

# Human Working Memory

## Human working memory

There are various, more or less similar definitions of the working memory, like<sup>1)</sup>:

- “*short-term memory applied to cognitive tasks*”,
- “*multi-component system that holds and manipulates information in short-term memory*”, or
- “*use of attention to manage short-term memory*”.

What is mostly common to them is that they address working memory as the system which manipulates information from STM, and sometimes even LTM. As this system is one of the key components in the process of knowledge acquisition, the most commonly discussed working memory models of Baddeley and Cowan will be briefly discussed here.

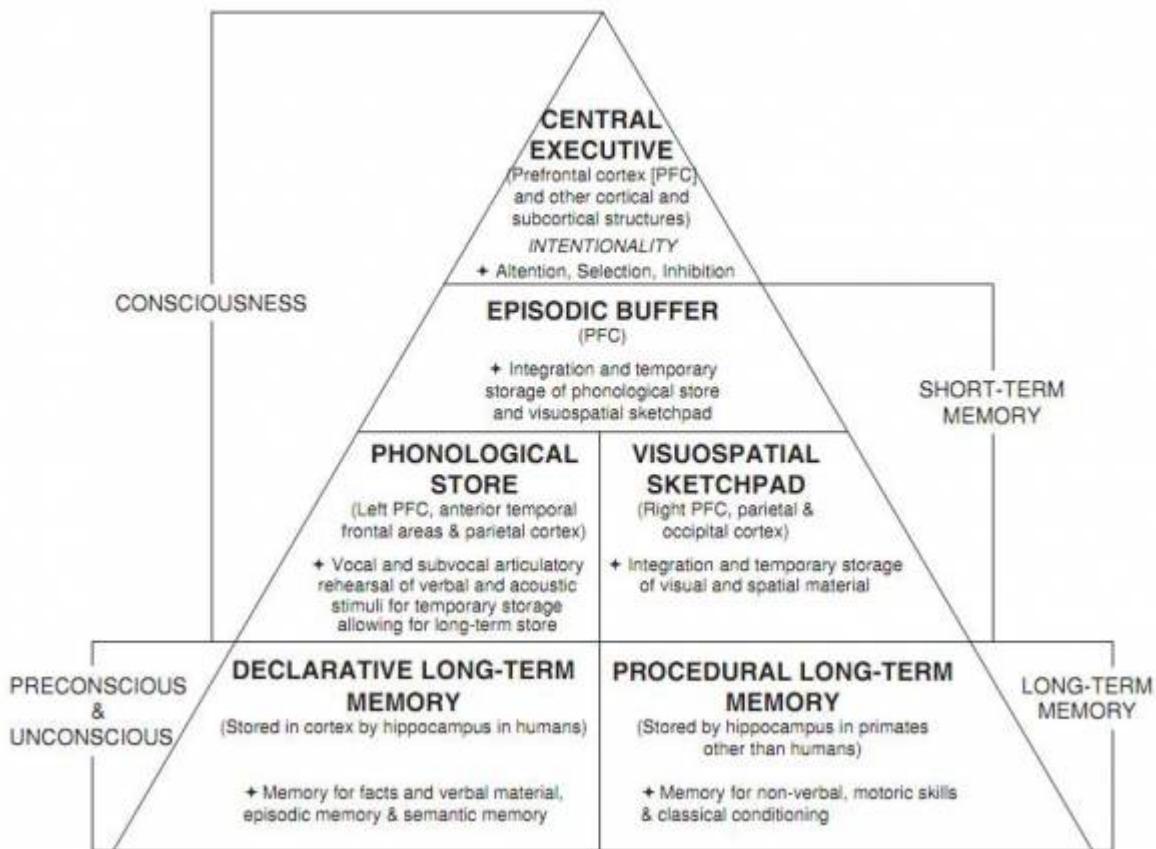
### Baddeley's model of working memory

**Alan Baddeley** and **Graham Hitch** proposed a multi-component working memory model in **1974<sup>2)</sup>**. This model was very well accepted and later adjusted to new findings. In their experiments Baddeley and Hitch examined subjects' retention of series of numbers which were memorized before they had to judge simple logical statements. The results have shown that although both tasks required working memory capacity, the ability of remembering the number sequence wasn't strongly affected by judging logical statements. This led to an assumption that working memory is composed out of more than one component.

Baddeley and Hitch suggested working memory is composed of three parts: the **central executive**, a system that controls the **phonological loop** (a subsystem for remembering phonological information such as language by constant refreshing through repetition in the loop), and the **visuospatial sketch pad** (a subsystem for storing visual information).

This model was later revised and improved by Baddeley<sup>3)4)</sup> but also contributed by other authors<sup>5)</sup>, which resulted in additional component of **episodic buffer**<sup>6)</sup> in year **2000** and more detailed functions and analysis of other components, as described in table below.

## Working Memory



### Central executive

The active memory consists of parts of long-term memory needed to perform a cognitive task. Elements can be activated also voluntarily or involuntarily. The amount of simultaneously active elements is still an issue of debate, but without rehearsing, evidence shows these elements remain active for about 10 - 20 seconds. Working memory holds all of these activated elements, but only about  $4 \pm 1$  of them can be in focus, what is decided by voluntarily or involuntarily attention switching using the central executive.

Just like in Atkinson and Shiffrin model, the incoming information is first stored in the sensory memory. Sensory information then activates certain elements inside the long-term memory. In his model, Cowan does not address the issue of processing information of different modality like Baddeley.

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5)

See: Coolidge, Frederick L., and Thomas Wynn. *The Rise of Homo sapiens: The Evolution of Modern Thinking*. Wiley-Blackwell, 2009.

6)

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