The modal model of working memory essay

The modal model of working memory consists of the central executive and two slave systems, the phonological loop and the visuo-spatial sketchpad. (Baddeley & Hitch, 1974, as cited in Baddeley, 1999). The phonological loop, which retains verbal material, in terms of speech-based characteristics, is further divided into a store and an active process. Phonological representations are held in the store and will then decay if not reactivated by rehearsal, the active process. The sobvocal articulatory rehearsal process allows inputs to access the phonological short-term store.

Rehearsal is important, therefore, in the encoding of new memories into short-term memory. Evidence for the phonological loop includes articulatory suppression (Richardson & Baddeley, 1975), word length effects (Baddeley et al. , 1975) and phonological similarity effects (Conrad & Hull, 1964), which all show recall performance to be hindered wit the introduction of one of these occurrences. Articulatory suppression, demonstrated by the repetition of nonsense syllables and preventing rehearsal of information to be recalled, suggests the importance of rehearsal as the active process.

Word length effect, where it was found that recall was poorer with longer words and later shown that this was because subvocal rehearsal is in real time, so rehearsal time was decreased, again indicates the importance of rehearsal for maintaining phonological information in short-term memory. The phonological similarity effect, whereby similar sounding words produced poorer recall than distinct words, suggests the fading of words stored in the phonological loop and the confusion with similar information.

Overall, findings suggest because the effects rest on similar common processes, they should interact in predictable ways. The interaction of these effects show rehearsal to be the active process supporting the phonological store and that these two systems make up the phonological loop. The importance of the phonological loop, and therefore rehearsal, in the encoding of new memories is demonstrated in neuropsychological patients. Patient P. V. (Vallar & Baddeley, 1984), for example, who had a stroke affecting the left hemisphere appears to have a deficit in the phonological loop.

She cannot learn new words, as the creation of association needs maintaining, has difficulty in word-non word associations, such as the acquisition of a new language and finds it difficult to comprehend complex language such as double barrelled questions and embedded clauses, as the maintaining of information is required. Young children have similar problems as their phonological loops are developing, (Gathercole & Baddeley, 1989). The visuo-spatial sketchpad, similarly to the phonological loop, contains a short-term store and an active process to convert and maintain information in the store.

The sketchpad is specialised in the processing and storage of visual and spatial information, which is where imagery enters the encoding of new memories. It has been found that the active process contributes to the formation of mental images. Baddeley (1975, as cited in Morris & Gruneberg, 1994) produced the first systematic study of the sketchpad, using a matrix of cells to be mentally filled. Participants were asked to encode the instructions for filling in the cells, but at recall the sentences were reconstructed from the stored image.

Concurrent tasks confirmed this phenomenon. The ‘ pegword mnemonic’, teaching subjects to associate numbers with highly imageable rhyming words, is further evidence for the sketchpad. Subjects are trained to use images as a way of remembering a series of items by linking items with the numbers on the list. Recall for words when the pegword method was employed was much higher than without, (Baddeley & Lieberman, 1980). It has been argued that we rarely use imagery in memory in the real world, as the need to retain such information is infrequent.

However, the independence of the two salve systems, phonological and visuo-spatial, demonstrated through dual task methodology, means that the two systems work independently from one another and further research demonstrates that the workings of one can compensate for the interruption of the workings of the other. Hulme & McKenzie (1992), for example, found that children with short-term memory and learning difficulties found it useful, when learning the alphabet, to trace letters with their fingers whilst saying the letters. Imagery becomes useful, then, when the phonological system is otherwise employed, and vital if damaged.

Patient E. L. D. described by Hanley, Young and Pearson (1991), highlights the importance of imagery, as she has a deficit specific to the visuo-spatial sketchpad. She has problems with the acquisition of new visual information such as faces, and the acquisition of new spatial information such as locations and directions. In long-term memory, semantic memory models look into the formation of associations in the encoding of new memories. Models of semantic memory, the system whereby we store knowledge of the world, include a variety of memory models.

Category search models state that we group information in our memory into categories. In encoding new memories, we would slot the information into a category. This relies on formation of associations. Feature comparison models, such as the Smith et al. model (1974, as cited in Baddeley, 1977), again use formation of associations, as they attempt to account for effects of relatedness on true or false judgements. The meaning of the concept is contained in a bundle of semantic features with both defining and characteristic features of the concept.

Network theories of semantic memory, such as Collin & Quillian's (1969, as cited in Baddeley, 1977), assume that long-term memory storage takes place on the basis of the formation of nodes, which represent hierarchically arranged links between concepts that are connected to other concepts through rational links, which specify the relationship. Retrieval from the network takes place through spreading activation, whereby a node is activated as a part of processing the current incoming information and is spread out through the associative network.

Activation will vary with strength of association between nodes and declines as the association moves away from the original node. Activated parts of networks are used by being retrieves or in the use of semantic knowledge contained in the network. This is an early type of connectionist approach, the type of which Collins ; Loftus (1975) state that have developed by abandoning hierarchy and by introducing the concept of strong and weak links. Laboratory evidence supported the hierarchical approach to an extent, though when processing atypical or unfamiliar information, anomalies emerged.

Connectionist models offer a more specified approach to the way information may be encoded in memory. The concept of connectionism as a framework for cognition has become increasingly popular and influential and facilitates communication between functional and neural models. Clark (1989, as cited in Morris ; Gruneberg, 1994) uses the term ‘ informational holism’ to describe this model, an interdependence between ideas in memory. It requires specifity, as models need to be constructed and run on computers, with the way the brain works and is organised being of relevance, for example the speed of communication via neurons.

It is mathematical, with units having a level of activation expressed as positive or negative numbers, varying with strength and weight of activation. Weights, however, can be changes, with knowledge being altered by experience. Mental states are viewed as patterns of activations, memories as traces and retrieval of memory as the restoration of previous patterns. It has biological plausibility, as characteristics of the models are as biologically minded theorists would expect, in a system trying to make sense of its environment.

Network theories, however, are subject to symbolic fallacy, where they can be made to account for any result, and are difficult to constrain, making it difficult to form testable predictions. As well as reliability, validity is also an issue, as concepts and inferences in networks may not be true to life. The schema theory models the storage of episodic information in long-term memory. It is here that application of meaning takes place in the encoding of memory.

Schemas, based on Bartlett's theory (1932 as cited in Baddeley, 1997), scripts and frames are used to organise our knowledge of the world and are employed to make predictions or form expectations and are used to fill in gaps in our knowledge. Bartlett argued that we actively make sense of events and store them in an organised structure. Schank (1982, as cited in Morris & Gruneberg, 1994) theorised that scripts are organised hierarchically in ' memory organisation packets, which are constructed of several scenes through higher level organisation.

Memories are then cued by underlying similarities at a rather abstract level, rather than by physical, concrete cues. It is theorised that there exist thematic organisation points as well memory organisation packets, where higher level anologies that exist between situations that are related in structure are stored (Schank ; Abelson, 1977). Alba and Hasher (1983) argue that schemas lack in precision and cannot provide the only account for the basis of encoding. Hintzman (1986) suggests that phenomena associated with schema arise from individual instances, rather than special frameworks.

The reliance on schema to fill in missing information, that which was not encoded or forgotten, causes errors (Thorndyke, 1977). The role and importance of rehearsal in the encoding of new memories has become clear over the years with the extensive research into short term memory, particularly of the phonological loop. Similarly, it has been found that imagery has importance in the visuo-spatial sketchpad of working memory, though its role tends not to be viewed as so vital. However, the importance of the role of imagery greatly increases when there is damage to the phonological loop, as the visuo-spatial sketchpad can help compensate.

Within long-term memory, the importance of formation of associations and application of meanings has been found as the basis for many theories of information encoding. There are, however, many theories as to how the encoding process works and each is difficult to scientifically verify. Because of the endless capacity of long-term memory, as opposed to the limited capacity of working memory, the encoding process still remains somewhat unclear and is still today being debated and researched.

It is theorised that semantic and episodic memories are encoded somewhat differently, with the emphasis in semantic memory being the idea of some sort of systematic mapping system, centrally involving the formation of associations, such as in network theories and connectionism. Research into episodic memory largely lies in the schema theory, where application of meaning and context are more relevant. In conclusion, rehearsal, imagery, association of formation and application of meaning have all been demonstrated to be of key importance to their relevant area within memory.

Research into memory and the encoding process is still highly active, with evidence supporting many of the central theories. Much more research into long-term memory needs to be done to assess the encoding process, which remains less clear than in short-term memory. In particular, the difference in the encoding of semantic and episodic memories is of interest. It is generally supported that there are two separate slave systems within working memory, controlled by a central executive, but the in functioning of long-term memory there is a lot to be learned.