Memory

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introduction

A definition: "memory is a function that permits animals and people to acquire, retain and retrieve many different kinds of information".

David Sherry & Daniel Shacter, 1987, Psychological review

Introduction: different characterizations of memory
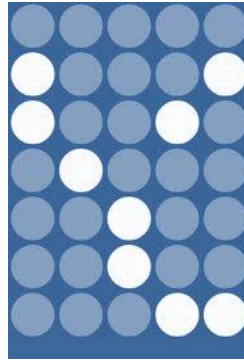

Remember a flashed image
Iconic memory

Need to borrow
working memory

Remember your trip
to Tunisia last
summer
Long term memory

Time scale

Introduction: different characterizations of memory

Do manage with music?
Motor skills implicit

Have you been to Tunisia?
Episodic memory explicit

Where is Tunisia?
Sematic knowledge

The content of the memory

Introduction: different characterizations of memory

Consolidating
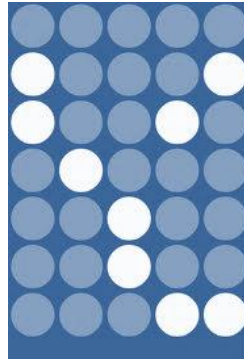
Encoding

Retrieving

Methodological issues: neuropsychology

- Patient HM: William Scoville & Brenda Miller

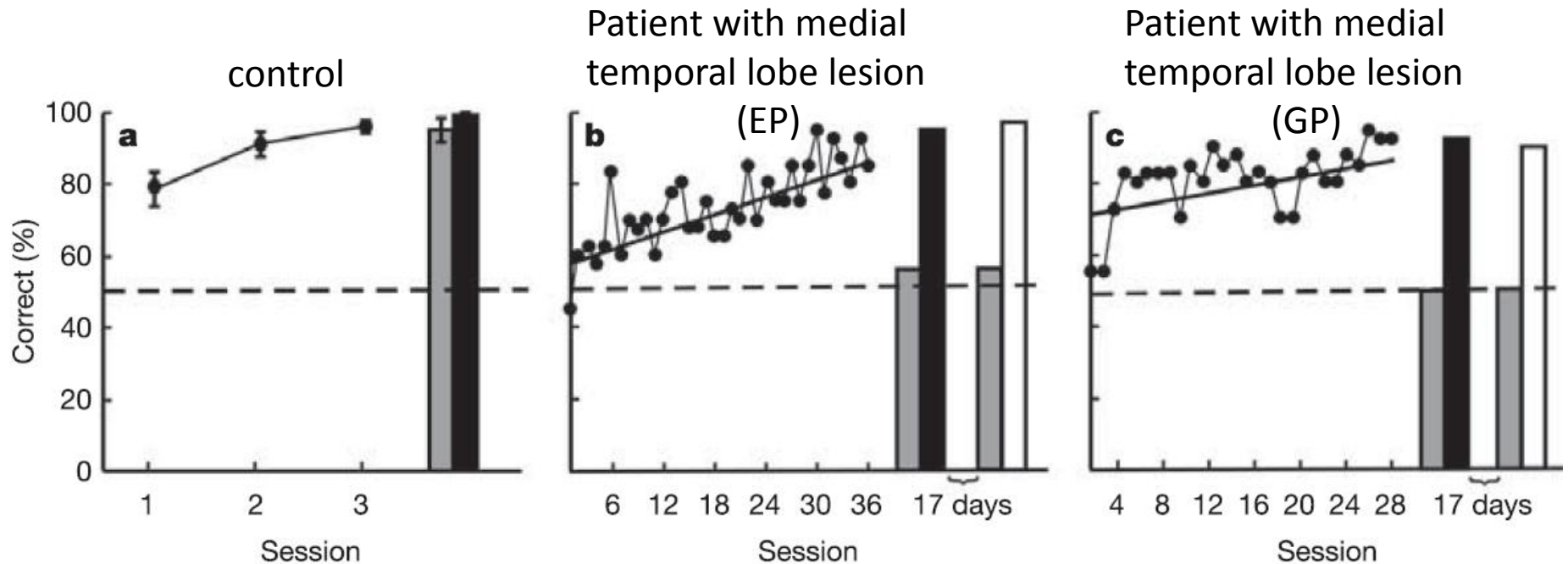Removed: bilateral amygdala, hippocampal formation and part of the association areas of the medial temporal cortex

Methodological issues: neuropsychology

- HM: anterograde amnesia + limited retrograde amnesia

Methodological issues: neuropsychology

control

Patient with medial temporal lobe lesion (EP)

Patient with medial temporal lobe lesion (GP)
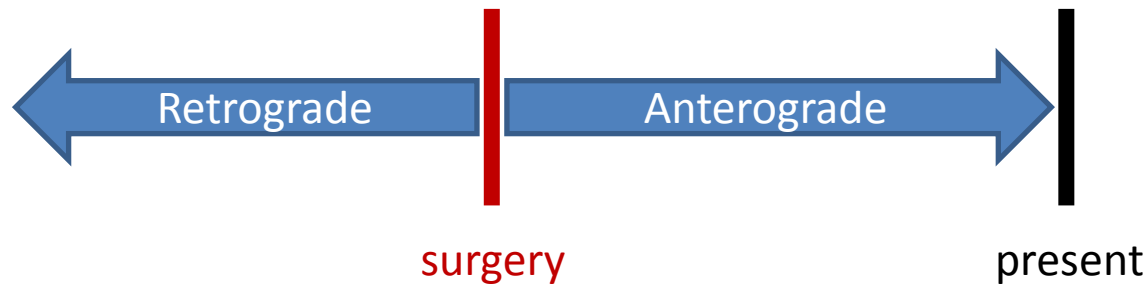
Task: learn to pair items verbally
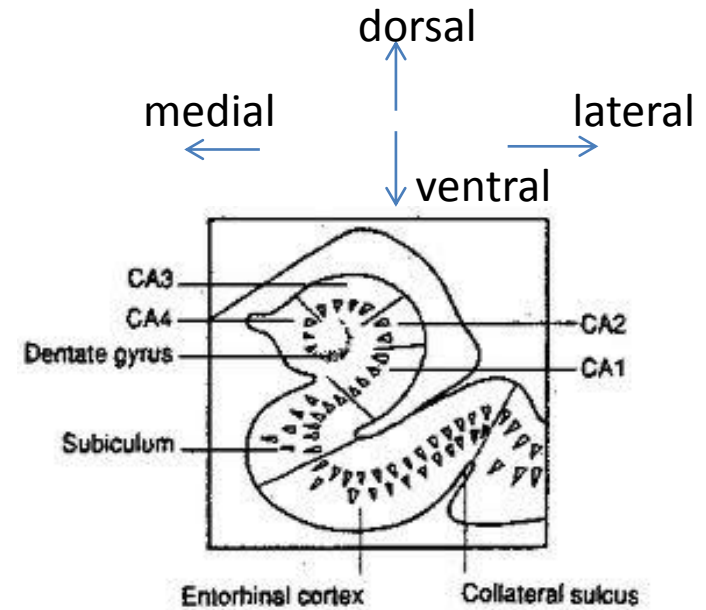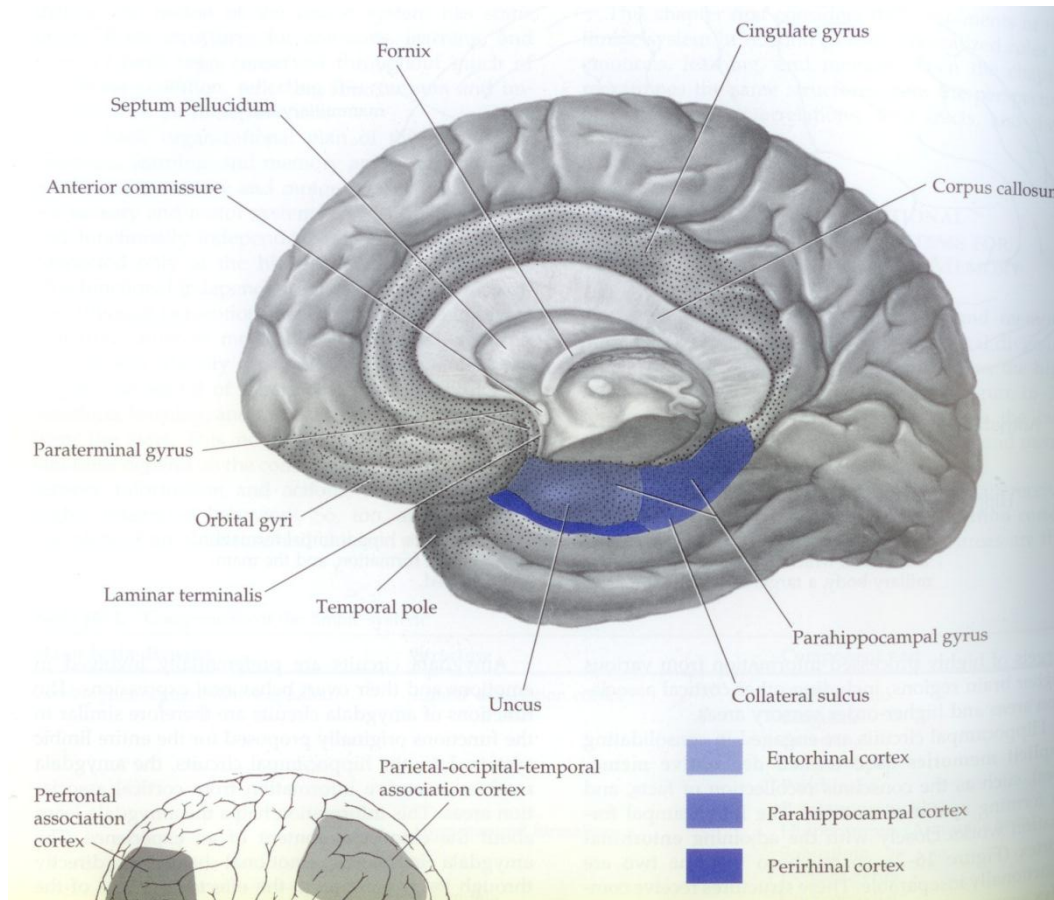Black/white: sort item verbally (as during training)
Grey: sort item presented as card (explicit generalization)

Bayley, Frascino, Squire Nature 2005

Methodological issues: neuropsychology

- Neuro-anatomy of the medial temporal lobe

Cingulate gyrus
Fornix
Septum pellucidum
Anterior commissure
Corpus callosum
Paraterminal gyrus
Orbital gyri
Laminar terminalis
Temporal pole
Uncus
Parahippocampal gyrus
Collateral sulcus
Prefrontal association cortex
Parietal-occipital-temporal association cortex

Entorhinal cortex
Parahippocampal cortex
Perirhinal cortex

dorsal
medial
lateral
ventral

CA3
CA4
Dentate gyrus
Subiculum
CA2
CA1
Entorhinal cortex
Collateral sulcus

Methodological issues: neuropsychology

- Connectivity of the hippocampal formation

Dentate gyrus

Mossy fiber

Parahippocampal cortex

Unimodal and polymodal association cortices (frontal, temporal, parietal)

CA3

Entorhinal cortex

Schaffer collateral pathway
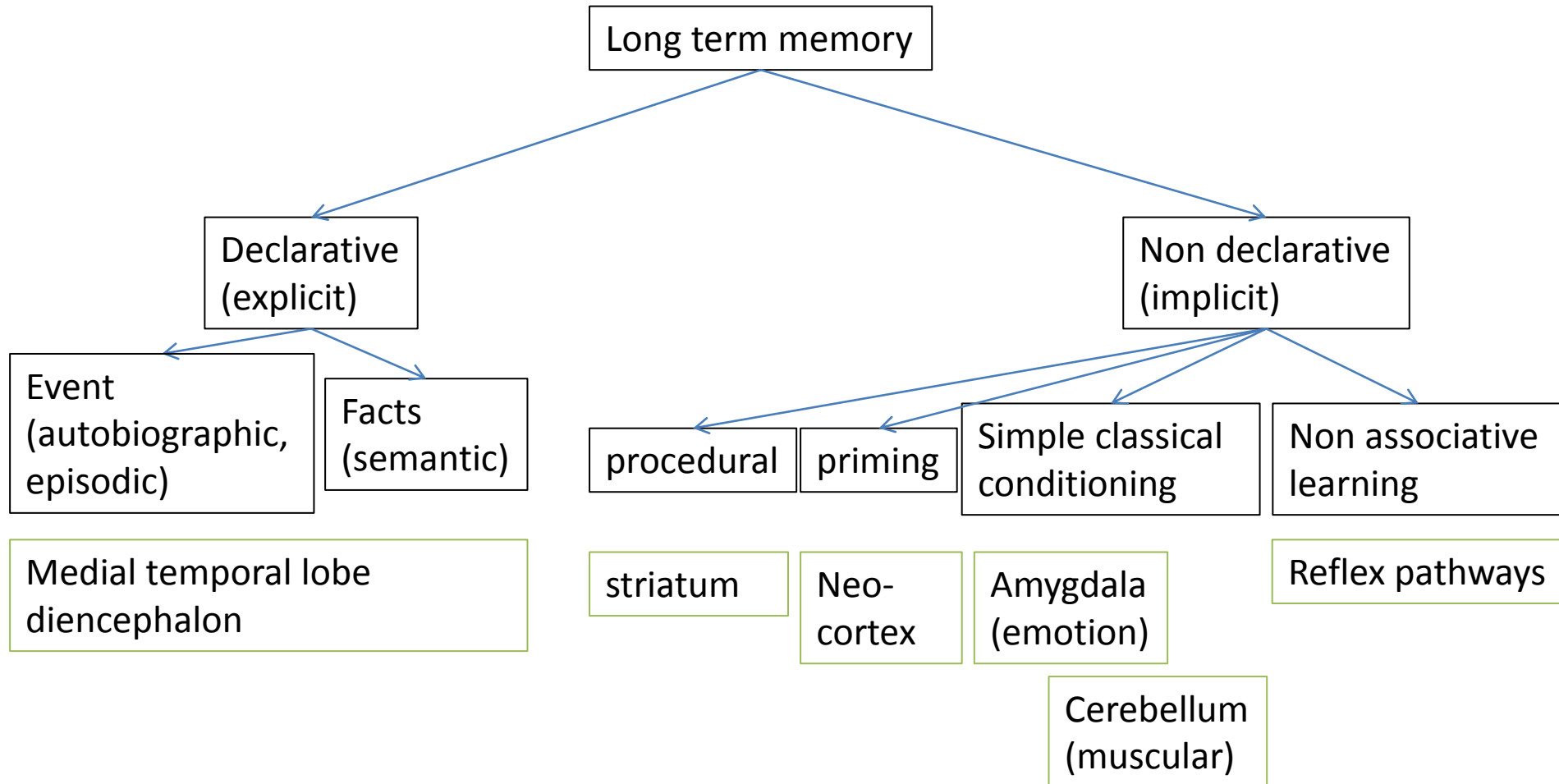
Perirhinal cortex

CA1

subiculm
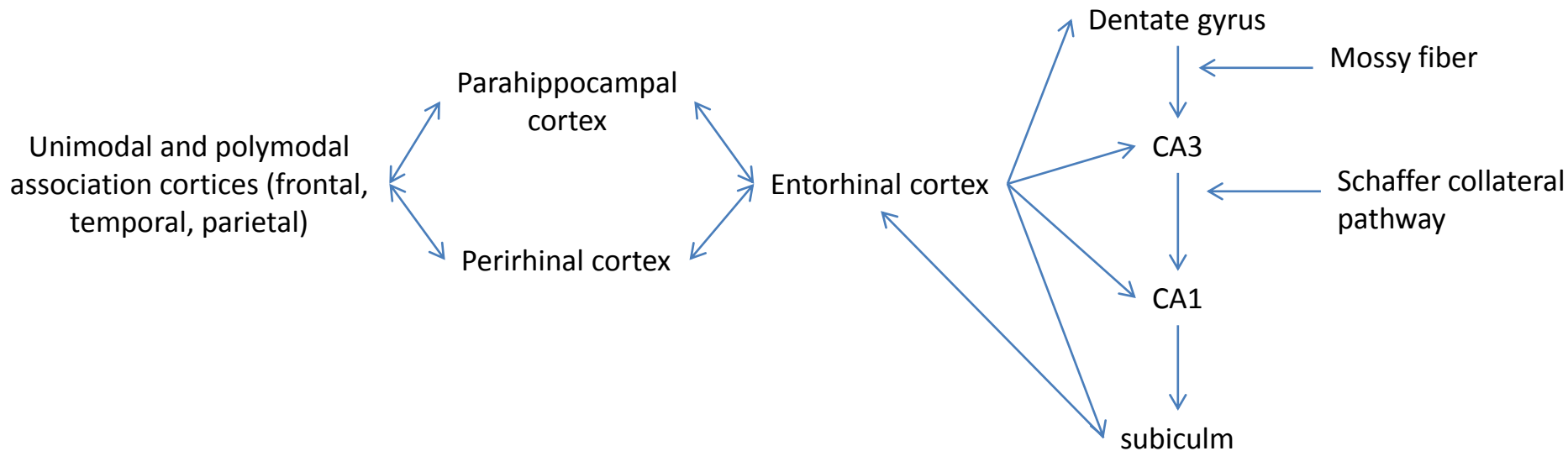
Methodological issues: neuropsychology

- Studies in controls
- 8 medial temporal lobe patients
- 4 memory task (with delay)
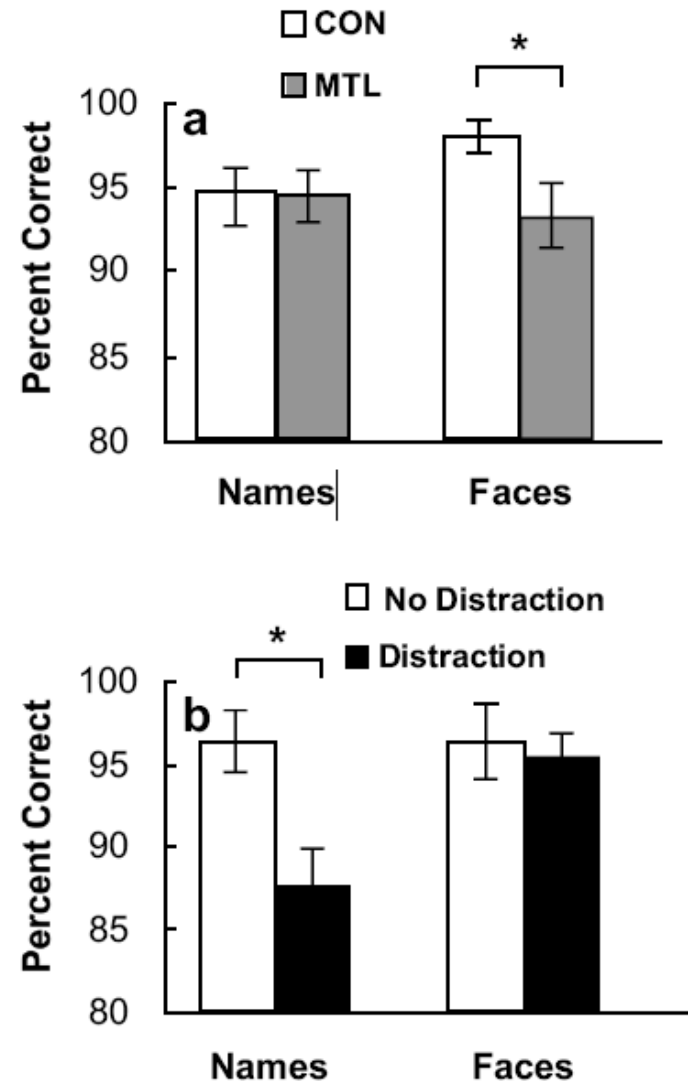
Shrager, Levy, Hopkins, Squire, J Neurosci 2008

Long term memory

Long term memory

Declarative (explicit)

Non declarative (implicit)

Event (autobiographic, episodic)

Facts (semantic)

procedural

priming

Simple classical conditioning

Non associative learning

Medial temporal lobe diencephalon

striatum

Neo-cortex

Amygdala (emotion)

Reflex pathways

Cerebellum (muscular)

Some classical models

- Atkinson & Shiffrin (1960s)

Sensory input → buffer

buffer → filter

buffer → (attention) → Short term memory

Short term memory → (encoding) → Long term memory

Long term memory → (retrival) → Short term memory

Short term memory → recall

rehearsal
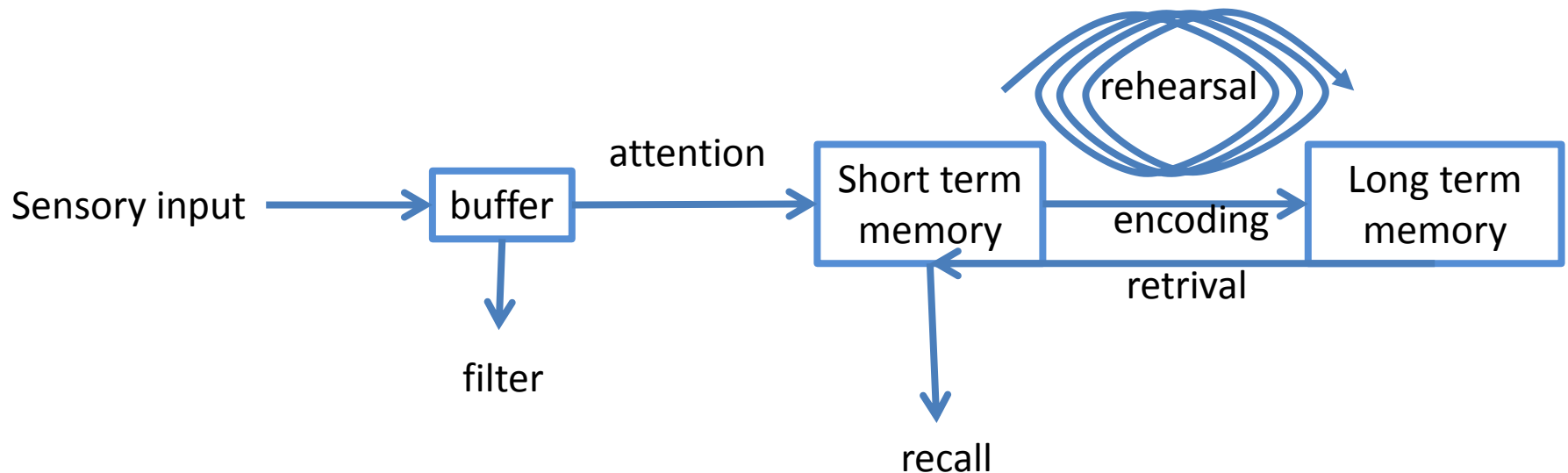
Some classical models

- Tulving (1970s – 1980s)

  - The episodic memory
  - The semantic memory
  - The primary memory
  - The perceptual representation system
  - The procedural memory

Some classical models

- Baddeley 1974

visual spatial sketch pad $\longleftrightarrow$ Central executive system $\longleftrightarrow$ Articulatory loop