Working memory affects cognitive processing

Working memory is based upon memories that are only stored for only a few seconds and are used for working on problems. It consciously processes, codes and “ works” on information Atkinson & Shiffrin (1968); Baddeley (1986). Working memory is capable of collectively organizing, storing, and processing information as activated memory elements, but it is limited (Engle et al., 1999). Psychologists believe that working memory can only hold seven things plus or minus two Miller (1956), but trying to maintain this when multi tasking unrelated exercises such as efficient problem solving and attention skills causes numerous motor conflicts. It is possible to perform multi primitive tasks and complete them but focus still has to be maintained on each item separately. Through the use of syllogisms and experiments on individuals suffering from schizophrenia and experiencing inattentional blindness, one can observe how working memory may affect problem solving and attention.

Working memory is separated into three parts; information is located in the auditory working memory otherwise known as the “ phonological loop” and is used when one needs to remember phone numbers and names. Visual spatial memory, called the “ visuo spatial sketchpad” enables us to maintain words in a visual form but this code fades quickly and when trying to store images such as photos that contain hard to describe intricacies making the visual code more important. Individuals who have photographic memory can remember less noticeable things and act as if they are reading directly from an eidetic Haber (1969) which is very rare. The third component, the central executive, controls the actions and decides how much attention is directed to the imagery and auditory sectors and retrieves information stored in long

term memory and puts it into action and is extremely influential in the processing of information in working memory (Nelson et al, 2000).

For us to have rational, organized thought, working memory is needed and acts as a temporary storage place. It is constantly at work and any new cognitive behaviour that occurs goes automatically through memory. In problem solving, the efficiency paradox is a phenomenon which occurs when information differs with respect to informational complexity (Hoffman et al, 2008). There is an equal understanding when it comes to the results between the accuracy and time with respect to problem solving that working memory had no effect on either one and the studies done by (Hoffman et al, 2008), show that efficiency of problem solving depends on what level of complexity the problem or information to be learned actually is. It can be said that when solving a problem, one must possess the working memory capacity to do so (Baddeley, 1998; Baddeley & Logie, 1999; Engle, Tuholski, Laughlin, & Conway, 1999). Mory (1992) stated that the term ‘ problem solving efficiency’ was the relation in the number of problems solved accurately and the time used to do so and this can be measured by the use of syllogisms.

Syllogisms are logical arguments consisting of two premises and a conclusion Copeland (2006). Experiments conducted by Goel, Buchel, Frith, and Dolan (2000) had participants solve logical syllogisms and it is quite normal that people come to incorrect conclusions because of habit and everyday mathematics. Deductive reasoning is used to show in relation with working memory, how to solve syllogisms which are used as a type of reasoning in problem solving tasks (Quayle & Ball, 2000). To further verify,

numerous processing demands must be used and this is very demanding on one’s working memory and will, therefore, be a factor in problem solving capabilities (Copeland & Radvansky, 2004; Johnson-Laird, 1999). Syllogisms are not very well known and can be challenging to inexperienced persons and previous knowledge does little to help with regards to problem solving (Leighton, 2006).

Working memory capacity is very limited and more efforts are used for mental illustrations leaving a gap in support available for inference generation (Quayle & Ball, 2000). When using inference in logic, the conditional logic is known as modus ponens which allows us to assume that a statement is conditional such as the following sentences; If Nalini understood this topic, she would then achieve a good grade and Nalini did not achieve a good grade. Another logic term, modus tollens states that if we are given a proposition that all P implies C and C is false, then it can be said that P is false. The probability of solving the problem correctly will be high which will also increase the time taken to authenticate the syllogism (Byrne, Johnson-Laird, & Tabossi, 1989; Schaeken, De Vooght, Vandierendonck, & d’Ydewalle, 2000; Vandierendonck, De Vooght, Desimpelaere, & Kierckx, 2000). Therefore, obviously concrete or simple syllogisms will need smaller processes to solve rather than abstract/complex ones that will be more challenging. It can be established through the works of (Copeland & Radvansky, 2004; Daneman & Carpenter, 1980; Johnson-Laird, 1983; Mayer, 2001) that persons with higher levels of working memory capacity will be able to achieve a better performance on problem solving tasks and that

working memory is also related to other tasks such as language (Haarmann, Davelaar, & Usher, 2003).

In classrooms, there are small time frames to complete tasks and in (Hoffman et al, 2008), the effects of abstract syllogisms and working memory in the form of an auditory recoding task on the efficiency of problem solving was used to see the relation between working memory and problem solving. The study concludes that the more challenging a problem the more working memory increases its functions. It can be stressed again that harder problems will take longer and shall be more difficult to solve making persons with higher functioning working memory capacity able to overcome the tasks faster and easier than those with less capacity. Furthermore, the key in efficiently solving problems lies in the level of challenge a problem presents as well as the working memory capacity of that individual person.

Seeing another object whilst absorbed on finding or inspecting another depends on how similar the object is and how challenging the priming monitoring task is. An example of this is entering a dark, crowded movie theatre and looking for an available seat. You are so fixated on the task at hand that it will come as a surprise when you see your friends the next day and they ask why you looked straight at them but did not acknowledge them even after they waved at you. In experiments done to show how individuals can sometimes fail to notice changes in their environment, we take for granted that the memories we have about familiar things, expecting that they will remain the same and preserve the same amount of detailing (Levin et al 2000). Simons and Chabris (1999) explored the relationship between attention and working memory in an experiment done on sustained

inattentional blindness which is when objects are not perceived when their attention is focused on another task.

Experiments testing this theory have the participants involved in a continuous task requiring them to focus on that task ignoring all others. During the experiment, something unexpected occurs, like a person in a gorilla suit Simons and Chabris (1999) or a woman in an umbrella Neisser (1979) but the participant who is being observed does not recognize or even take notice of it even though it is clearly visible to others who are not a part of the task. (Becklen and Cervone 1983; Littman and Becklen 1976; Neisser 1979; Neisser and Becklen 1975; Rooney et al 1981; Stoffregen et al 1993; Stoffregen and Becklen 1989). The fact that we can ignore a gorilla in the " room" is a result of our " visual scratch pad" being controlled by a tiny part of the brain called the posterior parietal cortex Vogel and Machizawa (2004) and Todd and Marois (2007).

This can form an explanation of why drivers say they ' looked but did not see' as humans can. Scientists have shown that is plausible to not observe something but still see it due to the lack of attention we have for our environment and surroundings. Miller (1956)'s memory limitation theory limits individuals and this could also have a part to play in accidents. If this theory is true then it would be assumed that race car drivers will have a higher visual working memory capacity than normal drivers as their tasks would be on a more extreme level demanding more attention (Vogel and Machizawa, Marois and Todd —-). In experiments done by Dr Daniel Simons of the University of Illinois and Dr Daniel Levin of Vanderbilt University further confirms that we see less than we actually do.

“ Sustained attention and working memory are closely related functions that may share common mechanisms” Silver & Feldman (2005). There is sustained attention in schizophrenia patients and healthy participants. This was found by using tasks with various distractors. In patients, the effort to deal with the distractions present were lower, showing a substantial association with working memory and executive function.

It is suggested that working memory as well as a related function in the pre frontal lobe is impaired when an individual suffers from Schizophrenia. As written earlier, working memory is a storage system and includes a central executive that controls attention between tasks and functions. Works by Desimone (1998) asked whether the same neural function is used in sustained attention and working memory. With schizophrenia, visuomotor performance is diminished and to ensure there were no interference (lack of cooperation or motivation), the theory used in testing was a basic part of attention, to see if the patient could resist distraction.

From the experiment, there was a significant link between the variable and verbal working memory but there was no relationship between spatial working memory and attention. The close relationship between attention, working memory and executive functions is located in the same place as the pre frontal cortex. The same function that sustains attention is very closely related to the mechanism in charge of memory function and is also responsible for the allotting of attention capabilities in working memory. The findings of the experiment present that attention and working memory do share similar and the same functions and circuits (Chelazzi L, Miller EK, Duncan J, et al, 1993, 1998).

In experiments done on animals, lesions and brain cooling Evidence from animal lesion Mishkin (1957) ,(Funahashi et al, 1993) and brain cooling (Fuster et al, 1985) showed that top down signals from attention and working memory processes may come from the same place in the pre frontal cortex. Neurons within the cortex help confirm an important position in working memory (Rainer et al, 1998). Sustained attention is very limited and when it needs help from working memory and an increase in task demands will result in similar patterns to those of patients.

These experiments show that working memory and sustained attention do infact share the same neural functions and may have the composition and proved that in patients suffering from schizophrenia, it is difficult for the attention system to support a lot of information causing cognitive functions like working memory to be limited. Visual memory is related to intelligence and similarly to the assertion above on problem solving, that individuals with a greater working memory capacity for remembering images in their heads may be better skilled at reasoning as well as problem solving but it strongly depends on the level and complexity of the problem and working memory capability of the individual.

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