VISUAL WORKING MEMORY AND AUTISM

[1]Joel Mathew Jose, [2]Mathew John Jose, [3]Ajith Geejo, [4]Edwin Josy, [5]Naik Siddharth Shrikant

[1]Postgraduate student, [2]Postgraduate student, [3]Postgraduate student, [4]Postgraduate student, [5]Postgraduate student
[1]Department of Psychology, [2] School of Business and Management, [3]Department of Physics and Electronics, [4]Department of [5]Physics and Electronics
[1]CHRIST (Deemed to be) University, Bangalore, Karnataka India, [2]CHRIST (Deemed to be) University, Bangalore, Karnataka India, [3]CHRIST (Deemed to be) University, Bangalore, Karnataka India, [4]CHRIST (Deemed to be) University, Bangalore, Karnataka India, [5]CHRIST (Deemed to be) University, Bangalore, Karnataka India

Abstract: People on the autism spectrum also use picture or picture cards to assist them with day-to-day activities As a result, they have optical significance. Whether or not, people with ASD have improved visual skills, visual processing is still unclear. And participants with ASD performed worse on a challenge where every second visual objective had to be located visually. Neither of these kinds of visual memory demonstrated major class distinctions. For more detail, additional research, visual, sluggish, or static support may be helpful for those who have the diagnosis of Autism Spectrum. Presenting inputs to students in a quick, distracting fashion isn't helpful. In contrast, people with ASD performed well in all memory measures except spatial recognition Thus, our analysis could result in ever more actively helping people with visual impairments. Individuals with autism are also known to be better at processing visual expression. Recalling has proven to be short in vision but In this study, memory difficulty can be related to memorization time Individuals with ASD doing poorly on visual recall likely to be discovered To comprehend, those with low central co-occurring LD would be enhanced (Funabiki & Shiwa, 2018). Also, with regard to this subject, it can be clearly shown that only the visual working memory is looked at in the test. Various findings show that autism spectrum disorder not only triggers problems of the sensory job memory but also the biochemical areas of the brain, including a temporal sulcus that interrupts the memory (Blair, 2002). Several working memory models have been identified: diffuse concentration, inhibitory management, ability, information updating, retention control, and restrictions, and episodic buffer use of various forms of working memory tasks (such as the Sternberg challenge, Corsi block-tapping, and WMS), it has become difficult, if not impossible, to arrive at a generally accepted conclusion from working memory tasks alone because there is a great diversity among the measures of working memory fMRI, and NIRS (fNIRS). The working memory is considered fundamental to the human cognitive functions, and processes. Working memory also affects other systems.

IndexTerms - **Autism, LD, Working memory, FMRI, Sensory memory, Attention**

I. INTRODUCTION

Working memory has been a topic of great interest to academics since its inception around the 1960s (Baddeley 1990, 2010, 2015). Indeed, more than a century of scientific studies surrounding memory and memory functions have not agreed on the classification of memory, especially regarding the different functions and mechanisms of memory (Cowan, 2005, 2008; Baddeley, 2010). The coining of the term “memory” in the 1880s by Hermann Ebbinghaus, to the distinction made between primary and secondary memory by William James in 1890, and to the now universally accepted and used categorizations of memory, which include: short-term, long-term, and working memory, studies that have tried to decode and understand this abstract concept called memory are extensive (Cowan, 2005, 2008). Short-term memory refers to the short period of information that lasts in the brain (Cowan, 2008). Populating short-term memory by temporarily holding the numbers in mind reflects the brief-term component of memory. Therefore, the concept of working memory has emerged as an alternative to short-term memory that provides a means of addressing short-term memory's oversimplification. (Baddeley, 2012). The working memory model by Baddeley and Hitch (1974) suggests that "working memory" is a multi-component system that manipulates information storage by way of a greater and more complex cognitive utility (Baddeley and Hitch, 1974; Baddeley, 1996, 2000b). In the process of learning, we could see main three subcomponents such as verbal working memory, visual-spatial working memory, and attentional control (Baddeley and Hitch, 1974; Baddeley, 2000b).

Following some cognitive conceptualization of working memory developed more than four decades ago, several experiments have intended to tackle this interesting working memory using various means such as interpreting its presence at the neural level and/or suggesting separate theoretical models in terms of neuronal function or brain stimulation patterns. From the cognitive neuroscientific standpoint, for example, verbal and visual-spatial short-term memory were examined separately. The distinction between them was documented through studies of patients with overt cognitive deficits for different verbal or visual tasks (Baddeley, 2000b). Based upon the above observations, numerous correlations and dissociations with working memory (e.g., phonological loop and visuospatial sketchpad) were then produced (Chai et al., 2018).

In many studies, working memory deficits were investigated in people with mental or neurological disorders. **Autism** is one of the major disorders researchers have looked at. Autism is characterized by an impairment in recognizing and responding appropriately to social and emotional cues. Recent research has shown that brain structures in common with those with autism are affected. Studies show that the Prefrontal cortex (PFC) volume of children with autism may be as much as 67% greater. It is suggested that the neural growth is due to overactive genes, resulting in greater brain volume. The link between abnormal PFC and autistic behavior is unclear, but the PFC's possible connection to the behavior suggests that **working memory** plays a role in the behavior (Courchesne & Pierce, 2005). The working memory profile of a student with autism varies depending on how their intelligence affects their ability to learn. Often high-functioning students have a slightly higher auditory working memory, whereas

low-functioning students perform the same degree as a pupil with a particular intellectual disorder. Students with Autism Spectrum Disorders (ASD) have been shown to have less working memory than typically-developing peers.

Looking on to the **visual-spatial memory** profile, one of the studies showed that visual working memory might play a role in developing social skills in children with autism. This is important because 1 of every 70 children may receive a diagnosis of autism. When looking on to the visual working memory in children having autism, it is found that it is being affected to the academic as well as in their daily life. In a classroom, poor visual working memory makes it difficult for students with autism to grasp math concepts and even solve simple arithmetic. Visual working memory functions as a "mental blackboard", making it difficult for children suffering from autism to carry out addition and subtraction problems in their head. Also, it is found that issues with visual working memory cause issues that causes the inability to recall sensory information often impacts social experiences. Individual's use their visual working memory to decipher body language and decide the right answer. Students with autism may fail to process the nonverbal communication from others and thus may be at a greater social disadvantage than their peers, which affects their social life (New Research Shows Visual Working Memory May Offer Answers to Autism's Social Challenges — ScienceDaily, n.d.).

Also, individuals with Autism Spectrum Disorder (ASD) show problems in visual search tasks while some have trouble in visual perception. (Minshew and Goldstein, 2001) reported that high-functioning individuals with autism performed more badly on visual memory tests, including a complicated abstract figure test; their performances declined compared to controls as difficulty grew on a maze learning task. (Williams, Goldstein and Minshew, 2005) found that individually living people with autism have trouble remembering faces and family scenes. Experiments from researches show that when conducted Visual Perceptual and Space Perception Battery (VOSP) in a test, the individuals having autism scored 5% less than the cutoff in object decision sub-test that depicts the rise in problems with the perceptual skills in individuals suffering from Autism (Blair, 2002).

II. EXPERIMENT DESIGN AND METHODOLOGY

In the articles the researcher have chosen, the researchers have focused on investigating visual memory in children suffering from Autism, experiments or tests were conducted for the research. Where, it was found that **Wechsler Memory Scale-Revised (WMS-R)** is being used for analyzing and understanding the effect of autism in visual working memory along with other subtests such as general memory, logical memory, etc.

The **Wechsler Memory Scale** WMS is a neuropsychology test that offers data signifying the various memory functions of a person. Anyone with an acceptable age range (from 16-90 years of age) can take this exam. WMS-IV is the fourth edition, which was released in 2009, intended to be used with the WAIS-IV. The WAIS-IV has seven subtests: Spatial Extension, Symbol Duration, Design Recall, General Cognitive Screener (goes from I to III), Conceptual Memory (goes from I to III), Verbal Paired Associates (goes from I to III), and Visual Replication (I & II). The output of a human is a five-point rating system involving their auditory memory, visual memory, visual working memory, immediate memory, and delayed memory. The WMS-IV also incorporates an optional cognitive test for individuals at risk for memory deficits or those who have been diagnosed with a number of neurological and/or developmental disabilities. Problems such as dementia or moderate learning disabilities. It is clear that the WMS is capable of differentiating among the memory-impaired clinical classes and that the primary index scores will differentiate among those with moderate and extreme memory impairments.

WAIS - R was established in 1981 and is considered more reflective of greater groups of people. Wechsler Adult Intelligence Scale - III (WAIS-III) was created in 1997 as a revision of the Wechsler Adult Intelligence Scale-Revised (WAIS-R). The key motive of these reforms was to update norms, further expand the age spectrum, adjust objects, create a higher IQ "ceiling" and "floor," and decrease dependence on timed performance.

While memory is one part of cognitive processing, the WMS-R has visual and auditory input tasks in which each information stimulus is introduced every second, which means that even visual awareness is uncontrollable. Therefore, in this research, the researchers have used nine subtests of the WMS-R, including visual and auditory working memory tasks for persons with ASD and people with normal development, to investigate which element of memory varying and whether people with ASD are better at visual working memory tasks. Participants were divided equally into various racial groups. The children came from the hospital and the neighborhood. The patients were diagnosed by a qualified psychiatrist using the Diagnostic and Predictive Manual of Psychiatric Disorders-Fourth Revised Edition. (DSM-IVTR; American Psychiatric Association, 2013). The research analyzed 38 male and 26 female subjects. The researchers have used the WMS-R to perform recall checks on multiple senses independently where it includes 13 subtests for the following memory types: general memory, mental control, figural memory, logical memory I, visual paired associates I, verbal paired associates I, visual reproduction I, digit span, visual memory span, logical memory II, visual paired associates II, verbal paired associates II, visual reproduction II, and digit span.

In this research, the researchers further conducted The Visual Memory Span subtest, which assessed working memory by administering both digit span forward and backward measures (Vis S back). And the subtest demonstrates that the two-item verbal memory evaluation protocols for Vis S for and Vis S back. In the test, we could find that the experimenter faced cards with various colored squares in a visuomotor task and then tapped two squares in rapid succession towards the participant. The individual was expected to respond in the same order how the researcher shows. This analysis was performed twice at various intervals, each time with different taps of the square. Every trial with the same number of squares was performed twice, and as a result, the highest achieved score was 14. In the Vis S back, the individual was faced with eight green circles. The process was the same as in the Vis S. In this evaluation, participants were asked to identify the seven squares backward in the demonstrated sequence, and the highest score was 12 points. The basic visual memory of Vis R (memorization of a schematic figure in 10 sec) did not vary between ASD and Typical Development (TD) classes; neither did the basic auditory memory of Log M. (Williams, Goldstein, and Minshew, 2005) and (Ambery et al. 2006) also registered no substantial variations between groups in the same auditory task of Logical Memory. However, (Minshew and Goldstein, 2001) recorded that young adults with autism did poorly on the Working Memory test (Logical Memory of the Wechsler Memory Scale-Revised) than controls. Williams and co-authors have shown that the difference between the Full scale and Verbal IQ scores is attributed to the larger Full scale and Verbal IQ scores in their participants than those of Minshew and Goldstein. We will make the same argument discussed in Williams et al., that ASD shows a 17-point Full scale and Verbal IQ advantage over (Minshew and Goldstein, 2001) and a 16-point IQ advantage over their controls.

In comparison, (Ambery et al. 2006) observed that people with Autism spectrum disorders do substantially poorer in visual memory for the rapid and delayed recollection of a complex geometric figure. When operating on a visual memory assignment, a subset of ADHD patients had lower scores on the Vis S for and Vis S back tests. And we could see that the Autism Spectrum Disorder group had poor results on the three visual memory tasks of Vis S forward, Vis S back, and Vis PA. The researchers examined whether this bad performance was due to attention deficit hyperactivity disorder traits such as inattentiveness or impulsivity. Since autistic people also use visual contact, and because of this, people believed they had superior eyes. However, the tests have also shown that their short-term memory is poor. The data showed that recall time might be linked to their comprehension level.

We could find that if the memorization period for individuals with Autism Spectrum Disorder is longer than recorded in the current study, those individuals will do better in visual memory. When it comes to everyday life, people with Autism Spectrum Disorder will have unique visual strengths. And we can see that memory functions well when it's limited to a small period. In everyday life, they can find any picture, scene, or person that they like and memorize it. However, various memory tasks required differing memorization periods, suggesting that conflicting outcomes on visual memory may depend on the memorization period. Regardless of the recall test's quality, it could be problematic for visual memory in people with ASD. (Funabiki & Shiwa, 2018).

When looking on to the advantages of the test, we could identify that the test is short and easy to administer, as a full test, we could use this test to show discrepancies between intelligence and performances at school, evaluates memory within different contexts of auditory, visual, etc. Also, we could see that the test has Strong psychometric properties and is having a well-established measure of structured verbal memory. When we look on to the disadvantages of this test, we could see that the test is having an overall reductionist interpretation of test scores, labels and stereotypes, test measures only on the present level functioning and only short-term predictions can be done and does not focus on the outcome of cognition rather than the process. And the main advantages is that this test could be used to predict future academic achievements. And we could see that special addition is the most difficult subtest to administer. Also, looking deeper into the advantages, we could see that there are no findings on delay in identification. For this test, or subtest of the updated WMS. Without evaluating, the output of the substance is not properly remembered, one may be unclear if a patient has encoding issues or retrieval problems. And also, we could see that the WMS tests should provide measurement of memory functioning as it is found to provide less information.

III. CONCLUSION

People with autism spectrum disorder (ASD) often use visual aids such as picture cards or drawings to help them with everyday life. Because of this, the symbols have actual visual power. However, whether persons with Autism Spectrum Disorder have superior visual perception, and how this contributes to superior processing of other senses remains uncertain. And the results found that participants with ASD had poorer visual working memory on a task on which a visual target was pointed every second. Another form of visual memory, called visual reproduction, which is a mechanism in which people recall items, showed no substantial variations between classes. Although more study is required to further understand the historical context of visual supports, slow or static presentation might be useful for those who have Autism Spectrum Disorder. Especially when presenting input to students, fast and uncontrolled visual presentations are impractical. In comparison, people with ASD did not have adequate spatial memory, but still did better in other dimensions of memory. Thus, our research could lead to identifying even stronger visual support services for people with visual impairments. And we could see that Autistic individuals are also assisted by visual stimulation which is believed to impart influence on them. However, recall tests have shown their shortcomings in visual memory. In this research article, we could find that memory complexity could contribute to memorization time. If retention time is longer than that observed in the present study, individuals with ASD scoring high on visual memory more likely to be detected. If so, the perceptual strengths of those with ASD will be a bit understandable (Funabiki & Shiwa, 2018). Also, when looking on to this topic, it is clear that the visual working memory is being only studied in the base of the test conducted and doesn't looked on to more methods of understanding. From different studies, it is found that not only autism spectrum disorder causes the visual working memory issues but also the biological parts of the brain including temporal sulcus which disrupts the memory (Blair, 2002). Several theoretical models of working memory exist in which various components (such as concentrated attention, inhibitory regulation, preservation and manipulating of information, updating and incorporation of information, capacity constraints, evaluative and executive controls, and episodic buffer) of working memory are identified. Coupled with the working memory tasks of different means that encompass a wide spectrum (such as Sternberg challenge, n-back task, Corsi block-tapping test, WMS, and working memory subtests in the Wechsler Adult Intelligence Scale [WAIS]), it has been challenging, if not extremely improbable, for working memory trials to find a consensus upon a coherent research procedure that is appropriate for generalization of findings due to the limitations bound by the existence of the study. There are a range of methods used to examine brain activity such as paper-and-pen studies, functional MRI, electroencephalography, diffusion tensor imaging and functional near-infrared spectroscopy (fNIRS). The working memory is believed to lay the basis for many other cognitive functions in humans and learning the working memory mechanisms will be the first step in promoting cognitive growth. There are also functions of working memory that affect other cognitive processes.

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