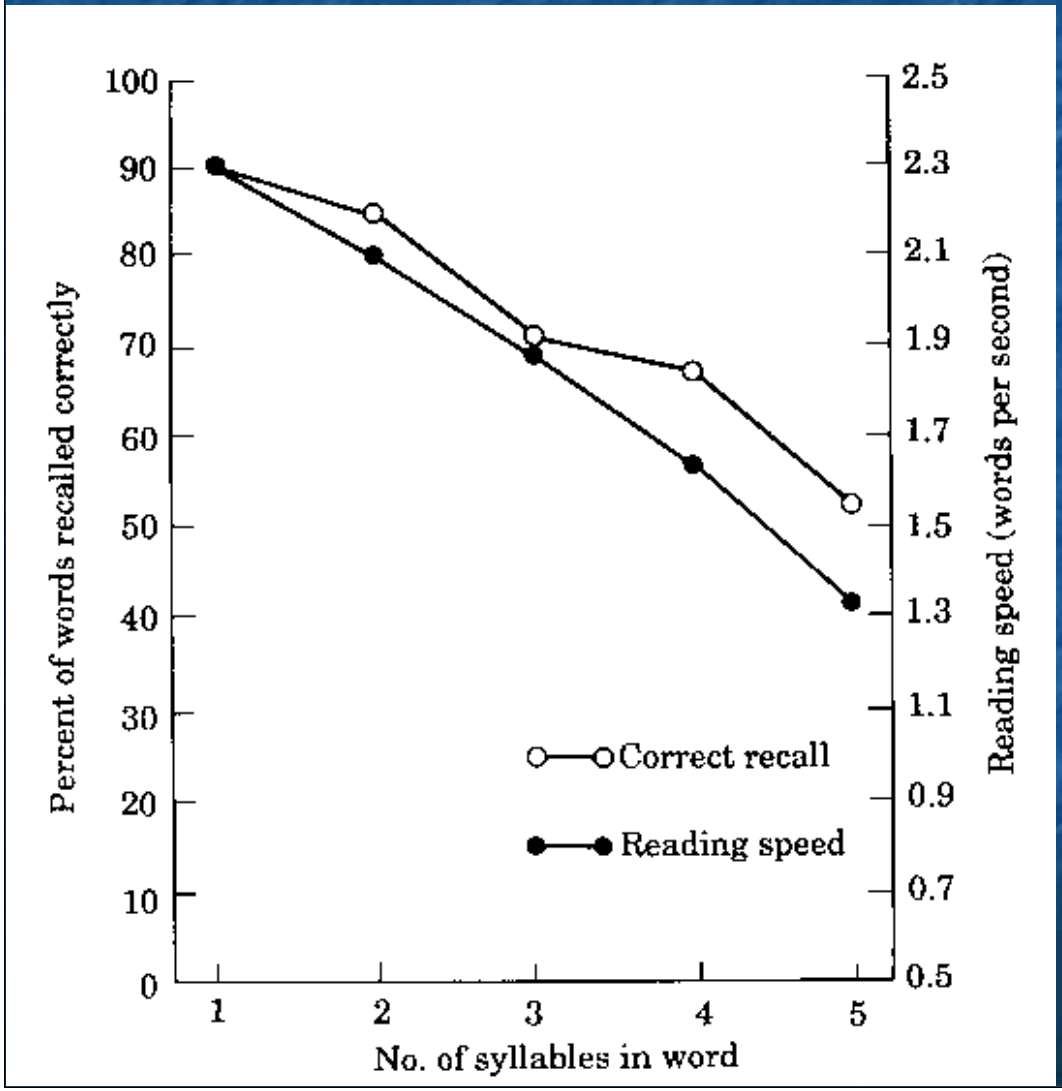
Model of phonological loop

Vallar & Papagno (2002)



Word length, reading rate and recall

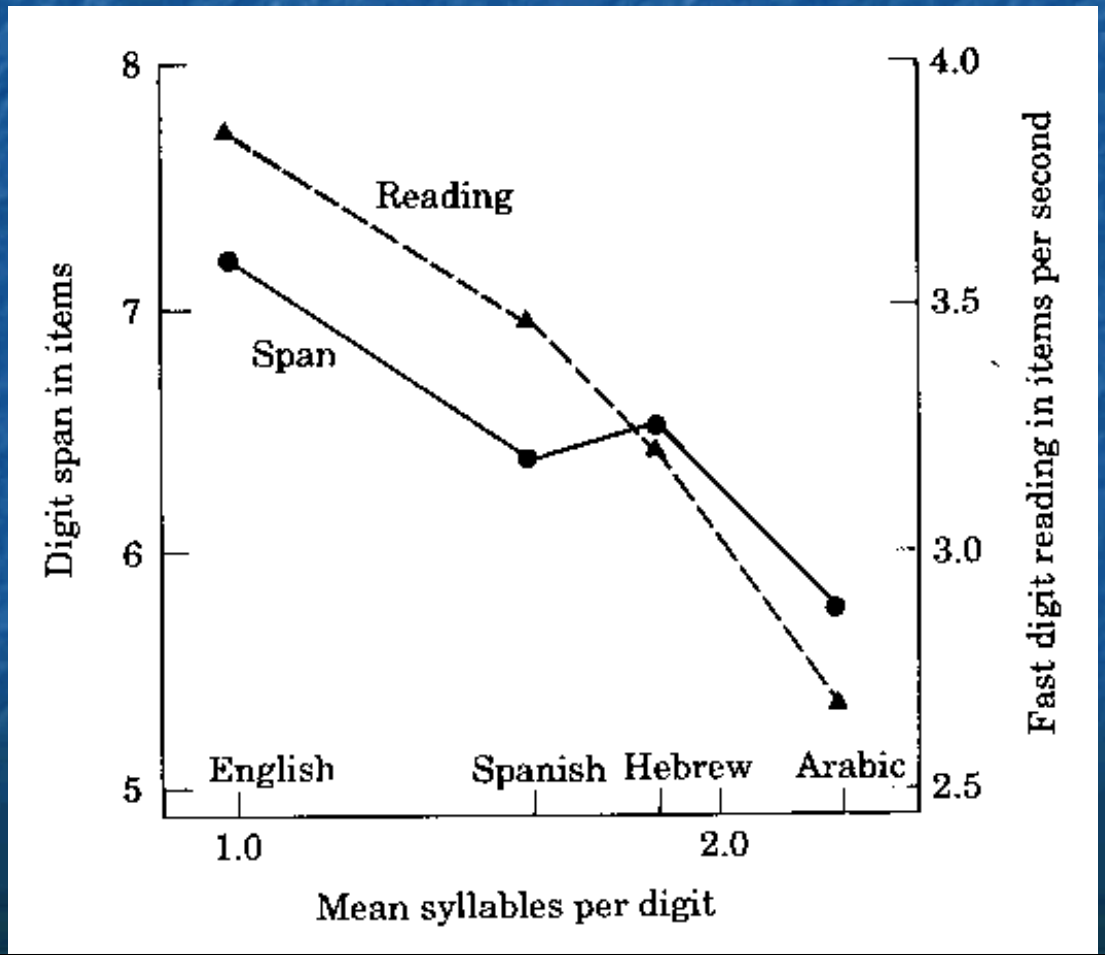
Baddeley *et al.* (1975)



Also, words like *harpoon* and *labile*, with long vowels, are more demanding than words like *bishop* and *wicket*.

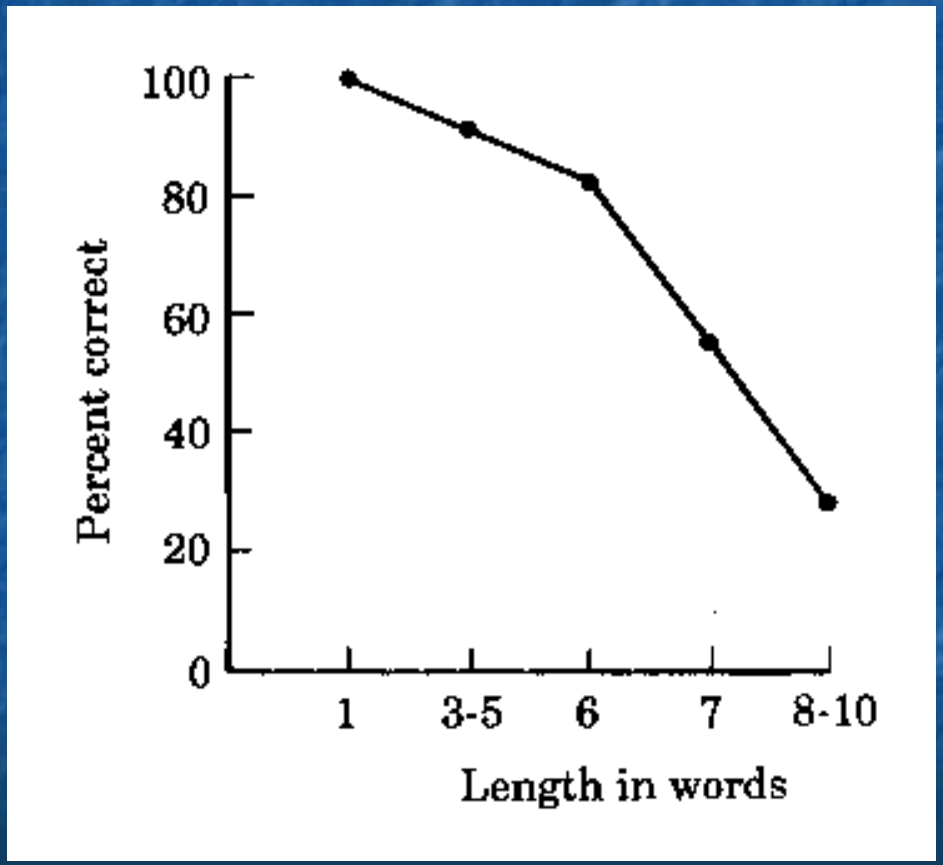
Memory span and reading rate across four languages

Naveh-Benjamin & Ayres (1986)

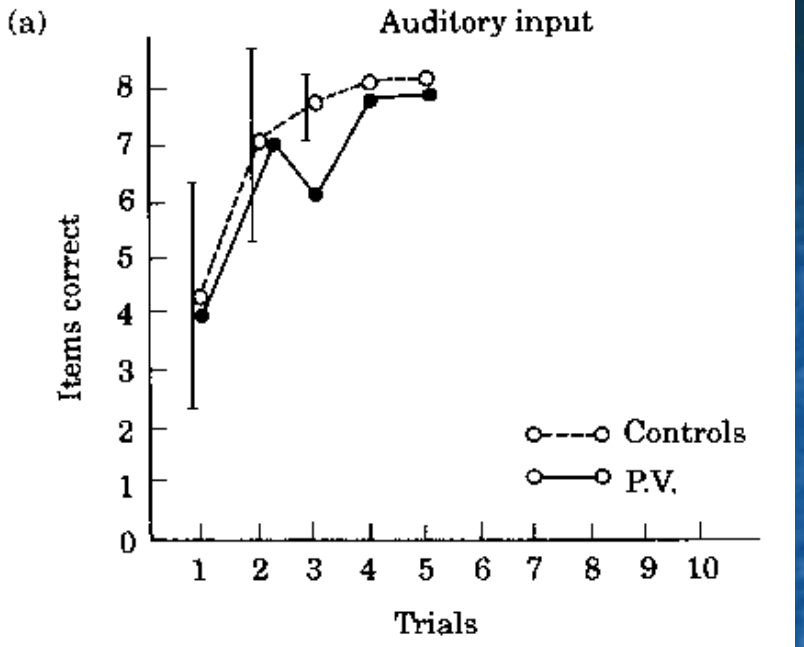


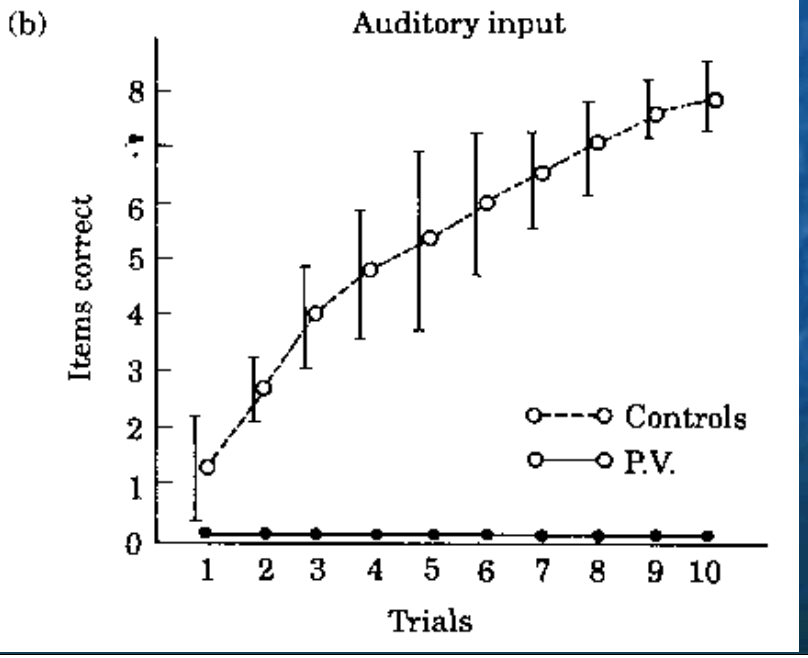
Memory and sentence comprehension

Baddeley & Wilson (1988)



TB (with impaired STM) found longer sentences harder to comprehend





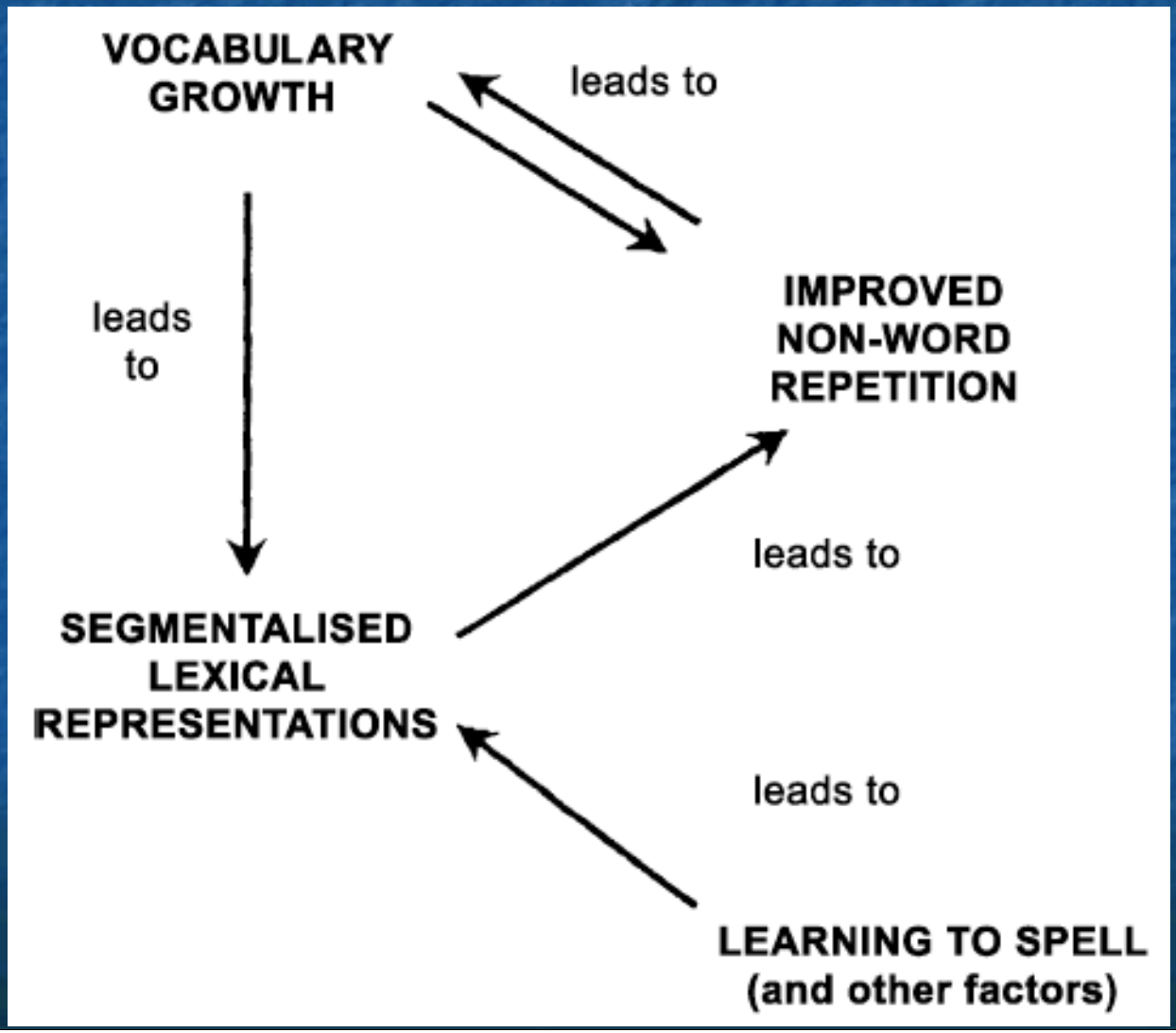
Role of the phonological loop

Baddeley, Papagna & Vallar(1988)

Patient PV leaning paired associates with (a) both known words, (b) one known and one unknown word, suggesting a role for the PL in vocabulary acquisition

An alternative proposal

Brown & Hulme (1996)



Reading span

Daneman & Carpenter (1980)

(1) When the last his eyes opened, there was
no gleam of triumph, no shade of anger.

(2) The taxi turned up Michigan Avenue where
they had a clear view of the lake.

(3) …

Syntactic complexity and working memory

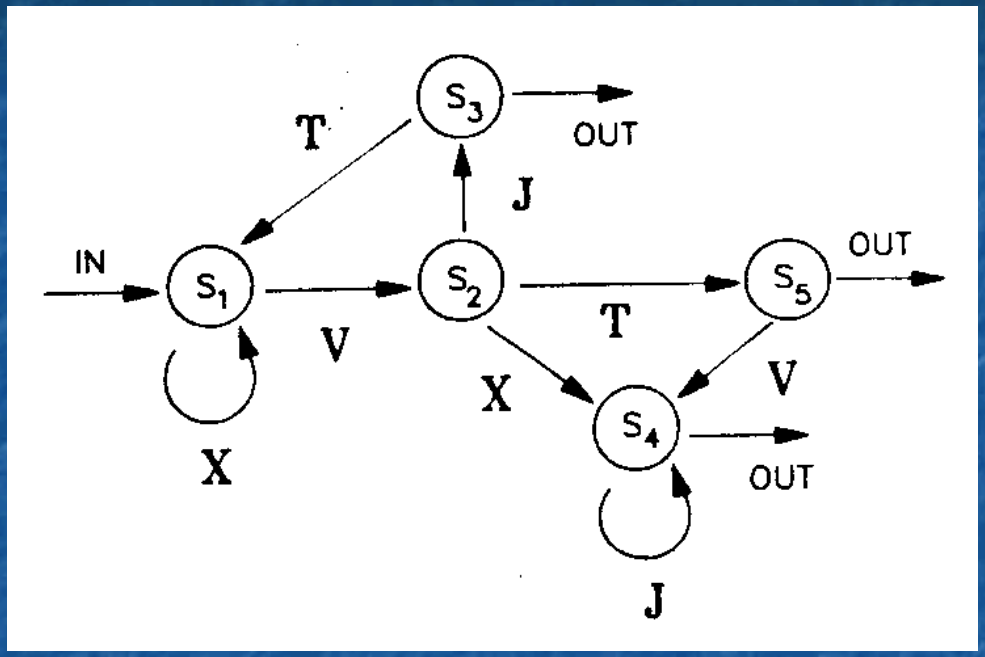
MacDonald *et al.* (1992)

(1) The experienced soldiers warned about the dangers before the midnight raid.

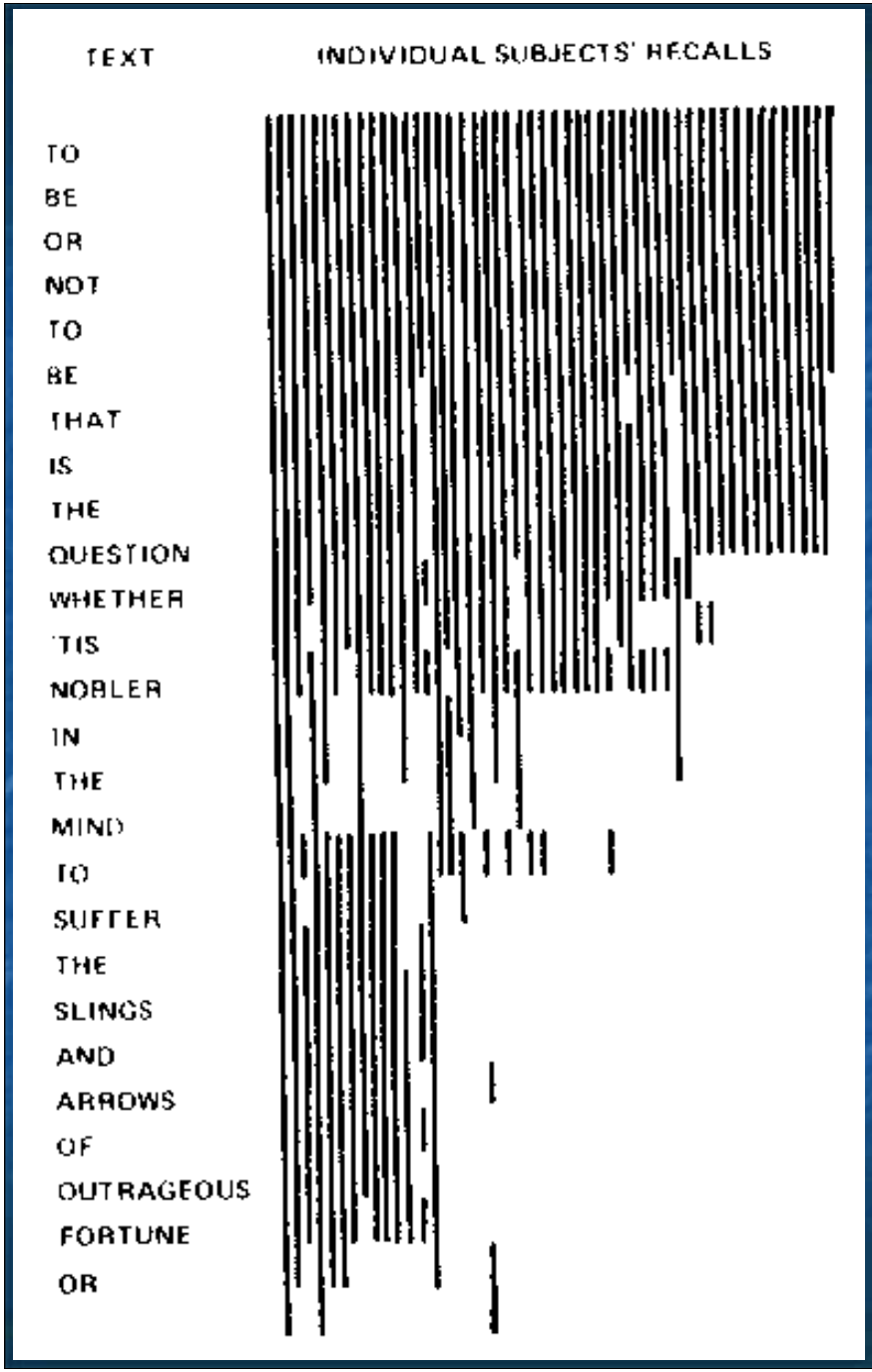
(2) The experienced soldiers warned about the dangers conducted the midnight raid.

The claim is that individual differences in verbal working memory predict performance on language comprehension tasks. Alternatively, there may be a more complex role for language esxperience (MacDonald & Christiansen, 2002).

AGL learning of FSGs



Learning of simple strings has been studied since Reber (1969) to look at "grammar learning". Alternative accounts suggest fragment learning and abstraction at test may also account for the transfer data (*cf.* Redington & Chater, 1996)



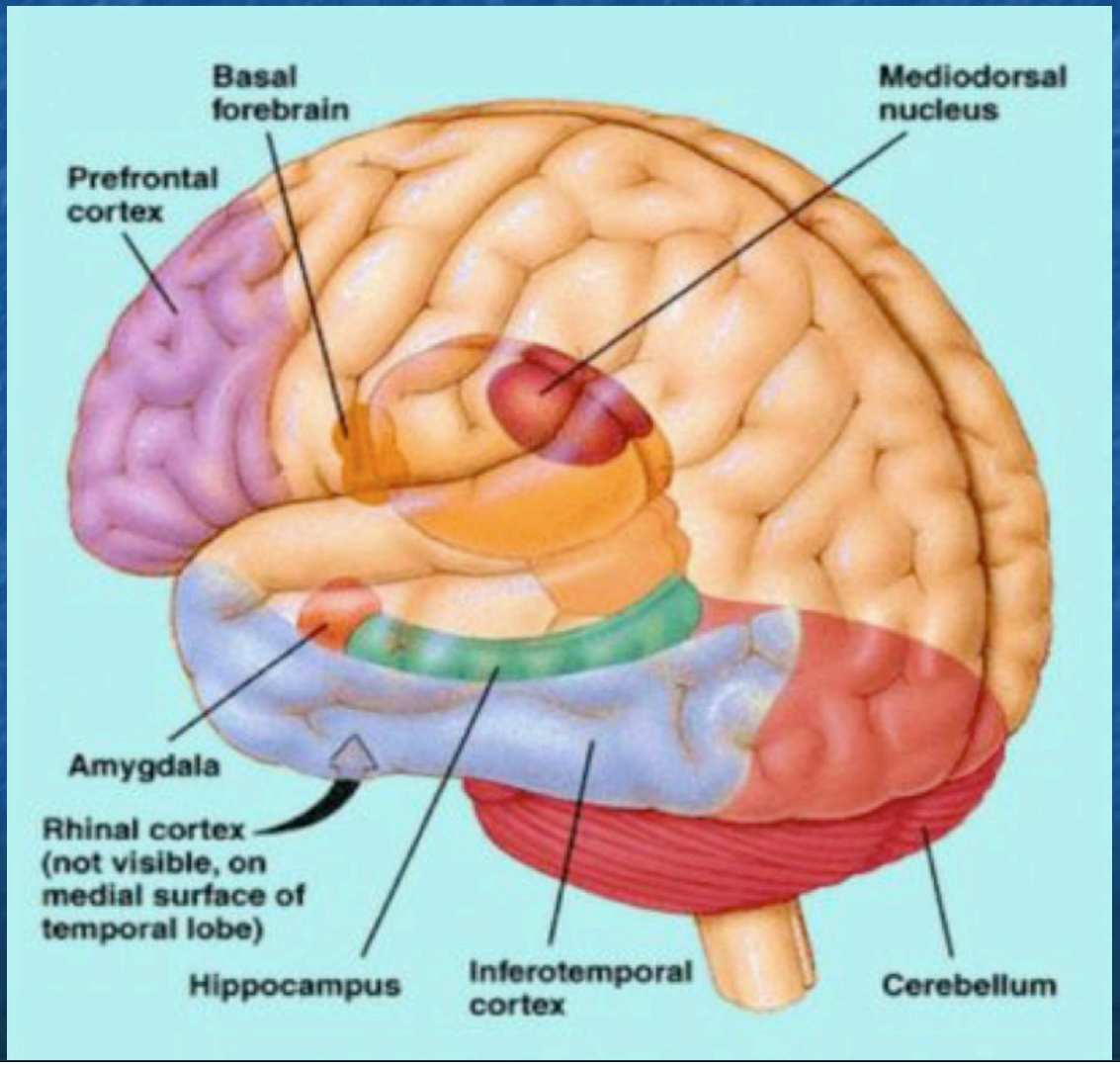
Longterm storage

Rubin, 1977

Long-term storage can be investigated by looking at recall of poems, speeches, *etc.*

Prosody, clause structure, *etc.* seem to play a role.

Longterm storage and the limbic system



Abstractionist *vs.* episodic storage

Does stored linguistic information retain traces of its origins, or is it amodal?

The DRM paradigm shows that visual field can affect the nature of a word used to search a memory experience (Bellamy & Shillcock, 2007)

We do seem to retain detailed traces of spoken words, which affect speaking (Goldinger & Azuma, 2004)

Conclusions

Verbal short-term memory is implicated in vocabulary learning, although it need not be seen as specifically linguistic

Polarities such as abstractionist *vs* episodic, amodal *vs* modality-specific, need to be cashed out neuroanatomically, rather than one pole of the relationship being pursued