PSYC 5303: Theories of Learning

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Week 7: Working Memory

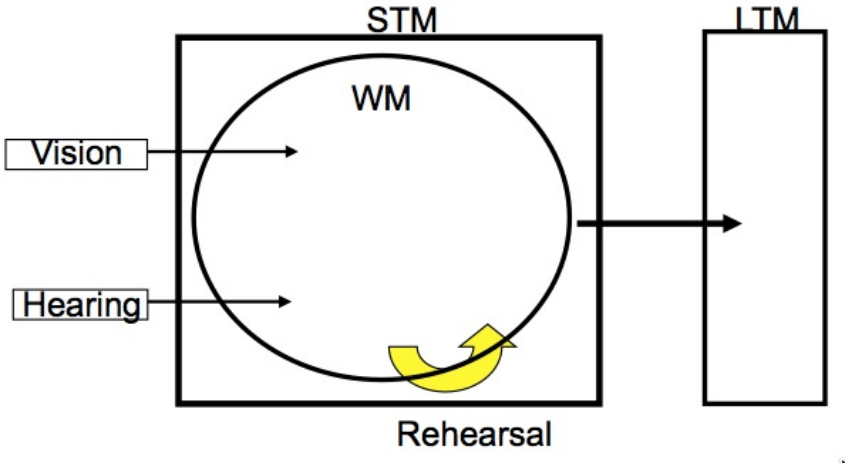
Working memory versus STM

Current models focus more on processing (than structures) and include STM in some form (storage and manipulation of information)

- There are multiple models of "working memory" that are designed to account for similar sets of data

Models of WM assume:

- STM is a storage unit and WM is the processes involved in completing a task
- WM requires conciousness – includes info we are currently attending to



Classic models of WM

- Baddeley's multi-component model (Baddeley, 1986, 2000)
- Cowan's activation model (Cowan, 1988, 1995)
- Nairne's feature model (Nairne, 1988, 2001)

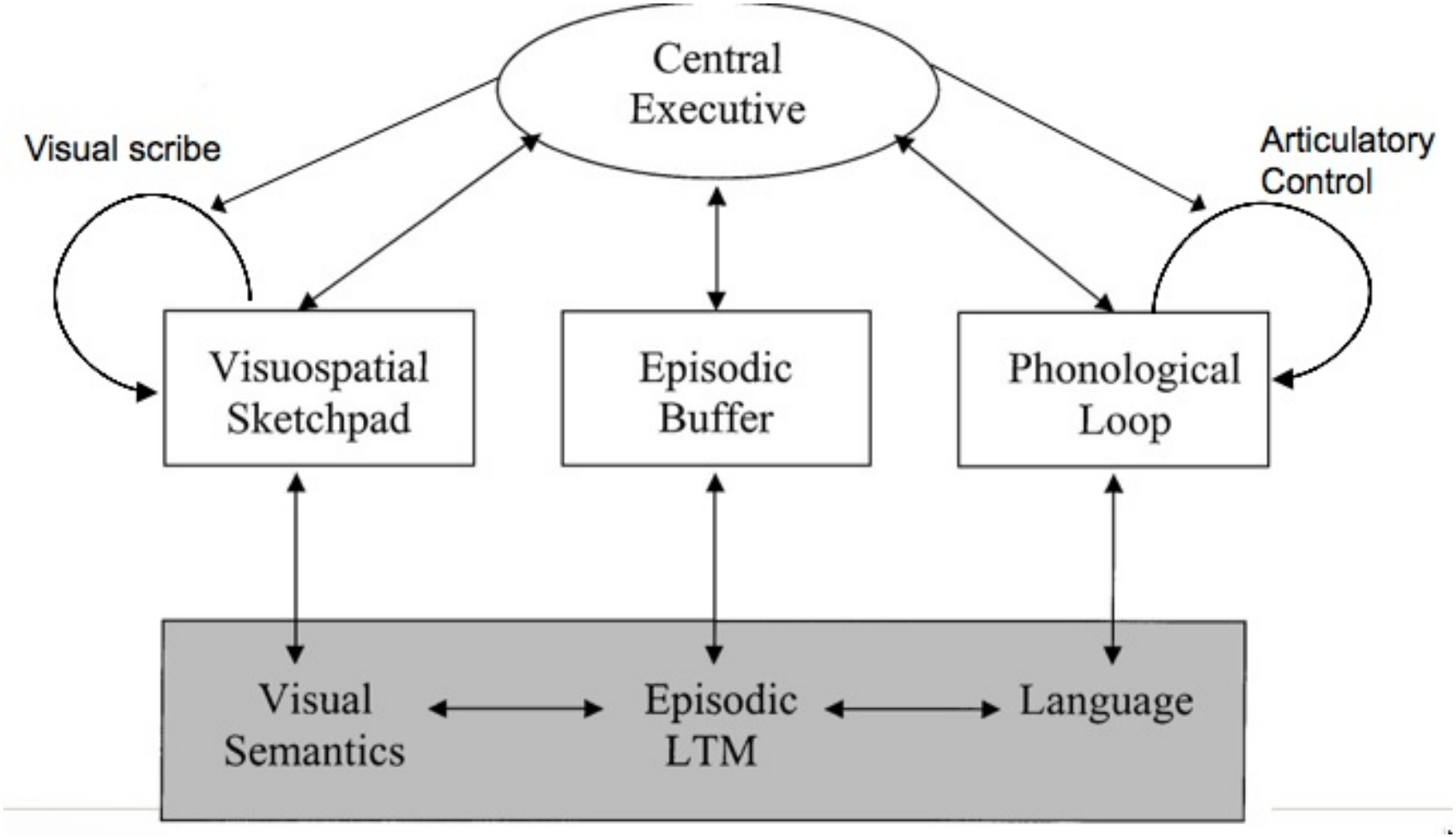
Baddeley's model of WM

Baddeley & Hitch (1974) – multicomponent model of WM

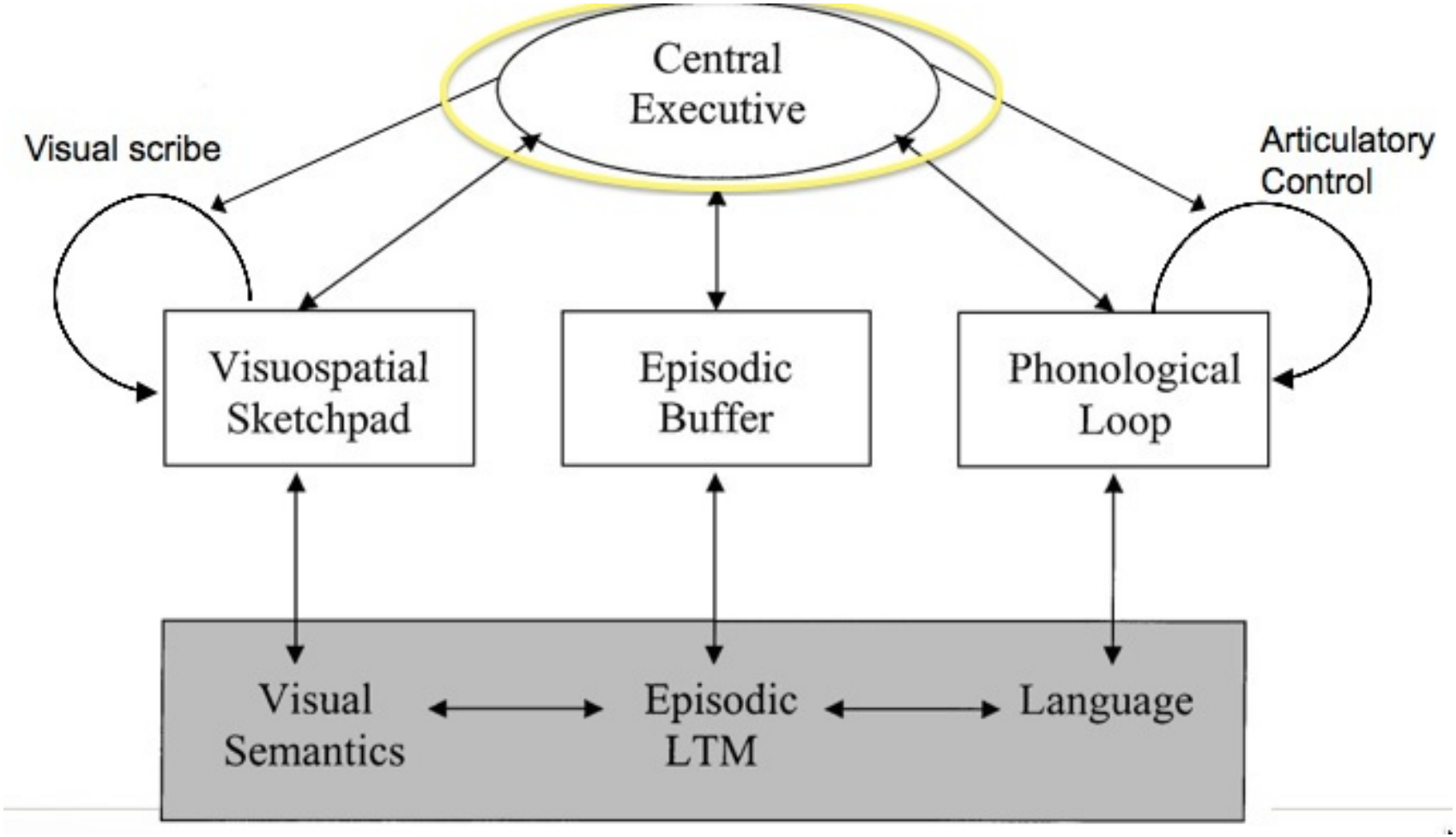
Components:

- Central executive – controls focus of attention and division of resources
- Three subsystems under its control
  - Visuo-spatial sketchpad
  - Phonological loop
  - Episodic buffer

Baddeley's model of WM



Baddeley's model of WM

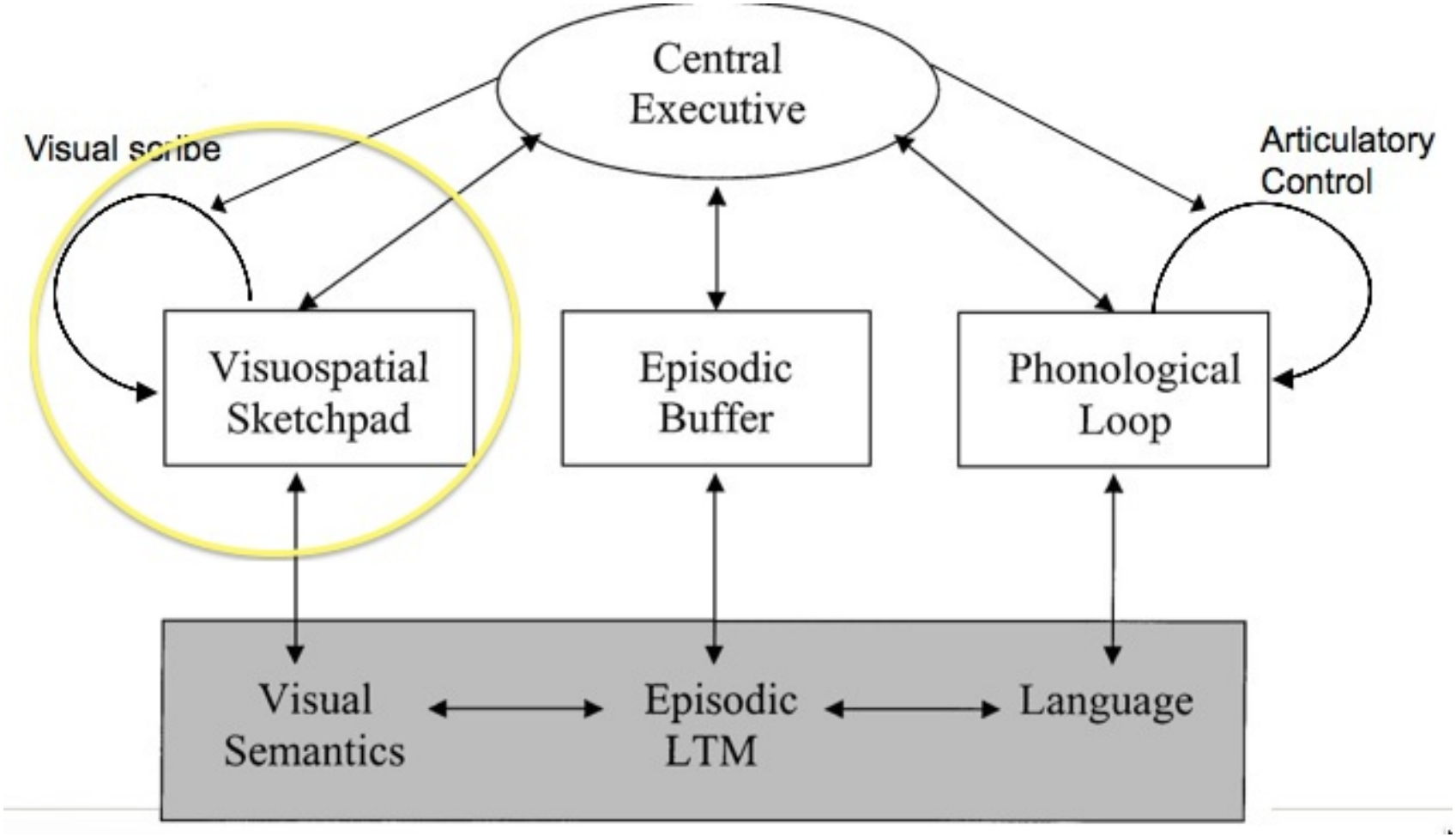


Baddeley's model of WM

Central executive

- Thought to be an attentional controller, with two main modes of operation (Norman & Shallice, 1986)
  - A semi-automatic conflict-resolution system, based on existing habits and requiring little attention
  - the supervisory attentional system (SAS), based on an attentionally limited executive
- Major functions
  - Direct attention to the task at hand
  - Divide attention between two or more tasks

Baddeley's model of WM



Baddeley's model of WM

Visuo-spatial sketchpad

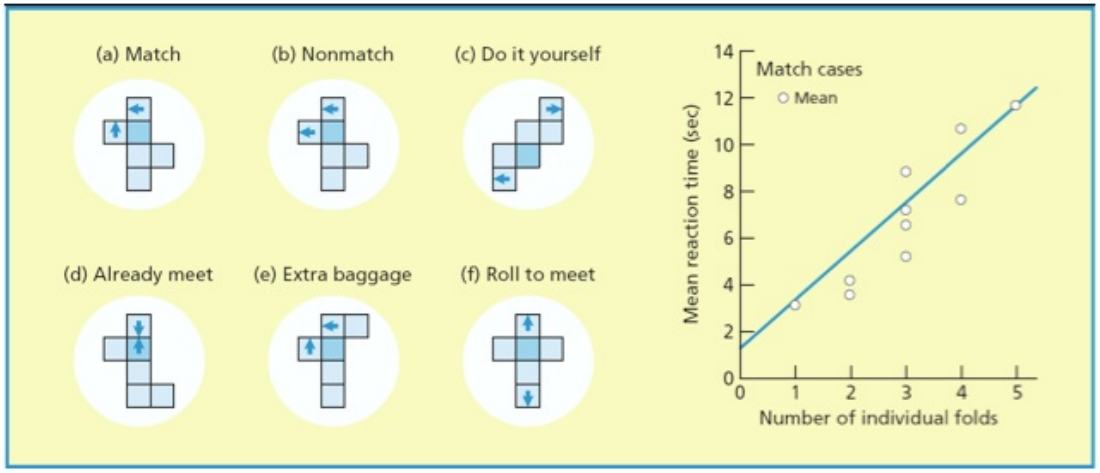
- Stores and manipulates visual and spatial information
- Info enters through perception or internally generated visual images
- Controls tasks like mental rotation and geographical search of a visual or mental image

Baddeley's model of WM

Visuo-spatial sketchpad – evidence

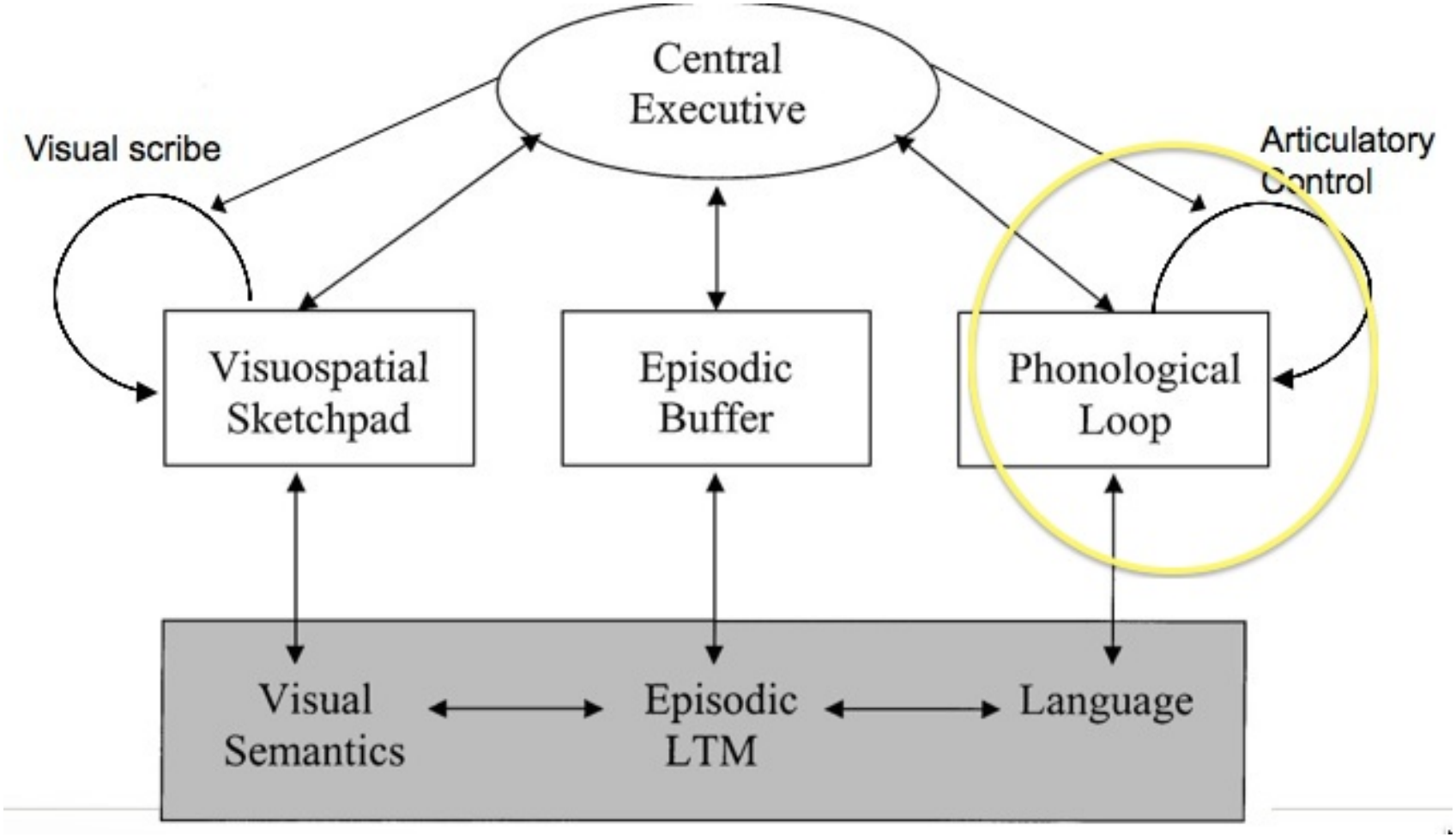
Baddeley (1992) – found that subjects' memory for chess patterns was more disrupted by a visual distractor task than an auditory one

Shepard & Feng (1972) – imagine folding the shapes below to create a solid, with the shaded area as the base. Will the arrows meet head-on?



- found that the time it takes to answer the question depends on the number of folds required

Baddeley's model of WM



Baddeley's model of WM

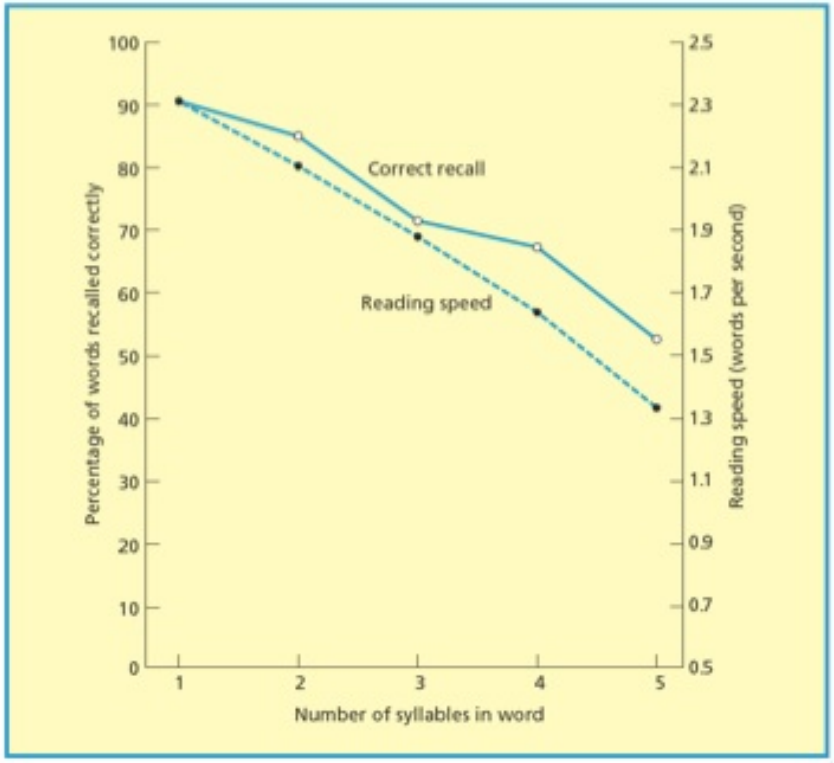
Phonological loop

- Two parts – phonological store (PS) and articulatory control process (ACP)
  - PS: stores auditory info for 1-2 seconds and then it starts to decay
  - ACP: recodes visual info to auditory code for storage and controls rehearsal
- 4 main effects in serial recall task to account for:
  - word length effect
  - phonological similarity effect
  - articulatory suppression effect
  - irrelevant speech effect

Baddeley's model of WM

Word-length effect (Baddeley, Thomson, & Buchanan, 1975)

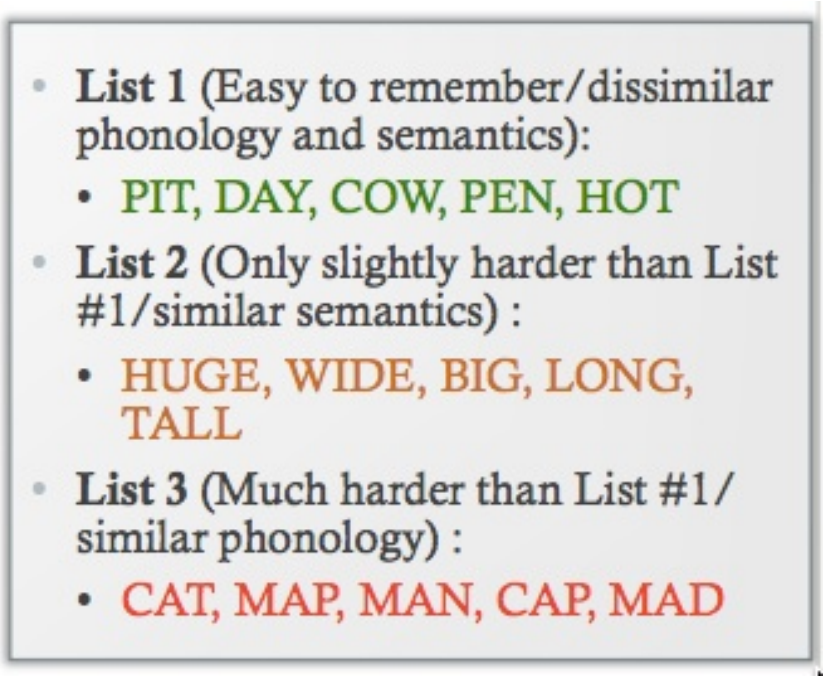
- Recall decreases as the length of time it takes to say a word increases
- Rehearsal takes longer for longer words – can't rehearse as many times



Baddeley's model of WM

Phonological similarity effect

- Memory worse for items that sound alike versus those that look alike or have similar meanings
- Works same for both auditory and visual presentation of words
  - implies visual items are recoded to auditory for storage and rehearsal by ACP

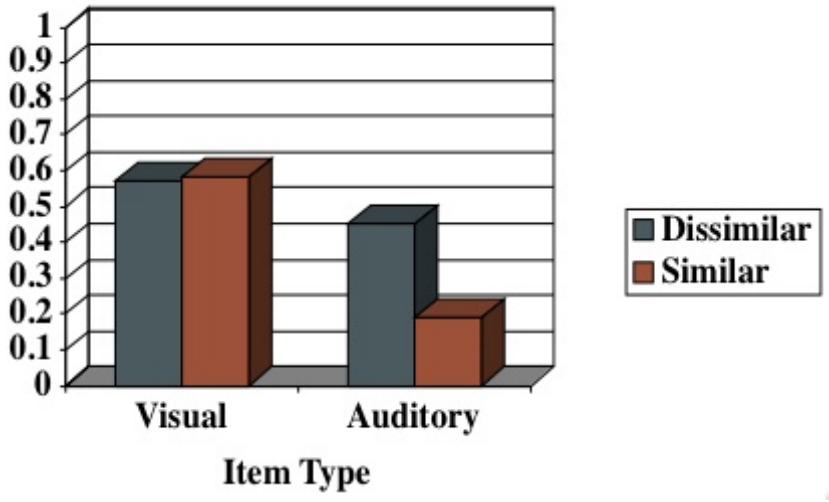


What happens if you prevent recoding of visual information into auditory information?

Baddeley's model of WM

Articulatory suppression effect (Peterson & Johnson, 1971)

- engaging in an auditory task during study (saying "the" aloud over and over) removes phonological similarity effect for visual items
- No recoding of visual info by ACP
- Phonological information gets in directly, doesn't need recoding



Baddeley's model of WM

Irrelevant speech effect

- Background speech presented during study decreases memory for visual items
- Irrelevant speech interferes with recoding of visual info to auditory
- Visual info weak in WM
  - something is likely stored in visuo-spatial sketchpad, but this system is not as efficient as phonological loop

Baddeley's model of WM

Problems with Baddeley model:

- Lovatt et al. (2000) - reverse word-length effect

Word Type	Stimuli	Mean Pronunciation Time	Percent Recalled
Short	*bishop, pectin, ember, wicket, wiggle, pewter, tipple, hackle, decor, phallic*	530 ms	70.7 %
Long	*Friday, coerce, humane, harpoon, nitrate, cyclone, morphine,* [illegible]	693 ms	65.5 %
Short	*button, tractor, whistle, spider, pencil, pocket, shovel, candle*	605 ms	60.7 %
Long	*pebbles, curtains, station, needle, branches, canoes, necklace, robot*	793 ms	65.1 %

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Baddeley's model of WM

Problems with Baddeley model:

- Lovatt et al. (2000) - reverse word-length effect
- Specific mechanisms for phonological loop and VSP not well-specified
- conceptual model versus computational model (good for explaining, not as much for predicting)