Working memory model

Memory has always been an interesting area of Psychology for researchers to investigate. As memory processes cannot be seen or measured, many theories have been put forward as to how and why information can be stored differently, and why some of this information can either be forgotten straight away or remembered for long periods of time. One memory theory was put forward by Baddeley and Hitch (1974) as an alternative to Atkinson and Shiffrin's Multi-Store Memory Model (1968), which proposed that information was stored in specific locations; the sensory store, short term store or long term store. The main difference in these two theories is that the short term store in memory is replaced by ' working' memory, and sees the memory process as more active and complex.

The Working Memory Model consists of three components, each playing their role in storing information as memories. The Central Executive is considered the most important part of working memory, yet is the least understood. It is a non-modular system that is involved with and responsible for the selection, initiation and termination of processes in memory such as retrieval, encoding and storing. The central executive also controls the other components in working memory. Baddeley compares the central executive with the supervisory attentional system first described by Norman and Shallice (1980), who suggested that the component has a limited capacity and is used for purposes such as decision making and planning. However, this component has had many criticisms put against it, the main one being that as the central executive is not an actual object but simply an area in the brain, its functions and processes cannot be scientifically measured. Although Baddeley believes that it is involved with certain memory

processes, this cannot be confirmed or denied, and it is impossible to know what it controls or what effect is has on other areas of memory function. Its role remains elusive, possibly because the central executive represents a number of areas in the brain that have not been proven to be related to each other and have no clear hierarchy. Also, studies investigating the role of the central executive have found that different processes are involved. In a study by Damasio (1985), the disassociation of decision making from working memory was investigated by asking participants to perform delay tasks and gambling tasks, as it was assumed that these two processes worked on separate anatomical sections of the pre-frontal cortex, where the central executive is presumed to be. One participant, EVR, had poor decision making but intact attentional and memory processes, which suggests that the central executive is not one unitary system, but that there are “ separate verbal and spatial memory systems” (Shah and Miyake, 1996). The fact that brain damage can selectively impair or spare separate executive functions in individuals shows that it is not one united component, as if it was, brain damage would affect the whole of the executive function.

The second component of Baddeley’s Model of Working Memory is the Phonological Loop, which is involved with sound and phonological information. This component is separated into two parts; the short term phonological store with auditory memory traces that are vulnerable to quick decay, and an articulatory control process that can revive the memory traces. To investigate the reliability of his theory, Baddeley put forward the Phonological Similarity Effect (1966), which found that when given a list of words, people found it more difficult to remember words that sound similar

to each other than those that sound different. It was also shown that semantic similarity had little effect on how easy words are to remember, which suggests that words are encoded phonologically rather than semantically in working memory. Further evidence for the phonological loop is that memory traces are quick to decay when the articulatory rehearsal process is blocked. This is achieved when people are given verbal material and asked to say something irrelevant at the same time. The ability to remember the verbal material is impaired as it cannot be rehearsed, and the memory therefore decays. Baddeley also found that the immediate recall of visually presented information can be disrupted by irrelevant spoken material even when participants are asked to ignore it. It was found that simple sounds had little effect on recall, whereas singing is very disruptive. However, if the singing was in a different language, it had less of an effect on recall, implying that interference operates at an acoustic level as opposed to a semantic level.

Although the phonological loop component can account for the effects of articulatory suppression and the negative effects of irrelevant speech on immediate recall, the model predicts that as irrelevant speech and phonological similarity both affect just the Phonological Store and not the Articulatory Control Process, then they should affect the same areas of the brain, but this is not the case. It would also be assumed that they should be interactive rather than independent, as both are involved with the same processes. What has been shown to be important in other studies as well as rate of rehearsal is the rate of retrieval (Cowan, 1998). Although the

phonological look model is good it needs to be modified to include these later findings.

The third component in the Model of Working Memory is the visuospatial sketchpad, which is thought to hold information about what we see. It is involved in tasks which require planning of spatial movements, and is used in the storage and manipulation of visual and spatial information. It is believed to be separated into three separate components in the right hemisphere of the brain; visual, spatial and kinaesthetic. Although the visuospatial sketchpad has not been invstigated as much as the other components in the model, there is some evidence that it does exist. Baddeley (1973) gave participants a simple tracking task that involved holding a pointer in contact with a moving light. Whilst this was taking place, participants were asked to imagine a block capital letter F, and, starting from the bottom of the left hand corner of the letter, had to classify each angle as a ‘ yes’ if it included the bottom or top line of the letter, and as a ‘ no’ if it did not. The participants found it very difficult to perform both tasks at the same time, which suggests that the tracking and imagery task were both competing for the limited resources that the visuospatial sketchpad has. Participants were able to complete the tracking task and a verbal task at the same time, which provides further evidence that there are separate components in memory, as verbal and tracking tasks use the phonological loop and visuospatial sketchpad respectively.

There is very little research done into investigating the visuospatial sketchpad, but it is reasonable to assume that if the central executive and

phonological loop are involved with memory processing, then there must be a component that is responsible for visual and spatial processing.

Baddeley later added a fourth component, in order to improve the Model. This is called the episodic buffer, which comprises of a limited capacity system that provides temporary storage of information held in a multimodal code, which is able to bind information from the subsidiary systems, and from long-term memory, into a unitary episodic representation. The principal mode of retrieval from the buffer is conscious awareness. The new model is different from the old mainly because attention is focused on the processes of integrating information, rather than on the isolation of the subsystems. In doing so, it provides a better basis for tackling the more complex aspects of executive control in working memory. Baddeley's main motivation for introducing this component was the observation that some people with amnesia have good short-term recall of stories, recalling much more information than could be held in the phonological loop, even though they presumably have no ability to encode new information in long term memory. However, there has been very little research into the episodic buffer component of the model, and even though it is seen as a helpful addition, the exact functions of it remain unclear.

The main strength of the working memory model in general is that it has high validity. The functions of it seem plausible, and though it cannot be measured or tested scientifically, it is reasonable to assume that there are different components in memory that encode different types of information, such as visually, phonologically and semantically. However, the main weakness of the model is that the functions of the central executive are

vague and difficult to test. Baddeley claims that the central executive has a limited capacity; yet how this capacity can be measured independently of the other components is not clear. Baddeley also says that the central executive is divided into subsystems; but these have not yet been identified and it is difficult to determine which processes that control the slave systems are part of the central executive and which are part of other systems.