الاضطرابات البيئية كمحفزات للذاكرة: دراسة تأثير التشويشات البصرية على استرجاع المعلومات

Environmental Anomalies as Memory Triggers: Analyzing the Influence of Visual Disruptions on Memory Retrieval

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الكلمات المفتاحية: الاضطرابات البصرية، أجهزة التذكر، استدعاء الذاكرة، الإشارات السياقية، إطار التشويش البصري كوسيلة تذكر.(VDM) .

Keywords: Visual Disruptions, Mnemonic Devices, Memory Recall, Contextual Cues, The Visual Disruption Mnemonics(VDM).

الملخص

تذكر المعلومات والخبرات هو ما يمكننا من حل المشكلات الجديدة التي نواجهها في المستقبل. تدرس الدراسة الحالية كيف يمكن لاضطرابات بصرية أو شوائب بصرية أن تكون فعالة في تعزيز الذاكرة والمساعدة في تذكر المهام التي يحتاج المشاركون إلى تذكرها. وبالتالي تهدف هذه الدراسة إلى استكشاف فاعلية التشويش البصري في تحسين استدعاء الذاكرة مقارنة بالطرق التقليدية. اعتمدت الدراسة على نهج مختلط من خلال إجراء بيانات كمية ونوعية. شارك في هذه الدراسة عشرون متطوعًا لم يعانوا من اضطرابات نفسية أو عقلية، تتراوح أعمارهم بين الأربعين والخمسين عامًا. تم توزيعهم إلى مجموعتين، مجموعة ضابطة ومجموعة تجريبية. اعتمدت مجموعة الضابطة على طرق تقليدية لتذكر المهام، بينما استخدمت المجموعة التجريبية التشويش والمناظر البصرية غير المعتادة كوسيلة للتذكر. اختبر الباحث قدرة المشاركين على التذكر في فترات ٢٤ و٤٨ و٧٢ ساعة وبعد أسبوع. كشفت النتائج تفوق المجموعة التجريبية على مجموعة الضابطة في تذكر المهام الموكلة إليهم. بالإضافة إلى ذلك، أكدت النتائج فعالية استخدام التدخلات البصرية لتعزيز الذاكرة وتذكر الأشياء وأن الاضطرابات البصرية تعد إشارة فعالة لتحفيز الذاكرة، خاصة إذا كانت هذه التدخلات مميزة وبعيدة عن المعتاد، حيث تساعد في جذب انتباه المشارك. لذا، فإن هذه الاستراتيجية أكثر فعالية من الطرق التقليدية، وكلما كانت الضوضاء البصرية أكثر تميزًا، كانت فعاليتها أفضل وأسرع في تعزيز الذاكرة. تشير نتائج البحث إلى أن إضافة هذه الاستراتيجية إلى الأنشطة اليومية للمشاركين قد تكون طريقة فعالة ومفيدة لتعزيز الذاكرة. يُلخص إطار التشويش البصري كوسيلة تذكر المستمدة من النتائج، مقدماً إطاراً قوياً لفهم وتطبيق هذه الاستراتيجية الجديدة للتذكر في مختلف السياقات

Abstract

Remembering information and experiences is what enables us to solve new problems that confront us in the future. The current study examines how visual disturbance or visual anomalies are effective in enhancing memory and helping to recall tasks that participants need to remember. Thus, it aims to explore the effect of visual anomalies in improving memory recall compared to traditional methods. The study relied on a mixed-method approach through a quantitative and qualitative data procedure. Twenty volunteers who did not suffer from psychological or mental disorders, aged from forty to fifty years, participated in this study. They were distributed into two groups: control and experimental. The control group relied on traditional ways to remember the tasks, while the experimental group used confusion and unusual visual anomalies as a means of remembering. The researcher tested the participant's ability to remember at intervals of 24, 48, and 72 hours and after a week. The results revealed the superiority of the experimental group over the control group in remembering the tasks assigned to them. In addition, the findings stress the effectiveness of using visual interference to enhance memory and remember things. The visual disturbance is an effective signal to stimulate memory, especially if these interferences are distinctive and far from the usual, as they help attract the participant’s attention. Thus, this strategy is more effective than traditional methods, and the more distinct the visual noise is, the better and faster its effectiveness in enhancing memory. The research results indicate that adding this strategy to participants’ daily activities may be an effective and useful way to enhance memory. The Visual Disruption Mnemonics (VDM) framework encapsulates the core principles derived from the findings, offering a robust framework for understanding and applying this novel mnemonic strategy in various contexts.

1. Introduction

Memory is inherent in the concept of learning. It can be defined as a person's ability to recall information that has previously been stored in the mind, or it is the mental ability to retrieve and preserve information, experiences, and ideas that have been acquired in life(Roediger and Butler,2011; Godden & Baddeley, 1975). As a fundamental aspect of cognitive function**,** memory is important in human scientific and practical life. Remembering our previous learning, information, and experiences is what enables us to solve new problems that confront us in the future. It also helps us to continue progress in acquiring new information and discovering new facts. In the context of modern psychology, memory is not just a storage facility where individuals keep all social events. Still, it is also the cognitive aspect responsible for the rational images that pass before our imagination, advancing our understanding of the world around us((Roediger and Butler,2011).

Many psychologists agree that memory is a mechanism in the brain, and it has three types. The first is sensory memory, which is the first gateway through which information passes into the brain, and it plays an essential role in how we interact with the surrounding world. This memory stores sensory impressions for a very short period. Short-term memory is the memory that preserves and stores information related to the individual's daily life, and its term is short, hence its name. Lastly, Long-term memory is associated with preserving information for days, months, and even years, and it is normally connected with events that occurred a long period ago. Factors affecting memory include the individual's desire to learn the information, the nature and importance of the stored information, the way the information is organized in the mind, the setting in which it was understood, and the retrieval cues available at the time of recall. All these considerations are critical in affecting the efficiency of memory recall(Kroll et al., 2002).

As stated by Tulving (1983), contextual cues play a pivotal role in enhancing memory recall by providing associative triggers that help retrieve the stored information. According to (Godden & Baddeley, 1975), these cues or signals can be internal, such as emotional states resulting from interactions with life matters, or external signals, such as various environmental settings. As a cognitive concept, "contextual cues" refer to the context from which information originates and which, in turn, is stored in human memory. Thus, memory cannot be stored and preserved in isolation from the context from which the stored information emerges. This phenomenon is known as "context-dependent memory", and it confirms that recalling information is more effective when two basic contexts match, namely the retrieval context and the encoding context. It also focuses on the idea that environmental features can function as a signal that helps

retrieve information in memory. An individual who learned a certain piece of information in a designated environment, such as a home or a classroom, can retrieve the same information when returning to the context from which it emerged. Related to the same subject, the study aims to understand how visual disturbances enhance memory and recall through scientific experiments and field investigations. The results could potentially improve individuals' quality of life by enhancing their ability to remember and retrieve information effectively.

1.2. Statement of the problem

Memory is one of the most important mental abilities on which daily life, academic, and professional success depend. However, many individuals have difficulties remembering information, which negatively affects their performance. Methods for enhancing memory are a popular research topic, but gaps in scientific understanding about how these methods can be tailored to individual differences remain limited. In addition, despite theoretical support, empirical research on visual disruptions in everyday settings as mnemonic devices remains also bounded. Existing studies have highlighted the potential of various mnemonic techniques and visual aids in improving memory. Yet, the specific impact of visual disruptions, such as intentional changes or interruptions in visual stimuli, requires further exploration. This gap in knowledge limits our understanding of how these disruptions can be leveraged to optimise memory retention. Therefore, this study aims to investigate the role of visual disruptions in memory recall, providing insights that could enhance cognitive interventions. These issues represent the core of the research problem that this study seeks to discover.

1.3. Research Objectives

This study intends to address the following objectives

1. Evaluate the effectiveness of visual disruptions as mnemonic devices in enhancing the recall of prospective memory tasks.
2. Analyze the role of environmental context in the effectiveness of visual disruptions on memory recall.

1.4. Research Questions

The present study is intended to answer :

1. How do visual disruptions in the environment influence the recall of prospective memory tasks compared to traditional mnemonic devices?

2. What is the impact of the distinctiveness of visual disruptions on the effectiveness of memory recall in different environments (e.g., kitchen, bedroom, living room)?

1.5. Research Hypotheses

The following hypotheses, which the study proposes, help determine expectations and potential relationships between variables

1. Participants who use visual disruptions as mnemonic devices will recall prospective memory tasks significantly higher than those who use traditional mnemonic devices.

2. The distinctiveness of visual disruptions will have a significant positive effect on the recall of memory tasks across different environments (e.g., kitchen, bedroom, living room).

2. Theoretical Framework

2.1. Brain and Memory

The human brain serves as the primary organ and the central processing unit of the human nervous system, overseeing the majority of bodily functions. It is a sophisticated organ responsible for managing thoughts, memories, emotions, sensations, motor functions, vision, respiration, temperature, hunger, and all bodily regulatory processes. Along with the spinal cord, which extends from it, the brain forms the Central Nervous System (CNS). In an average adult, the brain weighs around 3 pounds and is composed of approximately 60% fat. The other 40% consists of water, carbohydrates, salts, and protein. Psychologists argue that the brain is not a muscle; it comprises blood vessels and nerves, which include neurons and glial cells(Springer, S. P., & Deutsch, G. (1998).

Our brain is bicameral because it is divided into two hemispheres, left and right, each with distinct functions and specialities. The left hemisphere of the brain is responsible for complex functions such as language processing (including speech and writing), housing the Broca's and Wernicke's areas, which are responsible for linguistic abilities. It is generally responsible for analytical thinking, problem-solving, and understanding of theoretical information(Gazzaniga,2000). The Right Hemisphere specialises in spatial skills because it plays a crucial role in spatial awareness and processing and helps in understanding and interpreting visual information. It is also responsible for creativity because it was discovered that this part of the brain is more active during creative tasks and thus contributes to the ability to think "outside the box".

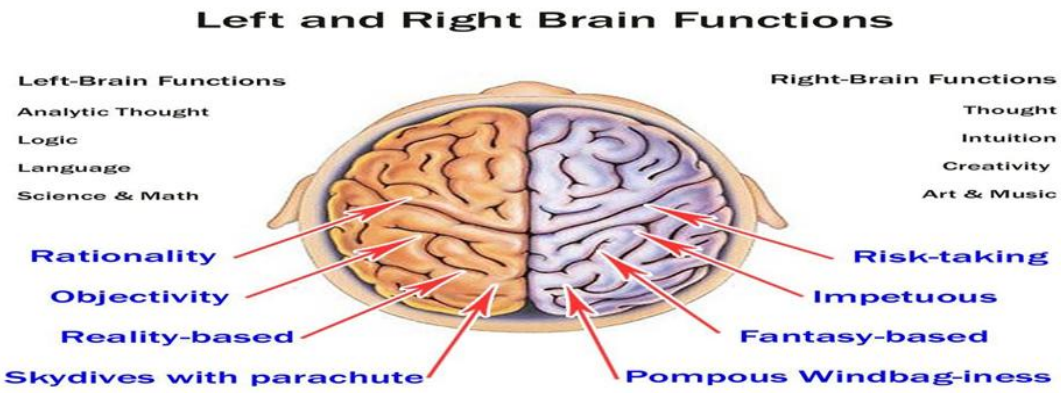


Figure no. 1:Left and Right Brain Functions

The Right hemisphere also controls emotional processing, holistic thinking, and nonverbal communication(Hellige,1993). The corpus callosum interconnects these two hemispheres to enable the brain to perform complex tasks and integrate various types of information.

Memory is a dynamic process influenced by the mind, involving the encoding, storage, and retrieval of information. The mind filters and processes incoming information, deciding what to retain and what to discard, highlighting the malleable nature of memories. It is studied within the fields of cognitive psychology and neuroscience and classified according to its duration, nature, and ability to recall emotional states. Scientists classified memory into three main categories:

1. **Sensory Memory**: This type allows you to remember sensory information briefly after the stimulus ends. It serves as the starting point for other memories. Repeated sensory experiences can move into short-term or long-term memory (Craik & Lockhart, 1972).

2. **Short-Term Memory**: This type allows for the recall of information for a short period, typically around 30 seconds. Information can be maintained in short-term memory through rehearsal, such as repeating a string of numbers(Smith & Vela,2001).

3. **Long-Term Memory**: This is where the majority of our memories are stored. Any memory recalled after 30 seconds is considered long-term. There is no limit to the capacity or duration of long-term memory, which is divided into two main categories: explicit and implicit memory(Craik & Lockhart, 1972).

Prospective memory, on the other hand, is crucial for everyday functioning, and it is defined as remembering to do things in the future. It

is when you remember to perform a task at the original time that you intended to accomplish that task. Prospective memory can be further divided into two subtypes: Time-Based Prospective Memory and Event-Based Prospective Memory. On the one hand, the former involves remembering to perform a task at a specific time or after a certain amount of time has elapsed. On the other hand, the latter consists in remembering to perform a task in response to a particular event or cue. For example, remembering to buy milk when passing by a grocery store. Prospective memory relies on various cognitive processes, including attention, executive functions, and the ability to monitor the environment for relevant cues. Deficits in prospective memory can impact daily functioning and are often seen in conditions such as Alzheimer's disease and attention deficit hyperactivity disorder(McDaniel and Einstein,2000)

As for McDaniel and Einstein (2000), this type of memory involves the multiprocess, suggesting that both automatic and strategic processes are fundamental in remembering to perform future tasks, and they focus on the role of external cues in triggering it, emphasising that distinct and salient cues are particularly effective. The work of these two scholars suggests that visual disruptions, which stand out due to their unusual nature, could serve as effective triggers for prospective memory, enhancing the likelihood of task completion.

There is no single place where all memories are stored. The brain stores different kinds of memories in various places when we recall any memory; these different regions interplay with each other and present a consolidated memory. The two main principles that describe and elucidate the impacts of incidental environmental context on human memory are:

1. The influence of environmental changes diminishes as the reliance on non-environmental cues, either during learning or recall, increases.

2. The impact of changing the environment between study and recall decreases when subjects are prompted during recall to mentally reconstruct the context from the learning phase (the mental reinstatement principle (Smith & Vela,2001).

Both principles suggest that the effects of environmental alterations are lessened when attention is diverted from the learning and/or recall environments. This phenomenon can occur due to a focus on associative information (overshadowing and outshining) or because the learning context is mentally reconstructed (mental reinstatement). These fundamental principles can be inferred from the theory that memory arises from the need to maintain a continuous mental representation of the environment (Glenberg, 1979).

2.2. Contextual Cueing

Contextual cueing refers to the process by which the presence of environmental cues aids in the retrieval of information from memory. Godden and Baddeley (1975) demonstrated that memory recall is enhanced when the context present at encoding matches the context at retrieval. Smith and Vela (2001) conducted a meta-analysis that emphasised the significance of prominent and distinct environmental cues in memory recall. The contextual cueing effect, influencing both adults and children, suggests a fundamental cognitive mechanism enhanced by expertise. Although related findings date back to the 1970s, the concept was formalised by Chun and Jiang in 1998. The standard contextual-cueing task, first developed by Chun and Jiang in 1998, demonstrated that implicit learning and memory of visual contexts can guide spatial attention toward task-relevant aspects of a scene. In a typical contextual cueing experiment (Vadillo et al., 2015), participants search for a T-shaped target among L-shaped distractors. The search arrays are divided into blocks, with half presenting new, randomly arranged displays and the other half presenting old, fixed displays. Participants showed faster reaction times to targets in old displays, indicating learned associations between spatial configurations and target locations. Despite this improved search performance, participants often could not consciously distinguish between old and new displays, suggesting that contextual memory is implicit. This phenomenon, known as 'contextual cueing,' has become a key tool in visual search research.

Experimental research examining how the surrounding environment impacts memory traces its origins to Carr's (1925) study on how incidental environmental changes affect maze running in rats. Following this, a bunch of studies have explored how ecological factors influence cognitive recall, with many supporting the notion that incidental changes in the environment can impact memory performance. One of them is Smith's 1994 study, which reviews some of these studies. Early research on how incidental environmental context affects human memory often used interference reduction paradigms. In these studies, participants learned interfering lists either in the same environment or in different environments. Some of them opined that interference was significantly reduced when interfering and target lists were discovered in various environments. The body of literature on contextual cueing lacks a definitive explanation for its mechanisms(Humphreys et al.,1989).

As a concept, contextual cueing involves distractors and target items with varying features like shape, hue, and size. Studies on whether salient targets enhance contextual cueing are inconclusive. Studies by Smith and Vela (2001) have shown that memory recall improves when the retrieval context matches the encoding context. Other studies have shown that

expertise significantly impacts performance on visually-based tasks due to the contextual cueing effect. Brockmole et al. (2008) demonstrated that chess experts can recall game positions better than novices, attributing this to their ability to use meaningful context derived from their knowledge of the game. Their experiments revealed that search benefits were greater for experts with meaningful game positions and reduced with random boards. Geyer et al. (2010) found that salient targets improved detection accuracy and reaction times in repeated item arrangements, while Conci et al. (2011) showed reduced contextual cueing effects when distractor sizes varied. There are mixed views on how contextual cueing operates. Some suggest it is determined by the proximity of items to the target, while others argue it involves forming associations between the target and the entire distractor background. Another perspective describes the effect as spatial congruency bias, where targets in old displays are perceived as more similar due to their identical locations, facilitating faster memory encoding and retrieval.

2.3. Previous Studies

Previous studies are an important basis for understanding and contextualising the current research. The forthcoming literature review indicates that visual disruptions play a significant role in enhancing memory through mnemonic devices. The examinations also highlight various techniques and their efficacy in different contexts, from cognitive psychology to clinical applications and language learning. This comprehensive analysis suggests that visual mnemonics are versatile tools that can aid memory and learning across diverse fields. Here are some of the related studies:

Table no.1 Previous Studies:

No.	Study Title and Authors	Publication	Aim	Population	Findings
1	**"Analysis of a Mnemonic Device: Modern Psychology Uncovers the Powerful Components of an Ancient System for Improving Memory"** by G.H. Bower	*American Scientist*, 1970	To explore the effectiveness of ancient mnemonic devices, particularly the use of visual disruptions in memory enhancement.	General population, focusing on cognitive psychology	Found that visual disruptions, such as imaginary visualisation, are crucial for processing incoming visual information and improving memory.
2	**"Updating Memory Using Mnemonic Devices"** by F.S. Bellezza	*Cognitive Psychology*, 1982	To investigate how mnemonic devices, like the link mnemonic, affect memory updating.	Adults participating in cognitive memory tasks	Showed that mnemonic devices could disrupt visual memory, especially through the AB, A-Br transfer paradigm, enhancing memory updating.

3	**"Teaching Clinical Reasoning with an Example Mnemonic for the Neuropsychiatric Syndromes of Traumatic Brain Injury"** by M.E. Peters, K. Moussawi, and V. Rao	*Academic Psychiatry*, 2018	To provide a mnemonic for teaching clinical reasoning in neuropsychiatric syndromes of traumatic brain injury.	Medical students and trainees	Highlighted how disruptions in neural circuits can lead to cognitive deficits and how mnemonics can aid in clinical reasoning.
4	**"Learning by the Keyword Mnemonic: Looking for Long-Term Benefits"** by M.H. Thomas and A.Y. Wang	*Journal of Experimental Psychology*, 1996	To evaluate the long-term effectiveness of the keyword mnemonic, especially the role of visual cues.	Students in learning environments	Emphasized the importance of visual cues, finding that picture distractors significantly disrupt recall compared to sentence distractors.
5	**"When the Future Is Hard to Recall: Episodic Memory and Mnemonic Aids in Denis Villeneuve's Arrival"** by H.C. Wojciehowski	*Projections*, 2018	To explore how visual analogies in film act as mnemonic aids for episodic memory.	Viewers of the film *Arrival*	Demonstrated that visual analogies serve as mnemonic aids, enhancing episodic memory through the cinematic experience.
6	**"Use of Mnemonics in Learning Novel Foreign Vocabulary: Help or Hindrance?"** by Y.T. Liu	*Academic Commons, Columbia University*, 2001	To assess the effectiveness of mnemonic devices, particularly visual mnemonics, in learning foreign vocabulary.	Learners of Chinese ideographs	Found that visual mnemonics can both aid and hinder the learning of Chinese ideographs, depending on the context.
7	**"Method-of-Loci as a Mnemonic Device to Facilitate Access to Self-Affirming Personal Memories for Individuals with Depression"** by T. Dalgleish, L. Navrady, E. Bird, and E. Hill	*Clinical Psychological Science*, 2013	To explore the use of the method-of-loci mnemonic for accessing self-affirming memories in individuals with depression.	Individuals diagnosed with depression.	Demonstrated that the method-of-loci is effective in helping individuals recall self-affirming personal memories, providing therapeutic benefits.

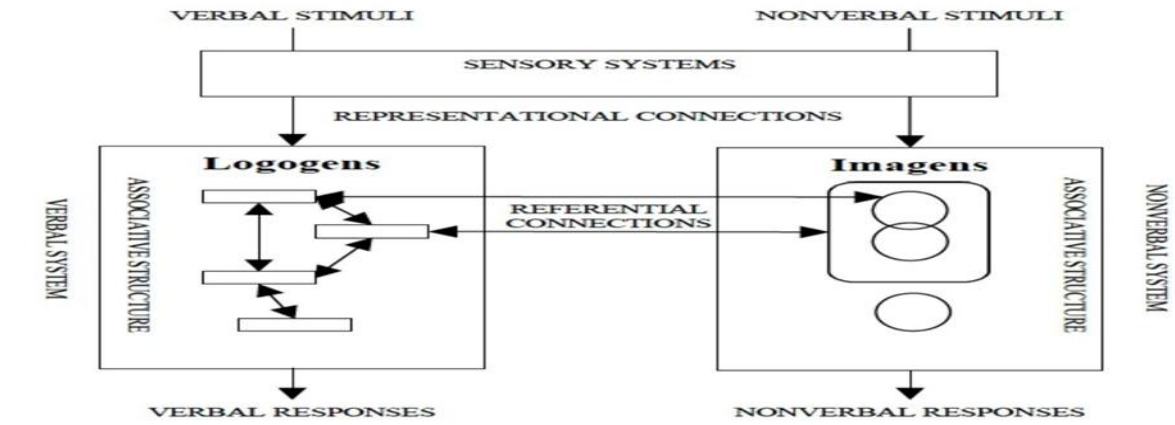
2.4. Dual Coding Theory

As a theory of cognition, Dual Coding Theory (DCT), conceptualized by Allan Paivio in the 1970s, suggests that creating mental pictures aids learning. Paivio posited that individuals can enhance their grasp of new information through two methods: visual imagery and verbal associations. DCT was introduced at a time when it was thought that human memory relies solely on words in inner or sub-vocal speech. These ideas were very influential as the rapid developments and cycling with sticks and

the influence of AI research profoundly affected psychological conceptions of our mental representations (Jacoby, 1983). The Dual Coding Theory (DCT) posits that mental representations are formed through the integration of verbal and visual information, each handled uniquely within distinct cognitive channels. This theory asserts the existence of two encoding systems: analog codes, which preserve perceptual features akin to physical objects, predominantly for visual representations; and symbolic codes, primarily for verbal information, representing concepts through abstract symbols, such as words and their combinations (Johnson, et.al.,1993). The combination of a visual cue and its associated task during the encoding process enhances a memory's resistance to forgetting. Paivio's research demonstrated that human behavior and experience are based on the interaction of verbal and nonverbal mental mechanisms, each specialized for activating linguistic and imagery details. These systems form associative networks that develop and activate through contextual influences (Krafka, & Penrod, 1985).

One of the key points in this theory is that verbal representations are sequential and symbolic, while nonverbal representations are parallel and perceptually similar to their referents. Referential connections are critical concepts as they link verbal and nonverbal systems, allowing operations like naming images and imaging words. Associative connections within each system facilitate complex activation patterns. DCT also focuses on the idea that past experiences and individual differences influence the development and activation of these mental representations. The theory emphasizes that concrete and imagery-rich material is more likely to evoke mental images, aiding memory and understanding. Consequently, it might provide a unified explanation for educational psychology, supporting higher-level strategies and beliefs in education, and integrating cognitive, emotional, and motor skills processes. This can be done by utilizing diagrams, charts, and other visual aids in conjunction with verbal explanations (Schnotz & Kürschner,2007; Wiley & Voss,1999).

Figure no. 2 Dual Coding Theory



Dual coding theory proposes that combining these distinct visual elements with verbal tasks provides a cognitive advantage, leading to improved memory retrieval. In the context of this study, visual disturbances (such as upside-down milk containers or water containers) serve as strong, distinctive, and easily remembered visual cues because they might create a dual coding effect. The unusual character of visual disturbances ensures that they attract attention and are processed deeply, enhancing memory retention. This theory has also been utilized in addressing a range of psychological problems, including thinking techniques and individual differences in thinking styles. However, there are a few constraints to the Dual coding theory, for instance, it doesn't address the possibility that cognition might be mediated by something other than images and words. Although this theory is debatable, it was beneficial for a bunch of studies that we have since that time and it paved the way for numerous new theories that we hold strongly today. (Kolers & Roediger,1984).

3. Methodology

3.1 Research Design

This study investigates the impact of visual anomalies on memory enhancement by comparing the performance of twenty volunteers, aged 40-50.These participants do not suffer from psychological or mental disorders. The study relied on mixed method approach through a quantitative and qualitative data procedure The participants were divided into control and experimental groups. The control group used traditional memory techniques to remember some tasks while the experimental group employed confusion and unusual visual anomalies to remember the same tasks. Participants were given a set of tasks to remember. Both quantitative and qualitative data were collected , through a questionnaire and semi-structured interviews respectively,to answer the research questions. Memory performance was assessed through this process at intervals of 24, 48, and 72 hours, and after one week.

3.2. Participants

Table 2 summarizes the participant selection criteria, recruitment methods, and key procedures followed in the study. These measures were taken to ensure the reliability and validity of the research findings. The information is formatted in the following table:

Table no. 2: Participants information

Category	Details
Participants	Twenty male and female participants, ages 40-50 years old.
Selection Criteria	- Freedom from mental illness and memory-related disorders - Lack of use of medications affecting cognitive function - Middle-aged group (40-50 years)
Focus of Study	Middle-aged adults exhibiting unique memory characteristics
Recruitment Method	Messages sent through WhatsApp, with assistance from relatives
Informed Consent	Participants were informed about the study, the conditions for participation, and their right to withdraw at any time without penalty. Full consent was obtained.
Confidentiality	Data anonymized and securely stored
Pre-study Questionnaire	Participants completed a demographic questionnaire covering age, gender, educational background, occupation, stress levels, sleep patterns, and daily routines
Exclusion Criteria	- History of neurological or psychiatric disorders - Use of medication affecting cognitive function
Group Assignment	Participants were randomly divided into the control group or experimental group (10 participants in each group)
Debriefing Session	Provided closure to participants and ensured transparency in the research process

3.3. The Control Group and the Experimental Group

The volunteers were randomly categorized into two groups: the control group and the experimental group, each of which involved ten participants. Instructions were given to both groups according to the group's situation. The researcher adopted an explanatory approach to the control group by giving them instructions using traditional methods in order to remember the tasks assigned to them. Traditional methods include written notes, the use of a calendar, or the use of small stickers (McDaniel & Einstein, 2000) by placing them within the task environment.

The experimental group also included ten participants, but the instructions here differed from the previous group. The central point here is using unusual objects (visual disturbances) placed in specific places to remind them of the task assigned to them and to stimulate their memory within the environment. The researcher explained this matter through

examples and explanations in the Arabic language and gave several examples in order to grasp the information. Common household items for visual disruptions as mnemonic devices are adopted here to catch the participant's attention due to their incongruity with the usual setting, thus serving as effective memory cues (Smith & Vela, 2001; Paivio, 1986). Examples of such items include:

- An upside-down milk carton placed in the kitchen.
- An inverted picture frame positioned in the living room or bedroom.
- A pen or other small object placed in an unusual spot, such as balanced on its tip or placed sideways on a shelf.
- A book turned to face the opposite direction on a bookshelf.
- A kitchen utensil (e.g., a spoon or spatula) placed in an unexpected location, such as the bathroom.

List of Tasks to be Remembered

The researcher asked the participants in both groups to remember a set of tasks that must be performed in the home environment (bedroom, living room, kitchen, bathroom). These tasks are chosen to represent a range of typical household responsibilities that require timely attention. Each task will be assigned a specific visual disruption to enhance the likelihood of recall. Participants in the control group will receive similar tasks but will use traditional methods, such as written notes or small stickers, to aid their memory (McDaniel & Einstein, 2000; Roediger & Butler, 2011). These are some examples of tasks included in the study. These tasks were distributed across different rooms in the participant's home to utilize the contextual cues provided by the visual disruptions:

Kitchen

1. Water the plants on the kitchen windowsill.
2. Refill the sugar container.
3. Clean the microwave.
4. Take out the trash.
5. Put away the clean dishes from the dishwasher.

Bedroom

1. Make the bed.
2. Put dirty clothes in the laundry basket.
3. Dust the bedside table.

4. Change the pillowcases.
5. Organize the books on the nightstand.

Living Room

1. Vacuum the carpet.
2. Water the plants in the living room.
3. Wipe the coffee table.
4. Organize the magazines on the coffee table.
5. Turn off the TV and put the remote in a drawer.

Bathroom

1. Clean the bathroom mirror.
2. Replace the hand towel.
3. Refill the soap dispenser.
4. Empty the bathroom trash can.
5. Wipe down the sink.

3.4. The implementation steps

By following these steps, the study aims to systematically test the effectiveness of visual disruptions as mnemonic devices compared to traditional reminder methods

Table 3. The implementation steps

Step	Description	Elaboration
Task Distribution	Tasks are distributed across various home locations (kitchen, bedroom, living room, bathroom).	Utilizes the natural context of each space to facilitate memory recall, based on the principle from Godden & Baddeley (1975).
Instructions for Experimental Group	Specific instructions on creating and placing visual disruptions.	Participants are encouraged to be creative with visual disruptions to ensure they are noticeable and distinct, such as placing items in unusual spots.
Instructions for Control Group	Guidance on using traditional reminder methods (sticky notes, small coloured stickers).	Clear instructions are provided to ensure consistent and effective use of traditional methods, based on Roediger & Butler (2011).

Daily Monitoring	Participants check in daily to report task completion.	Daily monitoring helps track progress, and adherence and allows timely identification of any issues or difficulties encountered by participants.
Evaluation	Assessment of task recall accuracy and completeness after the intervention period.	Compares the effectiveness of visual disruptions against traditional methods to rigorously test the hypothesis that visual disruptions enhance memory recall.

3.5. Procedure

To accurately measure the efficacy of visual disruptions as mnemonic devices, the recall test was conducted at different intervals. The initial recall test takes place 24 hours after the initial task assignment. Participants in both the control and experimental groups are asked to recall the list of tasks they are given by writing down as many tasks as they could remember, which helped establish the short-term effectiveness of the different memory aids used by the two groups, and their responses have been collected for analysis. Then the long-term impact of visual disruptions on memory recall is also tested by the follow-up tests procedure at 48 hours, 72 hours, and one week (7 days) after the initial task assignment. During each follow-up test, participants were again asked to recall and document the tasks they were assigned. These intervals are strategically chosen to assess how well participants retain the tasks over time and to identify the differentiations in the recall performance process between the two groups. The table gives an extra illustration:

***Table 4. The testing schedule and procedure**:*

Recall Test Interval	Description	Purpose
24-Hour Recall Test	Participants will be contacted 24 hours after they receive their tasks. They will be asked to write down all the tasks they remember without any external aids.	Provides a baseline measurement of the effectiveness of the visual disruptions versus traditional methods.
48-Hour Recall Test	Two days after the initial task assignment, participants will undergo another recall test.	Helps to determine the stability of their memory and the ongoing impact of the mnemonic strategies.

72-Hour Recall Test	Three days after the task assignment, a further recall test will be conducted.	Gauges medium-term memory retention and any potential decline in recall accuracy.
7-Day Recall Test	One week after the initial task assignment, participants will take the final recall test.	Crucial for understanding the enduring effects of visual disruptions on memory retention.

3.6. Data Collection Methods

To systematically assess the effectiveness of visual disruptions as mnemonic devices, quantitative data were collected throughout the study at each recall interval (24 hours, 48 hours, 72 hours, and 7 days). The first step was the task recall recording which followed the procedure that at each designated interval, participants were asked to recall and document the tasks they were initially assigned. The number of tasks recalled by each participant was recorded and meticulously crafted. As for the control group, the process involves noting how many tasks they can recall using traditional memory aids, while for the experimental group, it was measured how effectively the visual disruptions facilitated their recall. Then comes the process of data entry and verification through which the recalled tasks were collected and entered into a secure database for analysis and data entry was cross-verified by a second researcher to ensure accuracy for maintaining the integrity and reliability of the study's findings.

Additionally, qualitative data were gathered to provide a profound comprehension of the participants' experiences and perspectives of the mnemonic strategies used. The second method of collecting data that the researcher adopted was semi-structured interviews, which were conducted after completing the first method. The aim of the interviews is to collect details and record more notes about the participants' experiences and the strategy that each group followed as a means of remembering. The interviews included questions about the ease and challenges that the two groups faced in these two experiments. The flexibility of structuring the interviews helped a lot in smoothing the process and collecting data because were conducted at times and in ways that suited the participants. It was either an in-person interview or a video interview via WhatsApp, according to the participant's availability. Each interview lasted twenty to forty minutes and was recorded using a special audio device after obtaining the participants' consent. The responses from each recall test will be collected and analyzed to compare the performance of each group. The analysis focused on the number of tasks accurately recalled at each interval and the consistency of recall over time. By comparing these metrics, the study aims to identify whether visual disruptions offer a significant

advantage over traditional memory aids in both short-term and long-term memory recall.

4. Data Analysis and Discussion.

4.1 Quantitative Findings

The quantitative analysis aimed to compare the recall performance between the control and experimental groups over several time intervals. The following table summarizes the average number of tasks recalled by participants in both groups at each time interval.

Table 5. Quantitative Findings

Time Point	Group	Mean Tasks Recalled	Standard Deviation	Range
24 Hours	Control	5	1.2	3-7
	Experimental	8	1.1	6-10
48 Hours	Control	4	1.3	2-6
	Experimental	7	1.2	5-9
72 Hours	Control	3	1.1	2-5
	Experimental	6	1.3	4-8
7 Days	Control	2	1.0	1-4
	Experimental	5	1.2	3-7

The descriptive statistics designate that the experimental group consistently outperformed the control group in terms of recall performance across all time points. At 24 hours, the experimental group recalled an average of 8 tasks compared to 5 tasks in the control group. This trend continued with the experimental group maintaining a higher recall rate at 48 hours, 72 hours, and even after 7 days.

Repeated Measures ANOVA

In order to compare statistically the recall performance between the two groups over time, a repeated measures ANOVA was conducted. The results are summarized in the table below.

Table 6. Repeated Measures ANOVA

Analysis Component	F-value	p-value	Effect Size (Cohen's d)	Interpretation
Main Effect of Group	F(1, 18) = 15.23	p < .001	d = 0.85	Significant difference between groups.
Main Effect of Time	F(3, 54) = 9.87	p < .001	d = 0.70	Significant difference across time points.
"Interaction Effect" (Group x Time)	F(3, 54) = 4.67	p < .01	d = 0.75	Significant interaction between group and time.

The repeated measures ANOVA revealed a significant main effect of group ($F(1, 18) = 15.23$, $p < .001$), indicating that the experimental group recalled significantly more tasks than the control group. Additionally, there was a significant main effect of time ($F(3, 54) = 9.87$, $p < .001$), suggesting that recall performance varied significantly over the different time points. The interaction effect between group and time was also significant ($F(3, 54) = 4.67$, $p < .01$), indicating that the difference in recall performance between the control and experimental groups changed over time.

Post-hoc Comparisons

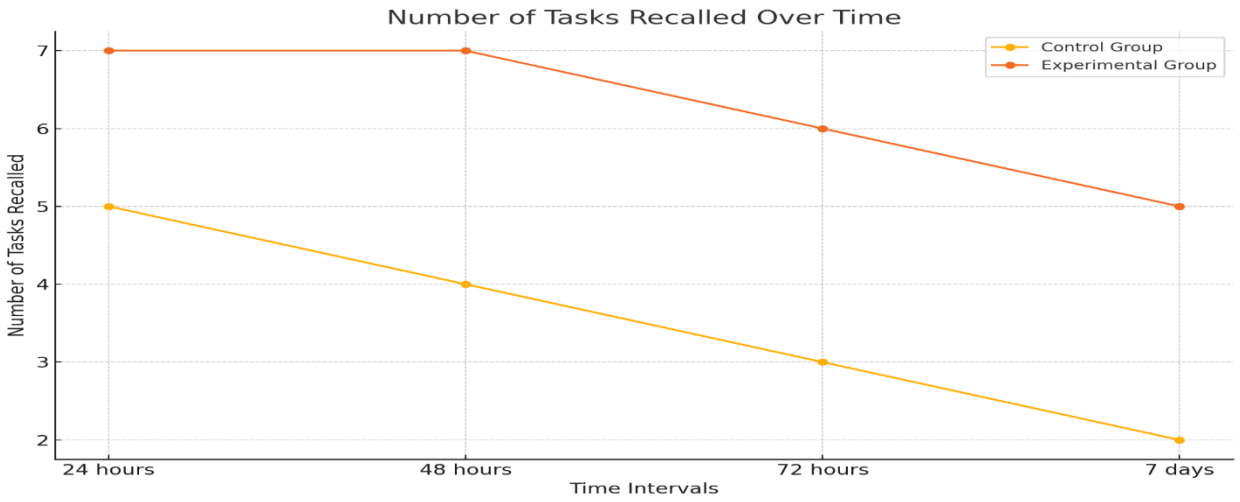
The post-hoc comparisons table uses the Bonferroni correction to determine the significance of the differences in recall performance between the control and experimental groups at each time point. The results indicate that the experimental group significantly outperformed the control group at all intervals. As shown in the table, the difference in recall performance at 24 hours is statistically significant ($p < .01$), and this significance persists at 48 hours, 72 hours, and 7 days, although the p-values increase slightly over time. In the table below the specific p-values for each comparison are provided clearly:

Table 7. Post-hoc Comparisons

Time Point	Comparison	p-value	Significance
24 Hours	Control vs. Experimental	p < .01	Significant
48 Hours	Control vs. Experimental	p < .01	Significant
72 Hours	Control vs. Experimental	p < .05	Significant

7 Days	Control vs. Experimental	$p < .05$	Significant

Figure 3.The number of Tasks Recalled Over Time



The line chart above shows the number of tasks recalled by participants in the control and experimental groups over different time intervals: **Short-term Recall (24 and 48 hours)**, **Medium-term Recall (72 hours)**, and **Long-term Recall (7 days)**. The experimental group, which used visual disruptions, consistently recalled more tasks than the control group at each time interval. This demonstrates the effectiveness of visual disruptions as mnemonic devices, as participants in the experimental group were able to retain more information over the study period. This finding is supported by the significant main effect of the group and the interaction effect observed in the ANOVA results. The significant main effect of time also indicates that memory decay occurs over time; however, the experimental group's recall performance declines at a slower rate compared to the control group. This aligns with the DCT theory, which opines that information is better remembered when it is encoded both verbally and visually. The use of visual disruptions leverages this principle by providing strong visual cues that enhance verbal recall.

4.2 Qualitative Findings

The semi-structured interviews with the experimental group provided valuable feedback, emphasizing their unique experiences and perceptions regarding the use of visual disruptions. The table gives us a description of the qualitative feedback collected through interviews and its interpretation:

Table 8. Qualitative Findings

Analysis Component	Description	Result	Interpretation
Thematic Analysis	Systematic identification of themes from interview transcripts.	The emergence of key themes	Provides insights into participants' subjective experiences.
Coding	Assigning codes to significant statements and phrases in the transcripts.	Codes such as "Memory aid", "Visual cue", "Recall improvement", and "Ease of use".	Helps in categorizing and organizing qualitative data.
Emerging Themes	Some themes were emerged after coding.	The majority agree of the effecrtiveness of the visual distruption	Interpretations were given for each theme
Participant Quotes	Direct quotes from participants illustrating their experiences and perceptions.	Eample;"Turning the milk carton upside down really made me remember to buy groceries."	Provides authentic and vivid insights into participants' thoughts.
Saturation	The point at which no new themes or insights are emerging from the data.	Saturation achieved after interviewing 15 participants.	Confirms the comprehensiveness and adequacy of the qualitative data collected.

Some themes were generated from the analysis:

Theme 1: Increased Engagement and Task Completion: Participants noted that visual disruptions served as constant reminders to complete tasks. This persistent visibility kept tasks at the forefront of their minds, leading to increased awareness and engagement with their surroundings. For instance, upside-down milk cartons or inverted picture frames drew their attention repeatedly throughout the day, reinforcing the memory of tasks they needed to complete.

Direct Quotes: "*The upside-down plant in my living room constantly reminded me to wipe the coffee table. It was impossible to miss, I found*

myself finishing tasks more quickly because the visual cues were always present " (Participant 5) **,**"*The upside-down milk carton in the kitchen caught my eye every time I walked by. It was hard to ignore. The weird positions of objects were always there to remind me until I completed the task* " (Participant 3)**,** "*Seeing the picture frame inverted made me constantly remember I had a task to complete in the bedroom*." (Participant 7)

Theme 2: Emotional Connection: Several participants noted that the visual disruptions created an emotional connection to the task, making it more personally significant. This emotional engagement seemed to aid in better recall. Several participants noted that the visual disruptions created an emotional connection to the task, making it more personally significant. This emotional engagement seemed to aid in better recall.

Direct Quotes: *"Seeing the stuffed animal on my desk in an odd position reminded me of my childhood, which made me smile and think of the task I had associated with it. It became more than just a reminder; it was a trigger for a pleasant memory*. *The visual cues created a kind of emotional response, making the tasks seem more significant*." "(participant 8). "*It was almost fun to see these unusual things around the house. It felt like a game, which made it easier to remember what I needed to do*. *The inverted picture of my family made me think of them and remember to send that important email."* (Participant 5)

Theme 3:Simplicity and Memorability: The novelty of the visual disruptions was frequently mentioned as a key factor in enhancing memory recall. Participants felt that the unusual nature of these cues made them more memorable compared to traditional methods like written notes. Participants appreciated the simplicity of using household items as visual disruptions. They found it easy to integrate these mnemonic devices into their daily routines without requiring additional tools or complicated setups.

Direct Quotes: "*It was easy to just flip something over or place it in a weird spot. No need for extra tools or apps*." (Participant 4) , "*I liked that I could use things already around me to help remember tasks. It didn't take extra effort*." (Participant 8) ,*"Seeing my alarm clock on its side was so odd that it made me laugh and instantly think of the task I had to do."* , *"Turning my photo frame upside down was so unusual that it stuck with me all day. Unlike a sticky note that blends into the background, this was something I couldn't ignore*."(participant1*)*, "*The novelty of turning objects upside down kept me engaged. It was a new way to remind myself of things*." (Participant 2)., " *Using something different from the usual sticky notes was refreshing and helped me remember better*." (Participant 9)

Theme 4: Practical Challenges and Adaptations: Despite the overall positive feedback, some participants highlighted practical challenges. For

instance, while some disruptions were effective, others were less so due to their placement or the frequency with which participants encountered them. Participants had to adapt the technique to fit their daily routines.

Direct Quotes: *"Placing a spoon in the bathroom was strange and effective, but my partner kept moving it back, thinking it was a mistake." "I tried putting my shoes on the table, but it was too disruptive. I had to find a balance between something noticeable but not too out of place that it caused inconvenience*."(participant 10).

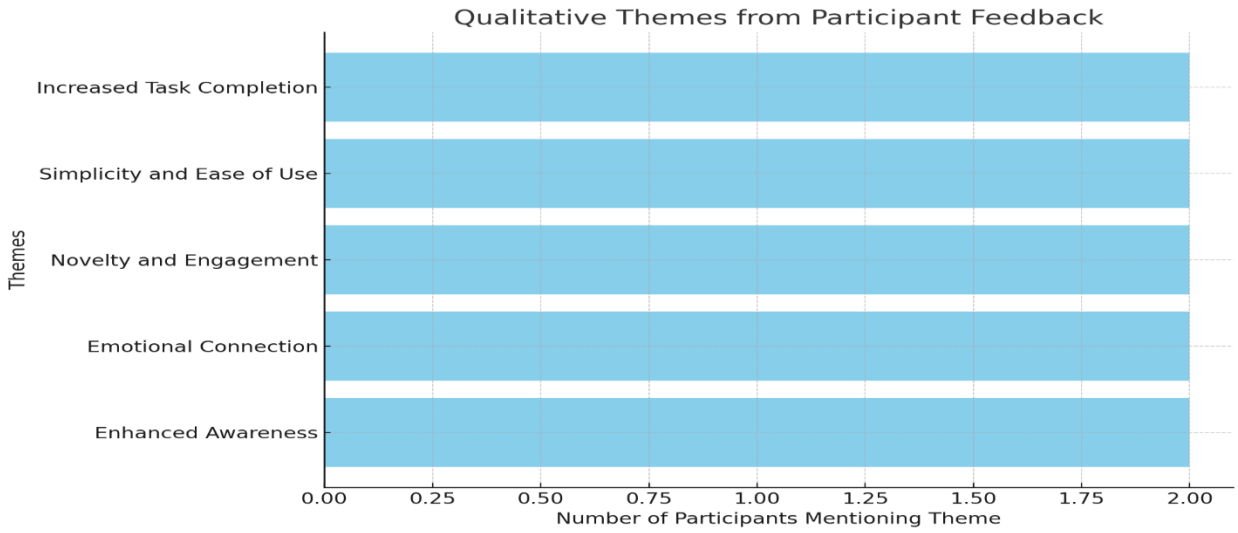
Theme 5: Creativity and Personalization: Participants also discussed how they personalized the visual disruptions to better fit their daily routines and personal preferences, which seemed to enhance the effectiveness of the method.

Direct Quotes: *"I hung my keys on a hook near the light switch, which was unusual enough to remind me to take the keys with me when I left the house."* (participant 1). *"Putting a book upside down on my nightstand was an odd sight before bed and made me think of the next day's to-do list."* ,(participant 7).

The qualitative feedback indicates that visual disruptions can serve as powerful mnemonic devices, particularly due to their ability to capture attention and create memorable, emotionally engaging experiences. Participants appreciated the novel approach and found it generally more effective than traditional methods. However, the success of this technique also depended on the appropriateness and placement of the disruptions, suggesting a need for personalization to maximize effectiveness. These insights complement the quantitative findings, reinforcing the potential of visual disruptions as a tool for enhancing memory recall. The analysis also indicates that visual disruptions not only improve memory recall but also make the process more engaging and emotionally resonant**.** Participants consistently reported that visual disruptions significantly improved their ability to recall tasks. Many participants described the method as "fun" and "interesting," which made the task of remembering feel less like a chore and more like an engaging activity. While some participants found it easy to integrate visual disruptions into their daily routines, others mentioned that it required a conscious effort and sometimes felt inconvenient.

The consistent higher recall performance in the experimental group suggests that visual disruptions serve as effective mnemonic devices, enhancing memory recall more than traditional methods. This finding is supported by the significant main effect of the group and the interaction effect observed in the ANOVA results. The significant main effect of time also indicates that memory decay occurs over time; however, the experimental group's recall performance declines at a slower rate compared to the control group.

Figure no.4: Qualitative Themes from the Participants

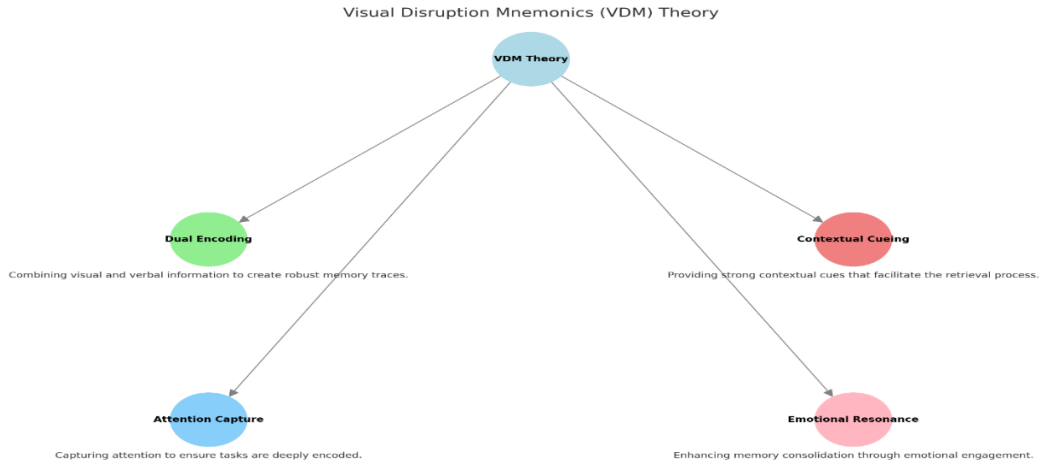


The hypothesis that participants in the experimental group, who used visual disruptions, would exhibit better memory recall than the control group was supported. The emotional and cognitive engagement with these disruptions appeared to strengthen the encoding and retrieval processes of memory. The results of this study align with previous research on contextual cues and memory. Studies have shown that contextual cues, such as distinctive environmental features, can significantly enhance memory recall (Smith & Vela, 2001). Our findings are consistent with these observations, demonstrating that visual disruptions act as potent contextual cues.

5. Generating a Theory - Like Framework

These findings contribute to a potential theory in cognitive psychology, suggesting that environmental anomalies can create strong mental associations that aid in memory retrieval. This aligns with the DCT theory, which opines that information is better remembered when it is encoded both verbally and visually. The use of visual disruptions leverages this principle by providing strong visual cues that enhance verbal recall. The consistent and significant findings from both quantitative and qualitative analyses suggest that visual disruptions can systematically enhance memory recall. This paves the way for formulating a theory-like framework based on the study's insights which the researcher calls "**Visual Disruption Mnemonics (VDM) Theory.** The diagram below visually represents the core components of the proposed VDM theory, highlighting how visual disruptions can enhance memory through four main mechanisms. It shows the central VDM Theory node connected to four main components, each described with its specific contribution to enhancing memory recall.

Figure no 5. Visual Disruption Mnemonics (VDM) Theory.



The main dimensions(principles) that support this potential are as follows:

First: The Dual Coding Theory Enhancement: The study findings go with Paivio's "**Dual Encoding Theory"**, which opines that information is better remembered when it is encoded both verbally and visually (Paivio, 1991). Our study results confirmed that the visual disruptions acted as vivid visual stimuli that were paired with verbal tasks, creating strong and memorable memory traces. This stresses combining visual and verbal information to create robust memory traces. The use of visual disruptions creates strong visual stimuli that are paired with verbal tasks, reinforcing the memory traces and aiding recall. Visual disruptions serve as dual encoders, combining visual and verbal information to create robust memory traces.

Second: Context-Dependent Memory: The effectiveness of visual disruptions can also be explained through the lens of context-dependent memory(**Contextual Cueing**). According to this view, recall is improved when the context at retrieval matches the context at encoding (Smith & Vela, 2001). Unique visual disruptions act as strong contextual cues that facilitate the retrieval process by creating a distinct and memorable context. This stresses the idea of providing strong contextual cues that facilitate the retrieval process. Visual disruptions provide distinctive contextual cues that help bridge the encoding and retrieval phases, making memories more accessible.

Third: "Attention Capture and Salience": The salience of visual disruptions captures attention, ensuring that the associated tasks are actively processed and more deeply encoded. This aligns with views suggesting that attention plays a crucial role in memory encoding (Craik & Lockhart, 1972). By ensuring that the tasks were actively processed, the visual disruptions enhanced the depth of encoding and, consequently, recall. By capturing attention through unusual and salient visual stimuli,

the study highlights the role of attentional mechanisms in memory enhancement. This means capturing attention to ensure tasks are deeply encoded and that tasks are not just passively encoded but actively processed, which strengthens memory consolidation

Finally: Emotional Engagement: Emotional engagement with visual disruptions enhances memory consolidation and recall, making the mnemonic devices more effective The qualitative feedback highlighted that participants formed emotional connections with the visual disruptions, which aided in memory retention. This dimension aligns with theories suggesting that emotionally charged memories are more likely to be retained and recalled. However, this study adds a novel dimension to the existing literature by specifically focusing on visual disruptions. Emotional memories are often more durable and vivid (Kensinger & Schacter, 2008), suggesting that the emotional resonance of the visual disruptions contributed to their mnemonic effectiveness. Consequently, enhancing memory consolidation through emotional engagement. Unlike traditional contextual cues that are often passive, the active and deliberate creation of visual anomalies in this study provided a more interactive and engaging approach.

Using visual disruptions as memory aids can have many practical uses because the simplicity and flexibility of this technique make it a valuable tool across various contexts. In daily life, people can use this technique to help them remember things like daily tasks, appointments, and other responsibilities. For example, in the educational paradigm, students can use visual disruptions to remember study schedules or assignment deadlines, while professionals might use them to keep track of important meetings or project milestones. Additionally, teachers can incorporate visual disruptions to help students remember key concepts or assignments. To enhance employees' task management and productivity in the workplace realm, managers can employ similar techniques.

6. Conclusion

The current study examines how visual disturbance or visual anomalies (which are distinctive and unusual changes in the environment in which we live) are effective in enhancing memory and helping to recall tasks that participants need to remember. Visual disturbance, such as placing everyday objects in an unusual position is an effective signal to stimulate memory in the individual who sees it. The study provides strong evidence that visual disruptions significantly improve memory recall in the sense that the experimental group consistently outperformed the control group at all time intervals, indicating that unusual visual stimuli effectively aid in task retention and retrieval. The key findings indicate that participants in the experimental group, who used unusual visual cues like upside-down milk cartons or inverted picture frames, consistently recalled

more tasks than those in the control group, who relied on traditional reminder methods such as writing notes . Additionally, they also consistently outperformed the control group across all time intervals, indicating that the introduction of unusual visual stimuli effectively aids in the retention and retrieval of tasks. These results support the hypothesis that visual disruptions are powerful mnemonic devices. The qualitative analysis further corroborated these findings, revealing that participants found visual disruptions to be memorable and engaging, thereby reinforcing their ability to remember tasks. Themes such as enhanced awareness, emotional connection, and the novelty of the disruptions highlighted the unique advantages of this mnemonic technique. The study provided compelling evidence that visual disruptions significantly enhance memory recall.

The Visual Disruption Mnemonics (VDM) framework encapsulates the core principles derived from the findings, offering a robust framework for understanding and applying this novel mnemonic strategy in various contexts. Further research can build on these foundations to refine and expand the theoretical framework, solidifying its place in the domain of cognitive enhancement techniques. This study shows that visual disruptions can serve as effective mnemonic devices, integrating principles from dual coding theory, context-dependent memory, attention, and emotional engagement. By leveraging environmental anomalies to enhance memory recall, the research uncovers how simple yet novel interventions can significantly impact cognitive functions.

7. Recommendations

The study suggests some recommendations

1. Incorporate visual disturbance techniques into educational curriculums and study programs to enhance students' memory retention.
2. Create digital applications and tools based on the Visual Disruption Mnemonics (VDM) framework.
3. Encourage the customization of visual disturbance techniques to match individual preferences and cognitive styles.
4. Conducting future studies to expand and support the field of cognitive psychology such as

8.Suggestions for future studies

Depending on the findings of the study, the researcher suggests some titles for future studies such as:

1.Experimental designs that control for individual differences in cognitive abilities and prior experiences with mnemonic devices could provide more nuanced insights.

2. Longitudinal studies could explore the long-term effects of visual disruptions on memory recall and whether the benefits persist over extended periods.

3. Examining the effectiveness of various types of visual disruptions and their impact on various types of memory tasks could further refine the understanding of this technique.

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