

# The history of the inhibition control theory psychology essay



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As far back as the 1800's William James came up with the notion of a primary memory with limited capacity a distinction from long term memory. Today working memory is defined as a limited capacity work space, a processing form of memory distinguished from short term memory which has been depicted as a short term store rather than a processor. Whilst driving the car you are also thinking of the directions to your friend's house; " drive straight 5 blocks, left by pizza express, then 1st left and you have arrived". This is an example of how working memory operates. (Baddeley 1986) defines working memory as a short term memory system involved in tasks that require concurrent retention and processing. Baddeley's model of working memory depicts a system with a central executive, a phonological loop and a visuo spatial sketch pad. Recently an episodic buffer has been included to provide a link and brief storage between the different components of working and long term memory (Baddeley, 2000). This model is in contrast to (Atkin and Shrifrins, 1971) proposal of a short term memory system, such that their model only had a short term store and a gateway to long term memory. Baddeley's model of working memory is commonly used today although it is not without challenges.

It has been well established that in older adults compared with younger adults there is a decline in memory. Specifically, age-related changes have been found in working memory. Two theories that explore the influence of the aging process in relation to the decline of age related working memory are; the speed of processing theory and the inhibition theory. (Salthouse, 1996a) posits that the speed of processing theory goes some way to answering how the influence of the ageing process declines in working

memory. Salthouse argues that a faster processor may activate and covertly rehearse information more quickly than slower processors. However (Hasher and Zacks 1988) argued that the aging influence on working memory was a result of deficits in the inhibitory function in older adults. Each of these theoretical positions makes an important contribution to our understanding of the influence of the ageing process on working memory.

Discussing the evidence this paper will specifically focus on the influence of aging on working memory. Firstly a description of the model of working memory by (Baddeley and Hitch, 1974 and Baddeley, 2000) will be presented. Evidence of how the ageing process influences working memory will be discussed, by analysing evidence from the speed processing theory and the inhibition theory. Finally the main points will be summarised along with a discussion of how the influence of the aging process impacts working memory.

## **Baddeley's working memory Model**

Initially Baddeley and Hitch, (1974) proposed a model of working memory. This originated from research into the short term memory model which did not fully explain the complexities of the short term memory system.

(1) working memory diagram

Figure 1 shows their proposed working memory model, the model has three main sections; The central executive (1) the phonological loop (2) and the Visuo - spatial sketchpad (3). The phonological loop and visuo-spatial sketchpad are known as the slave systems of the model. It has been postulated

that the central executive is responsible for controlling the phonological loop  
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and sketchpad. In doing so the central executive directs the working memory system, therefore acting similar to an attentional controller and not a memory system. Norman and Shallice (1986) proposed two controls for the central executive; an automatic controller based on existing habits and another of limited attentional capacity. For example driving a car which is an automatic process however within that your attention is limited to different obstacles and thoughts that come to mind such as the directions of where you need to get too. The central executive is responsible for processing the complex cognitive activity that one engages for example; writing an essay or multitasking. Supporting the idea of that the executive processing of dual tasks exists comes from Loggie et al, (2004). Loggie found that patients with Alzheimer's disease when compared with healthy young and older adults, showed impairments in dual task activities. However Alzheimer patients performed equally as well in comparison with the healthy group on single task demands. This suggests that Alzheimer's patients have damage to the section of the brain that is involved in dual task processing.

The phonological loop is said to be dedicated to speech based items and words in written form although they would have to be spoken for the loop to understand. The loop has two main purposes; firstly to be a temporary store of speech based information and hold it for a few seconds, then the articulatory process (2) comes into effect and circulates the information continuously. For instance, if we are trying to remember the name of a person we just met, we hear their name and then we keep repeating it so we don't forget. Baddeley argues that, the words which enter the loop auditorily are processed differently to visually presented stimuli. Such that auditory

words gain direct access to the loop and visually presented words enter indirectly via sub vocal articulation . i. e. inner speech. Theorists have debated the use of the phonological loop and have reasoned that the loop is not for remembering of information but functions so that one can learn new words.

The visuo - spatial sketch pad (3) is the process for imagery and spatial representation. It also uses long term memory. For example if you were asked to remember your kitchen in your house, the image of your kitchen would be drawn from long term memory and the manipulation and other spatial information would be employed by working memory. Whilst there is still more which needs to be understood regarding the visuo- spatial sketch pad in particular how the visuo and spatial elements interact. Loggie (1995) suggested that there are two separate functions operating within the sketch pad; a visual cache which is said to store visual information about form and colour, and an inner scribe. The inner scribe is said to process spatial and movement information, it is hypothesised that the main purpose of the scribe is to transfer information to the central executive and rehearse information in the visual cache.

<http://ars.els-cdn.com/content/image/1-s2.0-S016643281100605X-gr1.jpg>

In recent times (Baddeley 2000 & 2007) added a further component to the working memory model, the episodic buffer see figure 2. The episodic buffer is also assumed to be controlled by the central executive and to be of limited capacity. The executive accesses information via the buffer through conscious awareness. The executive has influence over the content of the

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buffer by attending to certain aspects of information which it manipulates and adapts. The buffer is a temporary store and integrates information from a variety of sources; the visual - spatial component, the loop and long term memory. The buffer is said to be episodic in that it holds episodes of information from different sources and assimilates this across space and time. These episodes are then elucidated via binding in the buffer into coherent events. All the processes in working memory model are said to have limited capacity.

Speed processing theory: the impact of aging on processing, in working memory.

Associations between the increase in age and cognition have been researched extensively since the 1920's (Foster and Conrad 1920). Salthouse and Babcock, (1991) discovered that the role of speed processing in working memory played a major role with increasing age. They used computation span which consisted of arithmetic problems and listening span tasks whereby the participants were verbally presented with sentences and asked to both memorise a word of the sentence whilst reading a booklet. They tested different cognitive processing components to ascertain which was the most responsible for age related decline. They found of the 460 adults between 18 and 87 that speed processing was a mediator of many of the age- related differences, such that an increase in age is related to a reduction in processing efficiency. In 1996 Salthouse explored this further and argued that within the speed processing hypothesis there were two mechanisms driving the theory; limited time and the simultaneous process.

Limited time is based on the belief that, the cognitive mechanisms are not  
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processed within the time frame and therefore cannot be executed successfully in time. For instance in the articulatory phonological loop as suggested by Baddeley, when hearing stimuli is being received but being processed slowly then the information does not get rehearsed in the appropriate time frame, thus leading to the impairment of the perceptual information and weakening of higher processing. The simultaneous mechanism is the concept that slow processing reduces the amount of simultaneous information available thereby reducing the information that is needed for higher level cognitive processing. For example Salthouse (1996) explains that this process is somewhat like juggling. Each task must be synchronised because synchronisation makes it easier for the higher level processing to be completed. If the process is slow and cannot sync effectively then the higher level processes are compromised.

In support of the age related speed processing theory Park et al, (1996) found that the speed of processing and working memory were highly correlated with each other. Across the life span age related influences on working memory has been linked with the reduction of speed processing. Park et al (1996) extended this research and investigated long term memory as a mediation of working memory. It was found that speed is the fundamental variant in age related influence of working memory and this influence is then mediated to long term memory. Speed processing not only has an influence on working memory but also on the working memory system as a whole for example in the Baddely and Hitch model, (1974) long term and working memory feedback to each other and reduced processing speed would affect this function . Salthouse (1993b, 1994, 1996) provided

further support for age related speed variances using perceptual speed.

They showed that Perceptual speed had an impact on cognitive functions including working memory.

The studies of the speed processing theory are useful as they elucidate the relationship of age related influences on working memory. Speed theory research indicates that as we get older we seem to respond more slowly. If limited by time older adults seem to make more errors than younger adults on working memory tasks. On the other hand it has been suggested that if tasks were slowed down error rates will also decrease for the elderly ().

Whilst there has been a substantive amount of research supporting the speed processing hypothesis research has been produced which argues against the theory. (Salthouse, 1985) raised concerns with the measurements in age related research, because baseline measures in tasks maybe obscured. Due to age differences older adults may react differently on tasks than their younger counterparts. This may be seen in a working memory manipulation tasks, such tasks would be more difficult for participants with weaker memory traces than those with not. It has also been argued that speed as an explanation for age related variances is too simple an explanation, there could be other underlying causes such as health or the cognitive ability of the individual which would also play part in speed processing therefore signifying that speed is not the sole indicator. Another concern was highlighted by Parkin, (1999) who went onto explain that studies thus far have relied on simple speed processing tasks so that all that is being measured is the speed of simple neural networks and not higher cognitive functions or actual working memory. In the same light arguments



against working memory tasks have also been raised such that one may never know if actual working memory is being measured or if it is a combination of other cognitive functions . i. e. tasks such as the reading and listening span used by (Danesman and carpenter, 1980) and the counting task used by (Case, Kurland and Goldberg, 1982). However, no single task is without its weaknesses and it is unlikely that they provide a true and accurate measurement of working memory. For example unsystematic variances in measurements could be task specific such that the results are affected by the construct of the theory procedure or use of stimulus material.

Despite there being a wealth of support for the speed processing theory it has of late fallen out of favour with theorist because it has been described as too simplistic and descriptive. As such it may not go far enough in explaining the functions that underlie the age related decrements in working memory. Suggesting that speed of processing is indirectly linked to the influence of aging on working memory and may not be the sole explanation but merely a mediator. Thus the question is left unanswered as to what mechanism is the driving force behind the age related slowing? And how does this age related mechanism have an influence on working memory?

### Inhibition Control Theory

The ICTheory aimed to answer this question. (Engle,) proposed the inhibitory control theory. Throughout Engle's research there has been an emphasis on establishing what processes underlie the association between age related influences on working memory. According to the inhibitory theory, in order to have efficient processing, relevant information must be activated according

to the current task, and then irrelevant information must be inhibited. The problem occurs when the inhibition mechanism is ineffective i. e. individuals are no longer able to ignore unrelated information thus important material gets confused with appropriate facts. Hasher and Zacks, (1988) extended this further and posit that older adults are more distracted by inappropriate information. For example they are more prone to proactive interference from the environment and this allows distracting ideas to remain longer.

Consequently, older adults tend to use immediate cues from the environment and mix this stimulus with target information. The inhibition buffer does not delete this interference which then leads to a disrupted pattern of recall. A study by (Hasher and Zacks, 1988) and (Bowles and Salthouse, 2003) lends support to the inhibition theory hypothesis. Bowles et al 2003 examined the age related effects of proactive interference on working memory tasks. Using working memory span tasks such as arithmetic problems and reading span, the results showed that older adults found it more difficult than younger adults to attenuate interference on both tasks. This supports the inhibition theory hypothesis. They also found a shared variance of 50. 6% between working memory and proactive interference indicating that inhibition theory may account for a sizeable portion of age related decline in working memory.

Although there is a wealth of studies supporting the inhibition theory, at the same time the hypothesis also suffers from the same weaknesses as the speed processing theory. Age related influences in working memory and indeed the baseline measures' in respect to age is further complicated by individuals' baseline memory and susceptibility to interference. Salthouse

and Meinz, (1995) have cautioned that inhibition cannot be the sole explanation of age related variances in working memory and that speed processing must also be instrumental in its explanation. To further their argument they posit that the way inhibition studies are measured (using difference scores) pose a problem as they may be unreliable and often correlate highly with baseline neutral scores. Additionally it has been argued that for both speed and inhibition studies what is being measured such as inhibition, perhaps is not an overall contribution but a factor in a number of different influences. Hence it would be beneficial to use multiple tasks to get a full picture of the age related effects of inhibition. (Macleod, 1991) observed the lack of research investigating correlations of the inference measures on different measures of the task. (Salthouse and Meinz, 1995) investigated this further, additionally looking at how processing speed related to explicit measures' of interference. The results initially lend support the inhibition hypothesis as correlations were found in task measures. This was also shown to have an effect on working memory and age related influences through decreased inhibition. Despite this it was also shown that the results were not independent of speed processing i. e. even though a reduction in variance was shown when interference was controlled for, the same reduction was shown when speed was being controlled for. Implicating both mechanisms (inhibition and slower processing speed) as the underlying cause of age related influences on working memory.

## Conclusion

Overall theories and studies have explored how the influence of the aging processes influences working memory. Studies have indeed shown that <https://assignbuster.com/the-history-of-the-inhibition-control-theory-psychology-essay/>

increased aging has an effect on working memory such that older adults are slower at processing information compared to their younger counterparts (Salthouse, 1991). Inhibition studies have shown that older adults find it difficult to attenuate interference and subsequently this weakens the working memory processes. It has also been established that neither of these two mechanisms (inhibition and speed) work independently of each other in explaining age related influences but as shown by working memory tasks are related and both have effects on each other. Furthermore according to Salthouse et al (1995) inhibition has a smaller variance than speed and is therefore mediated by speed. However there are positives for older adults. (May, et al 1999) maintain that older adults are susceptible to proactive interference however they also showed that age related decrements in reading span were greatly reduced if breaks were provided between trials and changing the order of the list i. e. conducting the test with the longest lists first. Murphy et al 2000 also found a reduction in age related decline in working memory. By testing younger adults in noisy backgrounds it was found that younger adults' results were comparable to the elderly. It can therefore be deduced from the current studies and theorists that whilst aging does have an influence on working memory, in the real environment conditions are changed to favour older adults then to some extent that these age related influences can be minimised if not eliminated.