

Outline of the key models of working memory



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Memory has long fascinated cognitive psychologists and cognitive theories as to the nature of memory go as far back as the late 19th century and William James (James, 1890). He was the first to propose a multi-store model of memory. In it he distinguished between primary and secondary memory. He stated that primary memory consisted of information that remained in the consciousness immediately after it had been perceived and secondary memory which constituted memories that had left the consciousness but were still readily obtainable. His theories became the benchmark for cognitive research in the area of memory and were expanded upon with the terms “ short-term memory” and “ long-term memory” soon becoming coined instead of his primary and secondary memory model. This was then developed into a three stage model by Atkinson and Shiffren in 1968 (Passer & Smith, 2009). This multi-store model was a quite a large advancement; however it was very basic in design as regards the workings of short term memory (Eysenck & Keane, 2010). It wasn't until the 70's and Baddeley and Hitch's model of working memory, that a more developed theory on short term memory was properly explored (Baddeley and Hitch, 1974). They believed that the three stage model of memory was too passive in its explanation on short term memory. This was the most complex theory in this area that had been put forward at the time, however Baddeley's Working Memory theory is not universally agreed upon and other contrasting views exist. For example Shah and Miyake disagree with some of Baddeley's assumptions in a paper published in 1996 (Eysenck and Keane, 2010).

In this essay different theories on working memory will be explored, also to be taken into account is how they compare and contrast. It will also be

evaluated whether working memory can be understood in terms of attentional control by taking into account various studies.

The Working Memory model has been greatly expanded on over the years since it was first published yet its core arguments remain the same. Working memory is a limited capacity system that temporarily stores and processes information (Passer & Smith, 2009). According to Baddeley, working memory is split into four components, a phonological loop, a visuo-spatial sketchpad, a central executive and an episodic buffer.

The phonological loop is where sounds are briefly stored in working memory. It is active when listening to spoken words or sounding out words while reading. Baddeley and Hitch proposed that the phonological loop is made up of two mechanisms, a “phonological store” and an “articulatory rehearsal system”. The articulatory rehearsal system silently repeats the information in order to access the phonological store which is connected with the perception of speech. As shown in Eysenck & Keane (2010) there is fairly good evidence to support its presence through research with brain damaged patients. However the point should be raised that the phonological loop seems to have little purpose as people with deficient phonological loops seem to manage very well.

The visuo-spatial sketchpad oversees the brief storage of visual and spatial information (Passer & Smith, 2010). Similar to the phonological loop Baddeley proposed that it also can be separated into two mechanisms, the “visual cache” which stores information concerning the image from and colour and the “inner scribe” which processes spatial and movement

information. It also transfers the information from the visual cache to the central executive. It should also be noted that the Baddeley's working memory theory allows for the phonological loop and the visuo-spatial sketchpad to be used simultaneously, this can be seen when a word is linked with an image in memory. Evidence by a variety of researchers supports the idea of separate spatial and visual components including research by Quinn and Mc Connell in 1996 and Beschin et al in 1997 however very little is yet proven about the processes which integrate both of these (Eysenck & Keane, 2010).

The central executive is the most important, yet least understood, of Baddeley's four components in his working memory model. It directs the overall action of the other components and is theorized to be contained in the frontal lobes of the brain. It is also theorized to be responsible for the switching of attention between tasks, the planning of sub-tasks to achieve a goal, the updating and checking of the contents of the working memory system and coding representations in working memory for time and place of appearance (Eysenck & Keane, 2010). Baddeley used the impairments displayed by individuals who suffered from damage to the frontal lobes on their brain as evidence to support the presence of the central executive. He hypothesised that it was because of a malfunctioning central executive that these individuals acted as though they lacked a system to control their processing resources appropriately. Baddeley called this " dysexecutive syndrome" (Eysenck & Keane, 2010).

The final component of Baddeley's model is the episodic buffer; this was only added to the working memory theory in 2000. It was believed that the model

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was lacking a general storage system that is not limited to just one form of information but can manage several types. This is the role that the episodic buffer fills. It takes information from both the long term and working memory and integrates and manipulates it so that it can be consciously used.

Baddeley also believed that the episodic buffer comes into play when chunking information. He proposed that the episodic buffer expands on the phonological loop's limited acoustic range and allows the brain to remember larger chunks of information in the short term by putting them into meaningful phrases and linking them together with what is already known in the long term memory (Passer & Smith, 2009)

Baddeley and Hitch's working memory model is extremely comprehensive and is a very valid alternative to Atkinson and Shiffrin's short term store model as it has more evidence to support its theories than the other way around (Eysenck & Keane, 2010).

However not all researchers agree with all aspects of this working memory model. Shah and Miyake (1996) disagreed with Baddeley's notion that there is only one central executive. They put forward the theory that there are in fact separate central executives that deal with verbal and spatial working memory systems respectively. They obtained evidence that supported their view through a study in which students were presented with tests of verbal and spatial working memory, in their results the correlations between reading span and spatial span seemed to agree with their hypothesis on separateness. This showcases that Baddeley and Hitch's model is not omnipotent.

Another working memory model is Cowan's Integrated Framework theory (Cowan, 1995). Here Cowan doesn't regard working memory as a separate system, but as a part of long-term memory and he believes that working memory is organized into two levels. The first level is made up of the activation of long-term memory stores; he believes that there can be many of these and that there is no limit to activation of these stores in long-term memory. The second level is called the "focus of attention". The focus is regarded as capacity limited and holds up to four of the activated stores.

Cowan's model is not as expansive as Baddeley's and it goes against the grain as it promotes a single-store model which could be viewed as dated by many researchers today. However it does attempt to understand working memory in terms of attentional control, a view shared by many.

A study on adults with ADHD sought to prove whether working memory ability could explain group differences in brain activity between those with ADHD and a control group during attentionally demanding situations (Burgess et al, 2010). Their results seemed to suggest that a link does indeed exist between working memory and attentional control.

Also, Baddeley himself said that the central executive and the supervisory attentional system (SAS) described by Shallice (1982) were one and the same. According to Shallice, the supervisory attentional system is a limited capacity system that is used for a variety of purposes, including the monitoring of tasks involving planning or decision making.

In conclusion this essay examined the working memory model and some of its offshoot models. Baddeley and Hitch's original model has been developed
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and most researchers use it as the base model for their studies in this area. It has been expanded upon many times over the years and seems to be able to incorporate more modern ideas into its basic structure. As a result the argument can be put forward that it is currently the best model of working memory.

As regards working memory and attentional control, they appear to be linked and studies seem to have shown that link as shown by