THE EFFECTS OF PROPOSITIONAL VERSUS ANALOG CODING ON FALSE RECOLLECTIONS: A STUDY ON PICTORIAL MEMORY OF YOUNG ADULTS

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ABSTRACT

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The current study aims to investigate the effects of encoding types on false recollection performance concerning pictorial information within the context of false memory literature. Dual code theory asserts that two distinct encoding types are involved in memory processes. This theory suggests that one of the codes is analog (imagery), specialized for nonverbal or nonlinguistic information, while the other code is propositional, specialized for linguistic or verbal information. The interconnected nature of these dual codes is highlighted in the encoding, storage, organization, and retrieval of visual stimuli. Despite this interconnectedness of the propositional and analog codes, psychology literature lacks extensive evidence demonstrating the separate existence of propositional and analog codes in memory. To address this gap, this study builds upon a previous study that successfully manipulated propositional and analog codes. In addition to replicating the methods from the mentioned study, nine new pictures were created, and ten pictures were used as studied pictures. Each picture generated three sub-pictures, constituting the foil category (unstudied pictures) based on the study. These sub-pictures included pictures with reversal, displacement, and novelty changes. It was anticipated that these changes would lead to false recollections based on the manipulation of propositional and analog codes. A total of 80 participants (42F, 38M) aged between 18 and 31 (M= 20.6, SD= 0.4) participated in the current study. During the study session, participants were told to view original

pictures, randomly presented on a computer screen. Following a distractor task, a recognition task was administered, and the original and foils were presented. Participants were asked to decide whether each picture was an “old” or “new” picture. Analyses were conducted on false alarm rates (old responses given to new pictures). However, it was assumed that false recollection may occur and differ between these sub-pictures contingent upon encoding types. The findings revealed that encoding types did not significantly affect false recollection performance. Significant differences were found between pictures in foil categories in terms of false recollection. Considering the significant effect of foil category on false recollection performance, it was found that old decisions given to displacement foil were as few as those given to novelty foil. On the other hand, old decisions given to reversal foil were at least as frequent as old decisions for original pictures. While the findings were generally consistent with the literature, there were some inconsistent points. It was concluded that there is a robust memory for visual details. However, it was found false recollection differences in terms of change types. In reverse changes, there were more false recollections than displacement and novelty foils. All results were interpreted in the context of the manipulation methods and the characteristics of the pictures.

Keywords: Pictorial Memory, Propositional Code, Analog Code, False Recollection

ÖZET

ÖNERMESEL VE ANALOG KODLAMANIN YANLIŞ ANIMSAMA ÜZERİNDEKİ ETKİLERİ: GENÇ YETİŞKİNLERİN RESİM BELLEĞİNE DAİR BİR ÇALIŞMA

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Mevcut araştırma, sahte bellek literatürü bağlamında resimsel bilgi üzerinde yanlış anımsama performansını etkileyen kodlama türlerinin etkilerini araştırmayı amaçlamaktadır. İkili kodlama kuramı, bellek süreçlerinde iki farklı kodlama türünün rol oynadığını öne sürmektedir. Bu kuram, bu kodlardan birinin (analog) sözel/dilsel olmayan bilgi türü için özelleştiğini, diğerinin (önermesel) ise sözel/dilsel bilgi türü için özelleştiğini öne sürmektedir. Bu ikili kodların birbirine bağlı doğası, görsel uyaranların kodlanması, depolanması, düzenlenmesi ve geri getirilmesinde vurgulanır. Önermesel ve analog kodların bu birbirine bağlılığına rağmen, psikoloji literatürü, önermesel ve analog kodların bellekte ayrı varlığını gösteren kapsamlı kanıtlardan yoksundur. Bu çalışma, bu boşluğu gidermek için önermesel ve analog kodları başarılı bir şekilde değişimleyen bir çalışmaya dayanmaktadır. Bahsedilen çalışmadaki yöntemlerin tekrarlanmasına ek olarak, bu çalışmada dokuz yeni resim daha oluşturularak toplamda on resim, çalışılmış resim olarak kullanılmıştır. Çalışmaya dayalı olarak, hatırlama aşamasında her resmin üç alt resminden oluşturulan çalışılmamış resimler kategorisi kullanılmıştır. Bu alt resimler, ters çevirme, yer değiştirme ve yenilik değişimlerini içermektedir. Bu değişikliklerin önermesel ve analog kodların değişimlenmesine dayalı olarak yanlış anımsamalara yol açacağı öngörülmüştür. Yaşları 18 ile 31 arasında olan 80 katılımcı (42K, 38E), (M=20.6, SD=0.4) bu çalışmaya katılmıştır. Çalışma aşaması esnasında, katılımcılara bilgisayar

ekranında rastgele sunulan orijinal resimlere dikkatli bir şekilde bakmaları söylenmiştir. Oyalama görevinin ardından, tanıma görevi olarak orijinal ve çalışılmamış resimler sunulmuştur. Katılımcılardan, her resmin "eski" ya da "yeni" bir resim olduğuna karar vermeleri istenmiştir. Analizler, yanlış alarm oranları (yeni resimlere verilen eski tepkileri) üzerinde yürütülmüştür. Ancak, yanlış anımsamaların meydana gelebileceği ve bu alt resimler arasında kodlama türüne bağlı olarak farklılık gösterebileceği varsayılmıştır. Bulgular, kodlama türlerinin yanlış anımsama performansını anlamlı olarak etkilemediğini ortaya koymuştur. Öte yandan, yanlış anımsama performansı açısından alt resimler arasında anlamlı farklılıklar bulunmuştur. Alt resimlerin yanlış hatırlama performansı üzerindeki anlamlı etkisi göz önüne alındığında, yer değiştirme değişikliği yapılan alt resimlere verilen eski kararlarının, yenilik değişikliği yapılan alt resimlere verilenler kadar az olduğu bulunmuştur. Diğer taraftan, ters çevirme değişikliği yapılan alt resimlere verilen eski kararlarının, orijinal resimler için verilen eski kararlar kadar sık olduğu bulunmuştur. Bulgular genellikle literatürle uyumludur, ancak bazı tutarsız noktalar mevcuttur. Literatürle uyumlu şekilde, görsel ayrıntılar için güçlü bir bellek olduğu sonucuna ulaşılmıştır. Bununla birlikte, değişiklik türleri açısından, alt resimlere göre yanlış anımsama performansında farklılıklar bulunmuştur. Ters çevirme değişimi uygulanan resimlerde, yer değiştirme ve yenilik değişimlerinden daha fazla sahte anımsama kaydedilmiştir. Tüm sonuçlar, çalışmada kullanılan değişimleme yöntemleri ve resimlerin özellikleri bağlamında yorumlanmıştır.

Anahtar Kelimeler: Resim Belleği, Önermesel Kodlama, Analog Kodlama, Yanlış Anımsama

To Those I Lost.

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I dedicate my thesis to him and our baby, who I believe unites my husband and me forever.

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LIST OF SYMBOLS AND ABBREVIATIONS

SM	: Sensory Memory
STM	: Short-term Memory
LTM	: Long-term Memory
VLTM	: Visual Long-term Memory
ROC Curves	: Receiver Operating Characteristic Curves

CHAPTER I

INTRODUCTION

"You are what you remember."

Umur TALASLI

We can define memory as the storage of mental representation of knowledge about the world (Klatzky 1975: 1). This storage contains all the information we accumulate throughout our lives, even though it does not have a physical, organic location. The process of filling this storage begins in childhood and continues throughout our entire lives. All our knowledge is stored in this area without any capacity limits. Memory plays a critical role in our lives, as we constantly refer to this resource. Therefore, memory is what defines who we are.

Memory is a field of study that has attracted the attention of many scholars throughout history. A great number of questions have been posed about this intriguing topic. How do we remember? How do some memories suddenly come to our minds? Why do we forget, or why are there things we cannot forget? Why do we struggle to recall certain things despite having many cues? How and why do we sometimes remember certain events incorrectly? The aim of all these questions is to shed light on the inner workings of this black box.

In the psychology literature, it is widely accepted that experimental studies on memory began with Ebbinghaus (1885). In his experiment, he examined his own memory performance using many strings of meaningless syllables. Firstly, he memorized these meaningless syllables and then repeated them at varying intervals of time. In this way, he determined the number of repetitions required for re-memorization. The initial memorization required more repetitions than the later ones, but the elapsed time also had an effect on the number of repetitions required. As a result of this experiment, the famous "forgetting curve", which illustrated the rate of at which something is forgotten over time, emerged.

This study of Ebbinghaus (1885) showed that memory could be studied using experimental methods. It is important in terms of explaining learning and relearning, as well as the quantitative aspects of memory storage and forgetting mechanisms. Memory studies, which originated from this pioneering experiment, have continued to evolve and expand ever since.

Memory researchers use different terms to describe various types of memory, and the terminology employed varies depending on the specific field of study. In essence, memory is given different names based on the focus of the research. One of the fundamental distinctions in memory categorization pertains to short-term and long-term memory. Another critical distinction is rooted in the nature of the information stored, as proposed by Tulving (1972). For instance, we can categorize memory into different types, including semantic, episodic, and procedural memory, based on the kinds of information they store.

According to Quillian (1968: 1), semantic information refers to meanings of words. In other words, semantic memory stores broad knowledge about the world but only "what" information is stored. Episodic memory, as elucidated by Tulving (1993: 67), pertains to the storage of personally experienced events, allowing individuals to consciously recollect earlier experiences in specific situations at specific times. In contrast, procedural memory is linked to individual skills and habits (Cohen and Bacdayan 1994: 554), such as the ability to ride a bicycle.

Another classification of memory form is implicit and explicit memory. Explicit memory is used when people consciously recall a particular experience, whereas implicit memory is revealed when performance on a task is facilitated in the absence of conscious recollection (Graf and Schacter 1985: 501). In implicit memory, there is no conscious awareness about an experience. Additionally, memories can be classified based on the senses they involve, such as visual and auditory memory.

Human beings have an incredible, continuously active system. Memory is an essential component of this system. The following section of this chapter has focused on how the human mind operates and how memory processes function within this system.

1.1 INFORMATION PROCESSING APPROACH

The world is filled with an enormous amount of information for human system, and humans are active organisms towards the world. The information processing approach claims that human mind always processes information, revealing "how the mind acquires, modifies, manipulates, uses, and stores knowledge" (Neisser 1967, Cited by Klatzky 1975: 2). Every stimulus provides information for human system. The Atkinson and Shiffrin Model (1968) explains how the human mind processes information based on the viewpoint of information processing theory. It emphasizes that memory system is the basis of the information processing. According to this model, there are three memory storage structures known as sensory memory (SM), short-term memory (STM), and long-term memory (LTM), each associated with processes like pattern recognition and attention. All of these memory structures have different functions but they work together. Atkinson and Shiffrin's Model is often called multi-storage memory, as visualized in Figure 1 below.

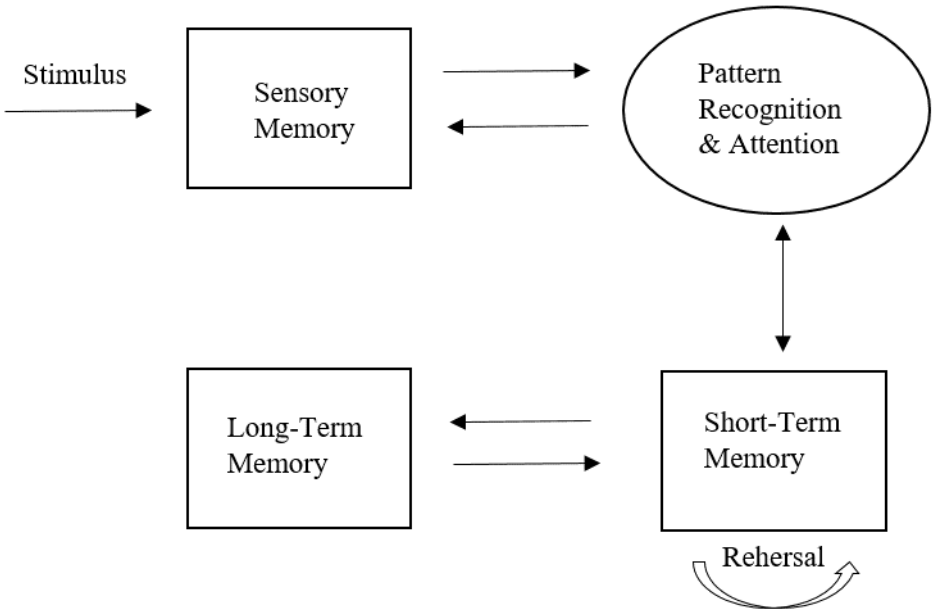


Figure 1: The Model Proposed by Atkinson and Shiffrin, which Explains the Information-Processing System

Note: In this figure, squares represent structures while circle represent process of memory.

Source: Klatzky et al. (1975: 7)

SM is the initial structure that receives information. In SM, information is often referred to as 'raw' because it has not been processed yet. In other words, the system

does not recognize it; it simply stores it. According to Sperling (1960), the storage duration in sensory memory is about 250 milliseconds (Massaro and Loftus 1996: 72). The processes of pattern recognition and attention are responsible for extracting the information stored in SM. The role of STM, the second structure, is to provide meaning to the information and transfer it to LTM. Rehearsal provides maintenance of information in STM and transfer it to LTM. Lastly, LTM stores the information. It is a gold mine of information. When a stimulus enters the system from the sensory memory, the processing of information begins. At this point, all of these memory structures and processes become active and interact with each other. This model explains memory in terms of the time that information remains in memory and how information is processed within each memory structure during this time.

The multi-storage memory model explains how memory processes information, involving a series of stages which are encoding, storage, and retrieval. Encoding refers to the initial entry of stimuli into the system; storage means retaining the information within the system, and retrieval concerns recollection or remembering. Several kinds of information are processed in these stages continuously.

The model explains the reasons people may experience memory problems, often attributed to impairments occurring at these stages. As Klatzky (1975: 4) explains, 'The information might not have been encoded properly in the first place; it could have been lost from storage; or people may be unable to retrieve it, even though it was encoded and stored.' In such situations, the memory system can make mistakes. To give an example, people cannot remember, they can fail to get access to information, or people cannot remember correctly, which might lead to false memories. In the subsequent part of this chapter, we delve into the phenomenon of false memory, which is one of the memory-related issues.

1.2 FALSE MEMORY

Human memory is not infallible; it can sometimes be mistaken. People commonly associate memory errors with difficulties in remembering or forgetting, but there is another type of mistake known as 'false memory.' False memory pertains to the recollection of events that either did not happen or are remembered quite differently from the way they actually happened (Roediger and McDermott 1995: 803). In other words, this memory error consists of creating a memory about an event that one did not experience (Jou and Flores 2013: 671). False memories may occur as

a result of perceiving events differently from the way they happened, intervening stored memories, or distortion occurring in retrieval stage (Roediger and McDermott 2000: 123).

1.2.1 The Beginning of False Memory Studies

Sigmund Freud and Pierre Janet were pioneers in the study of false memory phenomena, particularly those involving traumatic content (Gleaves et al. 2004: 3). Freud argued that traumatic events experienced in childhood are suppressed. Memories of traumatic events are pushed into the unconscious due to a process he termed "motivation forgetting" (Boag 2006: 75). Thus, he used techniques such as hypnosis to reach these traumatic memories at a conscious level. This view underlined the future therapeutic techniques.

In the 20th century, a debate emerged in legal cases. Some professionals asserted that traumatic memories, such as instances of abuse, were repressed and discovered using some techniques during therapy, and in other respects memory researchers argued that many psychotherapies include suggestive methods that could lead to false memories (Otgaar et al. 2018: 3). One group of professionals asserted that certain memories were stored but could not be accessed until "recovered" via therapy. On the opposite side, memory experts claimed that therapy only may provide to reconstruct these memories not recover them. It was called "Memory Wars."

A large number of repressed and recovered memories were suggested in forensic contexts. To give an example from Loftus (1997: 71), in 1986 a woman sought a therapy from a psychiatrist for her traumatic experiences. The doctor used hypnosis during sessions, and she convinced that she had repressed memories of abuse. Even she began to believe that she had experienced to be a part of a satanic cult and she had more personalities. Eventually, she realized that all of these were false memories planted in her memory by the psychiatrist and sued him. There have been many alleged cases, which there was no physical evidence has been found.

For example, Howe and Knott's article (2015: 636) highlighted a case from 1983, in which seven preschool teachers were accused of abuse and kidnapping the children. Only evidence was the information obtained from the interviews with the children. After extensive investigation, all charges were dropped. In another case, a father was arrested in 1989 for allegedly murdering of his daughter's friend (Loftus and Davis 2006: 470). His daughter blamed her father, George Franklin, and claimed

to have witnessed the crime 20 years ago. According to the authors, “these accusations arose on the basis of memories that adult children had “recovered” during psychotherapy”.

Numerous examples like these show the critical impact of false memories on people's lives. Especially in the United States, many people have blamed their relatives after psychotherapies. After legal investigations, it has been revealed that the claims did not have a grounding in reality. The crucial question was whether these accusations were entirely true or the result of false memories. In this regard, it is essential to understand how these memories may arise. Why do some people claim to remember things that did not actually happen? Thus, false memories can be thought of as a reconstruction of memory.

1.2.2 Reconstruction of Memory

The concept of reconstruction of memory was stressed by Bartlett in 1932. Bartlett emphasized that memory system reconstructs information acquired from the world. In one of his experiments, participants were asked to read a story that belonged to a culture different from their own. After the reading session, the participants were expected to remember the story at varying time intervals. During the reproduction phase, it became evident that participants had changed the story in various ways. Bartlett observed that participants were affected by their own cultures and, correspondingly, he stated that people can be influenced by their own schemas during the reconstruction phase. He aimed to emphasize that remembering is based on a reconstructive process. People reconstituted the story in alignment with their own schemas rather than memorizing it (Arbib 1992: 2). Schemas can be described as well-organized internal representations of information, and schemas, beliefs, and assumptions influence the processing of new information (Dozois and Beck 2008: 122). Schemas are formed through experience, and Bartlett (1932) noticed their effect. Information is encoded by adapting to existing schemas, beliefs, or attitudes during encoding. According to this perspective, no information is stored exactly as it is in memory. Reconstruction is an inherent feature of the nature of memory. Thus, false memories can be created in this manner.

1.2.3 False Beliefs and False Memories

At this point, it can be important to mention the differences between false beliefs and false memories. False belief is the state of being convinced that an event has occurred, even if a person has no pre-existing memories of that event. In contrast, false memories involve false beliefs about an event that has been experienced, and there are also memories for that event (Muschalla and Schönborn 2021). A good example is one's own birth (Otgaar et al. 2018: 22). Although this belief is not a false memory, it can be considered an example of belief that birth occurred. In false belief, people believe that an event has happened, but they have no recollection of it, but in false memory, people have a subjective experience of that event (Newman and Lindsay 2009: 4).

"Remembering" and "knowing" are two distinct types of experiences. Rajaram (1993: 90) said that a "remembering" decision refers to participants having a vivid memory of the item, with a conscious recollection of it occurring on the study list, as seen in the DRM paradigm. On the other hand, judging as "know" refers to the absence of recollection of the actual occurrence. The first study that employed the remember/know paradigm was reported by Tulving (1985). In his study, participants studied category names and instance pairs, then took recall tests that included increasingly more cues, and then made remember/know judgments. Results showed the cues, that with increasing participants exhibited fewer "remember" responses, but with cues provided, they showed more "know" responses. Studies using the remember-know paradigm were initiated by Tulving and have been ongoing for many years. This paradigm plays an important role in false memory literature. As mentioned earlier, recovered memories may be based on false belief because there is no recollection associated with them.

Under laboratory conditions, memory researchers have explored various methods to understand "what really happened" in people's memories. The following part of this chapter has focused on methods for studying false memory.

1.2.4 Methods of Studying False Memory

False memory is an illusion that occurs within memory. In order to study this illusion in a laboratory setting, false memories must be created using specific techniques. According to Otgaar and colleagues (2018), false memory can be created by

two primary methods: suggestion-induced and spontaneous false memories. In suggestion-induced methods, there are various external suggestions, whereas spontaneous methods observe how false memories occur without any external influence.

In suggestion-induced techniques, some external sources can affect people's memory. For instance, misleading information or instructions (e.g., Loftus et al. 1978; Loftus 1975; Loftus and Palmer 1974; Loftus and Zanni 1975), implantation methods (e.g., Garry and Wade 2005; Loftus and Pickrell 1995) or false feedback can be used to measure the external effect on false memory production. After being exposed to an event where participants receive new and misleading information, they make errors in the remembering phase because false knowledge can alter their memory of the relevant event. Additionally, these studies demonstrate that false information can influence and shape people's behavior (Bernstein et al. 2005). Another suggestion-induced method is social contagion for creating false memory. In social situations, people talk to each other about various topics and can influence each other. This might have quite critical effects on people's memory. In experimental situations, this effect has been tested (e.g., Roediger et al. 2001). The findings showed that when people talk about an event after exposing it, they might contaminate the information related to that event. In another method, imagination inflation, participants are expected to imagine an event (e.g., Garry et al. 1996; Garry and Polaschek 2000:7). In this way, participants become more confident in their recollection of critical events because they are instructed to imagine those events.

For measuring the occurrence of spontaneous false memories, one of the most-well known approaches is the Deese-Roediger-McDermott (DRM) paradigm. In the DRM paradigm (Roediger and McDermott 1995), participants are presented with a list of semantically associated words. In the recall phase, participants can recall a critical non-presented items due to semantic association. It is difficult for people to avoid this effect (Gallo 2010: 833). Over the years, the DRM procedure has been used, and it has made a significant contribution to the field of false memory literature. In spontaneous false memories, there is no direct implantation of false knowledge, contrary to suggestion-induces techniques.

The methods above demonstrate that people remember events that never happened (Roediger and McDermott 1995: 812). False memories can be characterized as a "reconstruction of memory". Contrary to the view of recovered memory, people may reconstruct their memories in various ways without consciousness. The results of

the numerous studies reveal that false memories can manifest in diverse forms, suggesting that people's memories can be distorted regardless of the methods employed in the false memory paradigm.

1.2.5 Stimuli Used in Studying False Memory

In false memory studies, verbal and visual stimuli have been used to observe participants' recall or recognition performance. In general, verbal materials, such as sentences or narratives, are used in false memory implantation studies. Similarly, visual materials can be used alongside verbal stimuli.

Mostly, after participants were exposed to a visual presentation (photos or videos), they were asked questions that included misleading or contradictory information (e.g. Drivdahl and Zaragoza 2001; McCloskey and Zaragoza 1985; Roediger et al. 1996; Zaragoza and Mitchell 1996) in suggestion-induced false memory studies. The misinformation effect was observed in this way. One of the most popular of experiments illustrating this effect is the reconstruction of automobile destruction carried out by Loftus and Palmer (1974) in false memory literature. The aim of the experiment was to examine the effect of suggestive questions about the traffic accidents. In the questions, critical words were changed regarding the speed of the cars. The results revealed that suggestive information in the questions can lead to the production of false memory.

In addition to implanted misleading information, it can be possible to observe people's tendency to create spontaneous false memory through visual materials. Visual materials can be considered a visual variant of the DRM paradigm (Jelinek et al. 2009; Moritz et al. 2006). For instance, in one experiment, colored pictures of objects were used (Koutstaal and Schacter 1997). In this procedure, specific categories were determined, and related pictures were assigned to these categories, much like in the DRM paradigm where target and lures words were specified. Three days later, after exposure to these images, participants took a yes/no recognition test. It was observed that when participants had studied the items from these categories, they often falsely recognized lures from those same categories. Besides, there are studies that investigate whether verbal or visual materials affect false recollection more than the other. In these techniques, visual materials were given as stimuli to the participants, but the effect of suggestive and spontaneous methods was actually measured.

1.2.5.1 Doctored Photographs

Visual materials can be doctored, manipulated or fabricated. In some cases, altered or fake visual stimuli are used to observe the production of false memories. In one experiment (Sacchi et al. 2007), researchers investigated how manipulated photographs affect memory performance about a real public event. The study explored how the memory of a real public event was affected by misleading digitally altered images. Results revealed that participants were influenced by the manipulation of the images. For instance, they falsely remembered that a larger number of participants participated in that event, or they judged the event as more negative. However, in these types of studies, it is not possible to be certain about participants' earlier memory of the specific event without pre-test assessment (Sacchi et al. 2007: 1020). Therefore, it can be concluded that pictures related to common public events have this disadvantage or bias.

In a different experiment (Garry and Wade 2005), researchers explored how photographs and narratives affect the recollection of participants. To achieve this, real events and a false event were utilized. Participants were given either a fake photograph or a fake narrative of childhood experiences. Within a week, they were interviewed three times and were asked to report everything about each event. The results showed that when participants were exposed to either a fake photo or a fake narrative, the narratives were more likely to produce false memory reports than photographs. In a famous study called "On a hot air balloon" (Wade et al. 2002), participants were exposed to a false childhood event via a fake photograph. The results revealed that they created complete or partial false memories about those events, even though they had never actually experienced them. The study by Garry and Wade (2005) demonstrated differences between the effects of verbal and visual presentations on false memory production. According to the experiments by Garry and Wade (2005) and Wade and colleagues (2002), it might be said that photographs have a powerful effect for eliciting false memories, but they might not be more powerful than narratives (Garry and Gerrie 2005: 322). On the other hand, Wade et al.'s (2002) study has a crucial finding in terms of participants creating a whole new memory based solely on the photo because a description of the event was not given to them (French et al. 2009: 48).

As mentioned previously, memory can be classified based on the senses they correlate with. In the following part, we continue by describing visual memory within the context of false memory.

1.3 VISUAL MEMORY

LTM is a storage unit for various types of information, including visual data. This sustained memory structure, where visual information is retained over extended periods, is commonly referred to as visual long-term memory (VTLM) (Luck and Hollingworth 2008: 7). Humans have the ability to recognize past objects or visual events they have seen (Schurgin 2018: 1035). In other words, VLTM enables us to decide whether we have previously seen something (Brady et al. 2011: 12). The question then arises: How much of the visual information is remembered, and how accurately is it remembered?

1.3.1 The Capacity and Fidelity of VLTM

VLTM is a storage system for visual experience over an extended period of time without any capacity limit (Schurgin 2018: 1035). For example, Shepard (1967) tested the ability to recognize “old” stimuli compared to “new” stimuli in a set of over 600 pictures, achieving a 98% accuracy in recognizing the old pictures. Standing (1973) examined memory capacity and memory performance with 10000 pictures in a forced-choice recognition test in single-trial learning. Results showed that the capacity of recognition memory for pictures is almost limitless, and recognition memory performance was superior than verbal material. These findings are important in supporting the idea of limitless VLTM and accurate memory performance, even with large sets of pictures. On the other hand, these studies were criticized for using semantically and visually distinct pictures in recognition session (Brady et al. 2011: 14). In these recognition tasks, foil items were quite different from the studied items. Thus, the viewers remembered accurately which images were studied based on the gist of the pictures. On this basis, some studies have suggested that representations in VLTM may contain more than the gist information of the picture (Brady et al. 2008: 14).

1.3.2 Some Evidence from Detailed Information Stored in VLTM

VLTM also stores object details. Individual objects information in a scene can be preserved in memory (Hollingworth and Henderson 2002: 116). This characteristic of VLTM have been examined through some changes made to specific units in scenes using change detection paradigms.

One paradigm for detecting the changes was carried out with a simple recognition test. In a study (Brady et al. 2008), participants initially viewed 2500 object pictures. Afterward, they were given a two-alternative forced-choice test, and were expected to decide which object they had seen previously. The two-alternative forced choice test included three conditions: novel, exemplar, and state. The novel condition included the old (studied) objects and new objects categorically different from the studied old items. The exemplar condition included old objects and the new, but physically similar item to the old item. Lastly, in the state condition, there were old items and new items that were exactly the same as old object but appeared in a different position. The correct recognition performances for novel, exemplar, and state conditions were 93%, 88%, and 87%, respectively. Similar results were obtained in another experiment (Utochkin and Brady 2020). Participants performance was above chance, they differentiated accurately studied item from test items. These studies found that details can be remembered correctly, and there is strong evidence of independent storage of the features. However, the objects in these studies were not presented in a scene, these were shown single. Thus, studies are also important which aimed to detect changes in a context.

Another paradigm for detecting changes involves the *reversal of the orientation* of a stimulus. The orientation of a picture is unlikely to be encoded because when the orientation is reversed, the meaning of the scenes does not change (Hollingworth and Henderson 2002: 116). However, Standing and colleagues (1970) exhibited results contrary to this assumption. In the experiment, to examine recognition memory, thousands of pictures were used, and participants were tested using a two-alternative forced choice test. In particular, the experiment focused on memory about the orientation of stimuli between the learning and test sessions. Participants were expected to identify whether the stimulus was in the same orientation as in the study session or in the reverse orientation. Results showed that the orientation could also be encoded because participants correctly identified the initially viewed picture orientation. That reversal change did not make the recognition of the test

stimuli difficult. Another experiment (Hollingworth and Henderson 2002) in which recognition performance was measured by rotation of previously attended target objects, participants accurately detected rotation changes. Target object was rotated 90° in depth. Identity of the objects was not changed by this manipulation, but the visual appearance was modified. Results showed that accurate detection performance was 29% for the rotation changes. Another study (Hollingworth 2005) also showed that participants accurately detected to the rotation of target object. Some of these detection studies were carried out through online viewing. Thus, participants pressed a button if they detected any changes while looking at a scene. According to Hollingworth's (2005) study, there was little difference in change detection performance between online viewing and delay testing. The change detection remained well above chance in both situations.

The other method involves *making a token change* to a target object in a scene. In this method, a target object is determined in the picture. While looking at the scene, eye movements are tracked, and when eyes move away from the target object, it is changed with another object (Hollingworth and Henderson 2002). Target objects within scenes were changed during a saccadic eye movement away from those objects (Hollingworth et al. 2001: 761). In this method, all target and token objects appeared in the same position. According to the coherence theory, changes in images of real-world scenes go unnoticed when made during a saccade, leading to "change blindness" (Rensink 2000: 19). Thus, due to visual attention away from the target object, changes are not detected. However, Hollingworth and colleagues (2001: 764) showed that participants were able to detect token changes in natural scenes with a 35% accurate rate when target objects were switched to semantically inconsistent objects. The rate of correct detection for consistent object was 18%. Thus, the consistency between objects in the scene can be an important factor. The object-scene relationships determine what objects should be where within a scene (Vo 2021: 10). For instance, Hollingworth and Henderson (2003: 931) demonstrated that participants detected changes more accurately in inconsistent objects than in consistent objects. Similarly, in another study (Hollingworth and Henderson 2002), the distractor objects were changed in two ways: the distractor object was a different category from the target object (type discrimination), and the distractor object was the same category as the target object (token discrimination). The time when the target objects in the scenes were replaced with another object was also manipulated. Some of these changes were

made after fixating the target object, and some of them were made before fixation. According to the results, participants more highly detected type changes than token changes after target fixation. Objects which were from a different category were easily detected. Likewise, participants easily detected when the changed object had been previously fixated.

Another method for detecting changes in a picture is related to *position specificity*. According to the view, the identification of a stimulus is facilitated if it matches a prime previously seen in the same context (Kahneman et al. 1992: 176). In an experiment (Hollingworth 2006: 64), the manipulation was the position of the target objects changed in the scene. After viewing, participants decided whether the objects were presented at the same position or at a different position. Results showed that memory performance was higher when the target object was in the same position in the recognition session. Thus, memory accuracy was higher if position consistency was maintained from study to test. Similarly, a different experiment (Gronau et al. 2008) proposed a result that when targets were positioned in an expected way, object recognition was easier than when targets were positioned in unexpected locations.

These change detection experiments were also carried out under conditions with or without background of the scenes. In this method, firstly participants viewed a natural scene, and then the test was applied in cases present or absent of background. One of the experiments (Hollingworth 2006) that used this method investigated memory performance of the distractor object, which either underwent token changes or orientation changes. According to the results, memory performance of distractor objects was more accurate when the background was present.

As seen in the experiments, the recognition technique is frequently used in visual memory paradigms (Bessette-Symons 2017; Miller and Gazzaniga 1998; Seamon et al. 2000). Recognition is the process of deciding whether or not one has seen something before. In this paradigm, false recognition occurs when people incorrectly make an “old” decision for items they actually have not previously seen, which can be called unstudied or distractor/lures items.

Lastly, change detection results can indicate that VLTM is robust for details. This converging evidence suggest that some representations of the original pictures are preserved (Standing et al. 1970: 74). The ability to detect changes, especially rotation changes, provides converging evidence that there can be visual representations in memory (Hollingworth and Henderson 2002). The following section of this part focuses on how visual stimuli are encoded into memory.

1.3.3 Picture Encoding

In the picture encoding, an important question arises: Is visual information encoded into memory in the same format as the original, or is it transformed into a type of non-pictorial information? Does the human system store a picture as a picture, or in another non-pictorial format as verbal? Moreover, is the visual information retransformed from that format during the remembering phase? In other words, what is the nature of the information stored in the LTM?

1.3.3.1 Two Theories about Representation of Visual Stimulus

In the literature, there are two main theories about this debate, known as the "imagery debate", which is one of the most contentious controversies concerning the nature of the representational format of knowledge (Talaslı 1990: 403). These theories are unitary code theory and dual code theory. The unitary code theory asserts that all information has a single coding format, whereas the dual code theory claims that human information system uses both visual and non-visual coding formats.

1.3.3.1.1 Unitary Code Theory

The theory posits that there is one common code of mental representation for all types of information (Mayer and Anderson 1991: 485). The code is verbal or propositional, which is a representation like as language. Propositions are statements about entities and relationships between them in a scene (Paivio 1978: 382). According to this theory, both verbal and non-verbal information are represented with propositions during encoding, storage, and retrieval processes. For a visual stimulus, propositions are established for all objects, their properties, and their relationships with each other. The verbal system interprets the visual input and creates speech or writing (Paivio 1975: 181).

1.3.3.1.2 Dual Code Theory

Contrary to unitary or common code, dual code theory states that there is a pictorial coding in addition to propositional coding. According to this theory, two distinct systems are involved in memory processes. One system is imagery, which specialized for nonverbal or nonlinguistic information, and the other system is specialized for linguistic or verbal information (Paivio and Clark 2006: 3). The systems differ in terms of the kind of the representational units (Paivio 1978: 379). These systems are not completely independent of each other (Paivio 2014: 41); both are involved during information processing. In encoding, storage, organization, and retrieval of stimuli, the dual codes are interconnected (Paivio 1975: 180). The activation spreads between verbal and non-verbal representations of any information (Clark and Paivio 1991). Due to the interconnection nature of these two systems, we can recognize and entitle things, or draw a picture in response to names (Paivio 1978: 380). Also, depending on individual differences, a word may arouse different images, or an object may be described differently (Paivio 1975: 182). Shepard and Chipman (1970) showed that visual properties of the states of the United States in LTM, and that given only their names, participants used that information in judging shape similarity (Klatzky 1975: 202). Verbal representation is word-like entity that has distinct elements such as sentences, words, letters, or phonemes, and this representation can be easily partitioned into these units (Clark and Paivio 1987: 6). Visual representation is describable as the representation of visual stimuli integrated, continuous, analogue, or holistic (Clark and Paivio 1987: 7). According to Paivio (2014: 42), representations of the nonverbal system are analogous and continuous in nature. According to this theory, a picture can be represented both propositional or pictorial/analog in memory.

The dual code theory is based on empirical evidence. Nonverbal and verbal codes are functionally independent, but they have an additive effect on remembering process (Paivio and Clark 2006: 4). If a stimulus is easy to imagine and describe verbally, this additive effect can occur. According to Paivio (1975: 182), stimuli of these two systems might be controlled or manipulated separately. For instance, visual recognition is easier for pictures than for letters or geometric forms (Paivio and Ernest, 1971). Concrete words have an advantage over abstract words in memory tasks (Kroll and Merves 1986; Walker and Hulme 1999). Similarly, memory performance for objects is higher than for concrete words (Paivio and Clark 2006). According to this

theory, these effects may occur as a result of simultaneously using both codes to represent concrete concepts. Thus, manipulating the characteristics of the stimulus affects memory performance.

1.3.3.1.3 The Comparison Unitary and Dual Code Theory

According to imagery researchers, visual information can be encoded with analog or propositional codes, as suggested by the dual-code hypothesis. Analog encoding is a representation of the original state of a picture in memory. On the other hand, propositional encoding creates a memorial representation by establishing relationships between items within the picture. Properties of the propositional codes are identity of objects and relationship information about a picture, whereas properties of analog codes include continuity over space in every point in the picture and contour information of the objects (Talaslı 1990). Analog memorial representation is nearly identical to the original stimulus, with no gaps in the information. Conversely, propositional codes create some gaps in the information because there can be create an infinite number of propositions for a single picture. Since people cannot generate an infinite number of propositions, many gaps occur in the pictorial information during the processing of it.

Talaslı (1990) demonstrated that in pictorial memory, both analog and propositional codes exist at the same time. Thus, people use analog and propositional codes when there is no manipulation or in natural look. In his experiment, he simultaneously manipulated these codes during the time of encoding a picture. He showed that when people look at a picture, they use either analog or propositional code if these codes are manipulated by the researcher. And even if both analog and propositional codes are manipulated, participants cannot use both of these codes simultaneously. However, Talaslı (1990: 405) emphasized that code manipulation is not meant to nullify one code completely as the other is rendered strong. The purpose is to weaken the effect of the propositional or analog code through manipulation. Otherwise, when people look at a picture, they use both of these codes at the same time.

1.4 THE AIM AND THE HYPOTHESES OF THE STUDY

The primary aim of this study is to examine how code manipulations affect false memory production in visual materials. In other words, we aim to investigate whether differences in false recollections occurrence are observed depending on encoding differences. Based on the information processing approach, it was assumed that memory problems can emerge in encoding stage. If true, false recollections can be expected based on encoding manipulations.

We know that code manipulations can be possible based on the simultaneous manipulation of propositional and analog codes in experiments (Talaslı 1990). Propositional representations are established on items and their relationships with other items. Thereby, manipulation on propositional code can distort associations between items. On the contrary, the analog code is related to complete visual representation. Therefore, manipulation on analog code distorts the continuity of visual information (Talaslı 1990: 405). In light of his research, we aimed to investigate significant differences between using both of these codes separately.

As Hollingworth and Henderson (2002) mentioned, there can be visual representation in memory. Based on the literature, we can say that VLTM stores object details, and humans have the ability to detect changes in a scene. We claimed that detecting these changes may be related to encoding methods, and false recollections may be more likely when a picture is encoded propositional or analog. The importance of this study lies in the fact that some false recollections may occur depending on encoding manipulations. The current study was expected to reveal especially old decisions for the unstudied or foil pictures due to different encoding conditions. To achieve these, the following hypotheses were tested in the study, as presented in Table 1.

Table 1: Hypotheses of the Study

1. In the condition when the propositional code is used old responses given to the reverse pictures will be significantly higher than old responses given to displacement pictures.
2. In the condition when the analog code is used old responses given to the displacement pictures will be significantly higher than old responses given to reverse pictures.
3. In the condition that when neither code is used old responses given to reverse and displacement pictures will not be significantly different each other.
4. In the natural looking condition old responses given to reverse and displacement pictures will not be significantly different each other.
5. In all four conditions old responses given to reverse, displacement, and original pictures will be higher than old responses given to novelty pictures.

CHAPTER II

METHOD

2.1 PARTICIPANTS

The current study was conducted with 85 young adults aged 18 to 31. All participants were inquired about their health status. Due to the potential influence of psychological, psychiatric, and neurological disorders and drug use on cognitive functions, five participants were excluded from the study. The analyses were conducted with a total of 80 participants, comprising 42 females and 38 males (M= 20.6, SD= 0.4). The participants were primarily selected from the students of Çankaya University and 12th-grade students from private and public high schools. Additionally, some participants were recruited from among university graduates. There were no statistically significant difference between participants in terms of age ($t(38) = -1.39$, $p > .05$) and years of education ($t(38) = -1.14$, $p > .05$) for the encoding type variable, which was a between-subject design. The demographic characteristics of the participants are presented in Table 2.

Table 2: Demographic Characteristics of the Participants

Variables	**n**	**%**
Age*	20.6(*0.4*)	
Gender		
Female	42	52.5
Male	38	47.5
Marital Status		
Single	77	96.25
Married	3	3.75
Education		
12th Grade Students	26	32.5
University Students		55.0
Students in Çankaya University	24	
Students in Other University	20	
Graduated	10	12.5

*Mean (Standard Deviation)

2.2 MATERIALS

2.2.1 Informed Consent and Demographic Information Form

Before starting the experiment, participants were provided with an informed consent form (see Appendix A) and a demographic information form (see Appendix B). The informed consent form aimed to provide information to participants about the experiment and explicitly stated that participation in the study was voluntary. The demographic information form contained questions about gender, age, marital status, occupation, educational status, language, and health status. If a participant indicated having any psychiatric, psychological, or neurological diagnosis, or using any medication within the last six months in the demographic information form, they were excluded from the study.

2.2.2 Visual Materials

2.2.2.1 Creating Visual Material

We created pictures in the course of this study were. If there are specific characteristics inherent to these pictures, they may affect recognition performance. However, in our experiment, instead of manipulating the inherent characteristics of pictures, we focused on manipulating the encoding methods. This approach allowed us to stabilize the properties of the pictures we created. These properties were identified with reference to the in Talaslı's (1990) experiment, and included meaningfulness, distinctiveness, visual richness, color, motion, and interstimulus similarity.

2.2.2.1.1 Meaningfulness

Findings suggest that memory performance is better for meaningful pictures. Nagata's (1986) experiment examined differences in picture recognition under conditions including concrete objects and abstract shapes. Concrete pictures included common objects, and abstract pictures were generated by computer. Overall, recognition of the concrete pictures was better than random shapes. In another experiment conducted by Bellhouse-King and Standing (2007), participants were given concrete, regular abstract, and diverse abstract stimuli. In the subsequent recognition test, participants identified the image they had previously seen. Recognition scores showed that participants had the highest scores for concrete items.

In our research we decided to use meaningful pictures rather than abstract objects due to the manipulations we will explain later made it necessary for used meaningful pictures.

2.2.2.1.2 Distinctiveness

Distinctiveness can be defined as the quality of being easily recognizable due to being different from other things. In literature, studies show that when more distinctive pictures are used as stimuli, they are better remembered than less distinctive pictures. For instance, in Friedman's (1979) study, pictures contained expected and unexpected objects. In the recognition session, participants discriminated target pictures from distractors in which either expected or unexpected objects had been changed or deleted. When expected objects were deleted or changed, participants did not easily notice. Also, participants' eye movements were recorded, and data showed that identifying unexpected objects took more time to analyze than expected objects. According to the author, identifying expected objects occurred automatically. Many studies have also explored the automatic recognition of objects. This case is called the "consistency effect". Humans have some expectations while processing any kind of information because, in the real world, objects tend to be in a consistent relationship with each other. People expect that objects should be compatible with their environment. There is a consensus that objects appearing in a consistent or familiar background are detected more accurately and processed more quickly (Oliva and Torralba 2007).

In Mäntylä and Bäckman's (1992) study, young and old participants walked into a room and viewed objects that varied in consistency with their expectation. In recognition tests, both age groups recognized unexpected objects better than expected items. This result shows that the consistency effect is valid regardless of age because schematic knowledge is a form of world knowledge. Another research (Henderson and Hollingworth 1999) investigated the influence of semantic factors on eye movements. Results showed that if an object was semantically inconsistent, the eyes tended to fixate longer, and the eyes tended to return to semantically inconsistent objects. In an experiment by Hollingworth and Henderson (2003), it was showed that changes to objects inconsistent with the scene in which they appear are detected more accurately than changes to consistent objects. It can be concluded that inconsistent objects have

an advantage in recognition. Based on these studies, we could conclude that the distinctiveness is a memorable characteristic of a stimulus. Thus, in our research, we did not use any distinctive figures due to their advantage over ordinary objects in memory system.

2.2.2.1.3 Visual Richness

How much detail should a picture contain to be better remembered? Does increased visual richness enhance memory retention for pictures? This topic yielded mixed results. In one study (Nelson et al. 1974), young people were exposed to pictures that produced (1) photographs, (2) verbal descriptions of the main theme of the photographs, (3) unembellished line drawings of the main theme of the photographs, and (4) main-theme line drawings embellished with extra details from the photographs. Pictorial conditions demonstrated higher recognition than the verbal condition; however, pictorial conditions did not differ from each other on recognition tests. Results showed a recognition advantage for pictures over verbal descriptions, and this advantage did not occur due to the extra details in pictures. In Loftus and Bell's (1975) study, photographs were remembered better than drawings because there was more informative detail in photographs. The probability of detailed encoding was found to be higher for photographs. Another study (Pezdek and Chen 1982) assessed the effect of the amount of detail in a picture on recognition. For this aim, simple and complex line drawings were composed. Results showed age differences in terms of physical details in pictures. While adults remembered simple drawings better than complex pictures, second and fourth-grade participants did not show any difference between these two conditions. In our study, we have used pictures of the same level of complexity, each containing approximately five images.

2.2.2.1.4 Color

In the relevant literature, several studies have compared the recognition performance in terms of coloring. Adult performance was significantly affected by the color of presentation (Borges et al. 1977), with colored pictures resulting in better performance than black-and-white pictures. In Anglin and Levie's (1985) study, no significant differences were found regarding the color types of pictures. However, another study (Wichmann et al. 2002) presented contradictory result, suggesting that

colored pictures (5%-10%) had better recognition performance than black-and-white images. Thereby, we can conclude that there is no absolute advantage of color pictures over black and white images. So, in this study, we decided to use black and white pictures, adhering to the approach taken in Talaslı's (1990) study.

2.2.2.1.5 Motion

According to Freyd's (1987) review, when people see a picture that includes implicit dynamic information, they are sensitive to this information. Such dynamic elements may include items in motion, such as a car in motion or a person jumping a wall. Although people do not observe real-time changes, they can establish a dynamic representation for these items. This dynamic representation can be in the form of propositional coding in the picture; thus, people can use this relationship in a test session. And, this propositional coding may produce a confounding effect when measuring differences between propositional and analog coding in pictorial memory. In light of this finding, we chose not to use pictures with dynamic information in the current study.

2.2.2.1.6 Interstimulus Similarity

In this study, similar pictures were employed, all depicting outside or landscape scenes. The pictures show similarities among themselves. Likewise, the characteristic of distinctiveness suggests that any picture markedly different from other pictures might affect recognition performance.

2.2.2.2 Studied (Original) Pictures

In the scope of this study, a picture set was created and utilized as target or original pictures. One of the pictures is from the experiment of Talaslı (1990). Based on this picture, nine different pictures also were drawn by a painter, resulting in a total of ten original pictures used for the learning phase of the study (see Figure 2). The studied pictures are presented in Appendix C.

However, before the main experiment, a pilot study was conducted to test the procedure. After the pilot study, three of the pictures were removed the picture set, and the reasons for their exclusion is explained one by one later. The main study was conducted with seven original pictures.

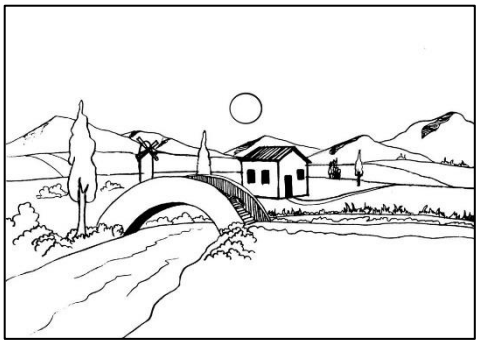


Figure 2: An Example of Target Picture for Studied Pictures

2.2.2.3 Unstudied Pictures

In the test phase of the study, unstudied pictures were used. For this part, three sub-pictures of each target picture were created as the foil category. The new pictures were generated according to three alterations as follows: reversal, displacement, and novelty (see Figure 3). In reversal alteration, one partial item is changed to its own mirror image in the vertically; in displacement alteration, one partial item in each picture is replaced with one another; and in novelty alteration, one specific item is added instead of the one target item in each picture. Initially, there were thirty unstudied pictures corresponding to each original picture. Following the pilot study, twenty-one unstudied pictures were selected for use in the main experiment. The unstudied pictures are also presented in Appendix C.

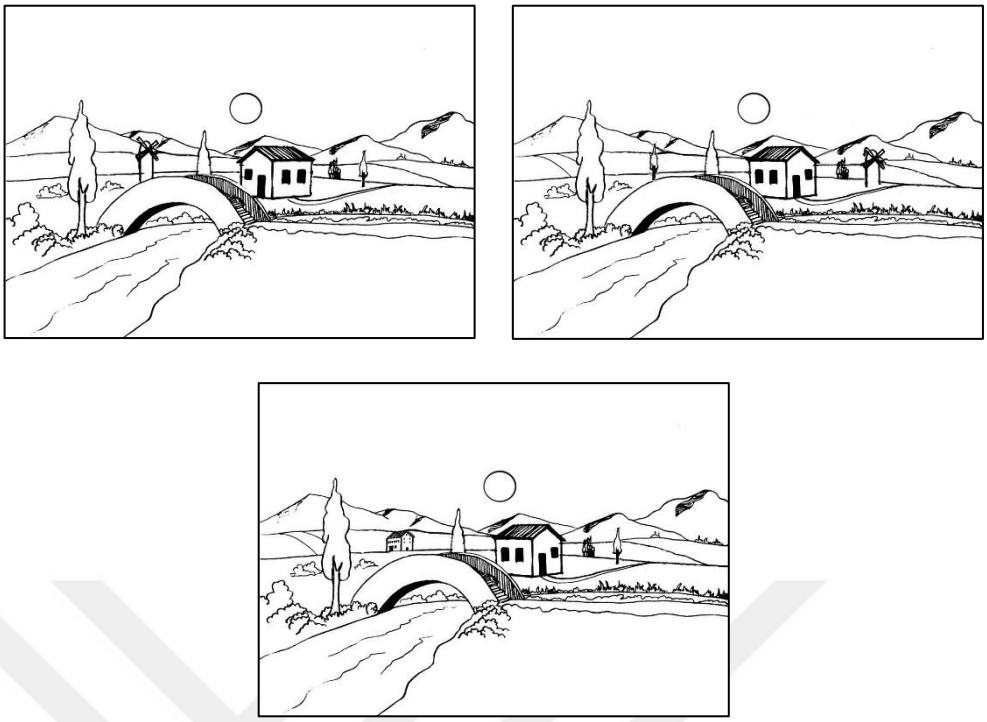


Figure 3: The Picture (Top-Left) is an Example for "Reversal" Changes, and the Picture (Top-Right) is an Example for "Displacement" Changes, and the Picture (Bottom) is an Example for "Novelty" Changes

2.3 EXPERIMENTAL DESIGN

In this study, the research design was 4 (encoding type: propositional, analog, neither, and natural looking) x 4 (foil category: displacement, reversal, novelty, and original) mixed factorial ANOVA. The encoding type variable was between-subjects; the foil category was within-subjects design. The four experimental conditions included the same five pictures with different encoding types. Thus, the differences in encoding types were independent variables. Based on to the logic of the study, we expected different number of false recollections for the foil conditions. Accordingly, the number of old responses given to foil categories and original pictures were dependent variables. The distribution of the participants is shown in Table 3.

Table 3: Distribution of the Participants across Conditions

	n
Only propositional encoding condition	19
Only analog encoding condition	21
Neither code used condition	20
Natural look condition	20

2.4 PROCEDURE

The study was approved by the Ethical Committee of Çankaya University (date: 09/06/2022, issue: 83, see Appendix D). Before the experiment, participants read and signed the informed consent form. Meanwhile, they filled out the demographic information form. They were tested individually in a quiet room. All experiment was carried out on a computer using the OpenSesame (3.3.12) experiment program. At the beginning of the experiment, an instruction was shown on the screen. The instructions are explained in detail in the following parts. For all experimental conditions, the instructions were different from each other and they were given in black letters on a white background (see Appendix E). After receiving instructions related to the conditions, participants started the experiment by pressing the "OK" button on the screen.

In accordance with the relevant conditions, each participant was shown the same picture set. All pictures were the same in all conditions, but the methods of presenting the pictures were manipulated between conditions. During the encoding session, a total of seven pictures were shown to the participants in the main experiment, with the order of the pictures randomized. The participants were instructed to only look at the pictures. Following the encoding session, a distraction task was given, followed by a recognition task. The instruction for distractor and recognition task also are provided in Appendix F.

2.4.1 Conditions

In the experiment, there were four different encoding conditions. In three of the conditions, different manipulations were applied to the pictures, and one of the conditions was determined as a control condition. The method used in Talaslı's (1990) study was applied with his permission. The manipulations and conditions were created on the computer software. All the conditions are explained in detail below.

2.4.1.1 Only Propositional Encoding Condition

The first condition was the *"only propositional encoding condition"*. In this condition, the use of analog code was prevented through manipulation. To achieve this, a grid pattern was used on the picture (see Figure 4). Analog representation is the same as the stimulus itself. To prevent the use of analog code, the grid pattern was used. The grid pattern was superimposed on the picture, creating some gaps in the encoding of pictorial information. Thus, this manipulation distorted the continuity of information and participants could use only propositional code. It was assumed that, with this manipulation, only inter-item relationships could be established during encoding of the picture.

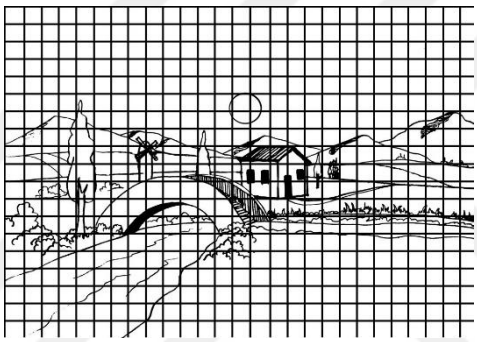


Figure 4: The Picture is an Example for Only Propositional Encoding Condition

The encoding instruction for this condition was given as follows: ''You will be shown some pictures. Each picture will have a grid. Please examine each picture carefully'. Participants were instructed to look at each picture carefully as it appeared on the screen, with each picture displayed for 18000 msec on the screen.

In this condition, it was crucial to notice the displacement changes in pictures, whereas it was important not to notice the reverse changes in pictures. More clearly, participants should have given "new" responses for the displacement pictures and they should have given "old" responses for the reverse pictures. These decisions showed that the pictures could be encoded propositionally. Thus, the differences in their decisions were counted.

2.4.1.2 Only Analog Encoding Condition

The other condition was the *"only analog coding condition"*. In this condition, the use of propositional code was prevented through manipulation. To achieve this, each picture was shown column by column, dividing the whole picture into 8 narrow strips (see Figure 5). Each narrow strip was shown to participants in a random order during the encoding phase, preventing them from seeing the whole picture. However, each column appeared where it should be according to the whole image on the screen. It was assumed that this manipulation made it harder for items to be associated with each other, thus manipulating the use of propositional code. Thus, participants could only use analog code.

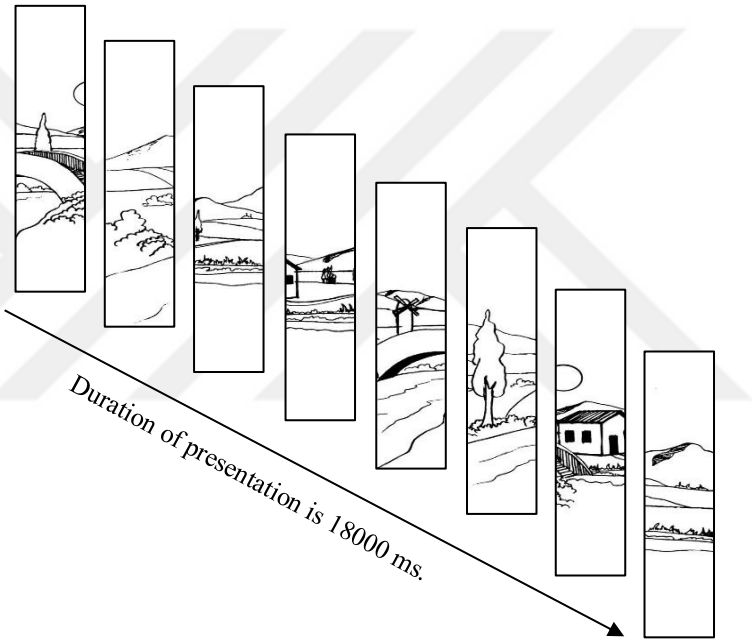


Figure 5: The Picture is an Example for Only Analog Encoding Condition

The encoding instruction for this condition was given as follows: 'You will be shown some pictures. Each picture is divided into eight narrow strips, which will be displayed individually on the screen. It is important that you examine the pictures carefully.'. During the encoding condition, each narrow strip of the picture was shown for 2250 msec on the screen. In total, the entire picture was shown for 18000 msec on the screen. It was expected that participants would only look at each picture carefully in this encoding condition while each column of pictures appeared on the screen.

In this condition, it was important to notice the reverse changes in pictures, whereas it was important not to notice the displacement changes in pictures. More

clearly, participants should have given “new” responses for the reverse pictures and they should have given “old” responses for the displacement pictures. These decisions showed that the pictures could be encoded in an analog way. Thus, the differences in their decisions were counted.

2.4.1.3 Neither Code is Used Condition

Another condition of the experiment was the *“neither code used condition”*. In this condition, the use of analog and propositional code was blocked simultaneously. To achieve this, propositional and analog manipulations were applied at the same time to each picture. Firstly, a grid pattern was implemented on the picture, and it was divided into 8 narrow strips (see Figure 6). Similar to the only analog encoding condition, each column appeared where it should be according to the whole image on the screen. In this way, neither analog nor propositional codes were used by participants in this condition. It was assumed that it was difficult to make relationships between items, and the manipulation distorted the continuity of information.

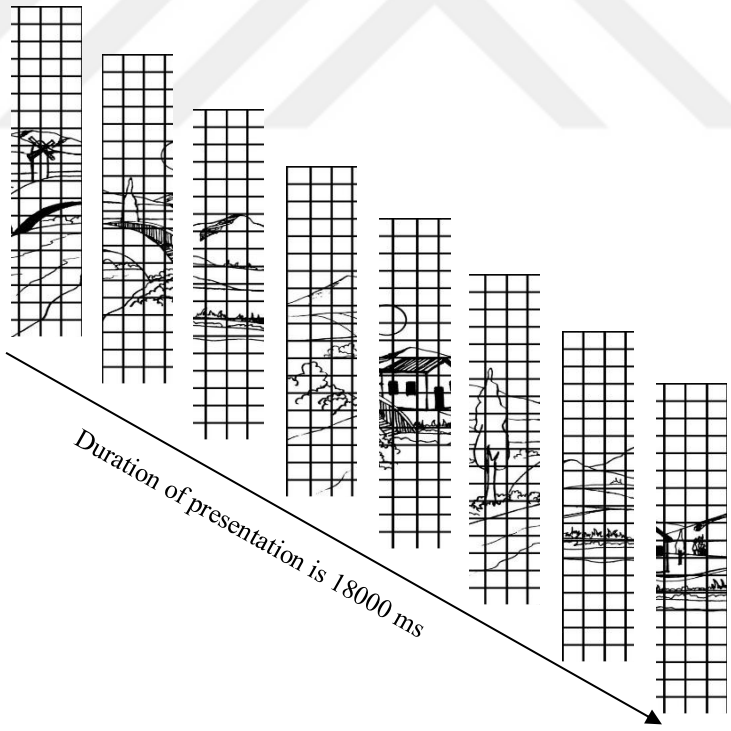


Figure 6: The Picture is an Example for Neither Code is Used Condition

The encoding instruction for this condition was given as follows: ‘Some pictures will be shown to you. There is a grid on the pictures and each picture is divided into 8 narrow strips. It will show on the screen. It is important that you examine the

pictures carefully.'. During the encoding condition, each narrow of picture was shown for 2250 msec on the screen. In total, the whole picture was shown for 18000 msec on the screen. It was expected that participants would only look at each picture carefully in this encoding condition while each column of pictures appeared on the screen.

In this condition, due to the both codes were manipulated neither the reverse changes in pictures nor the change of displacements in pictures were expected to be noticed. More clearly, participants should have given "old" responses for the reverse and displacement pictures. Thus, the differences in their decisions were counted.

2.4.1.4 Natural Look Condition

The last condition of the experiment was the *"natural looking condition"*, used as a control condition. Based on Talaslı's (1990) experiment, we know that when people look at a picture without any manipulation, they can use both propositional and analog codes at the same time. It was assumed that inter-item relationships were created, and continuity of information was not distorted.

The encoding instruction of this condition was given as follows: 'You will be shown some pictures. It is important that you examine the pictures carefully.'.' It was expected that participants would only look at each picture carefully in this encoding condition while the pictures appeared on the screen and each picture was shown for 18000 msec on the screen.

In this condition, it was expected that reverse changes and changes of displacement in pictures were discerned by the participants. They should have given "new" responses for the reverse and displacement pictures.

2.4.2 Distraction Task

In one of the parts of the experiment, a distractor task was given to participants. A simple mathematical task was used as a distractor task between the study and recognition phases. Twenty pairs of two-digit numbers were shown on the screen, and participants were expected to decide which number was greater than the other. For this task, they pressed the "F" or "K" buttons on the keyboard. The result of this task were not included in the analysis.

2.4.3 Recognition Task

After the distractor task, the recognition task was given as the last part of the experiment. The instructions providing information about this session appeared on the screen (see Appendix F). In this task, original pictures and their sub-pictures (reversal, displacement, and novelty pictures) were shown to the participants. The pictures appeared on the screen in a random order without any time limit. During the recognition session, a total of 28 pictures were shown to the participants in the main experiment. The purpose of the recognition task was to decide whether each picture was an "old" or "new" picture. If the participants decided they had seen a picture in the encoding session, they made the "old" decision and pressed the "E" button on the keyboard. Otherwise, if the participants decided they had not seen that picture in the encoding phase, they made the "new" decision and pressed the "Y" button of the keyboard. The participants were also indicated their confidence level for each answer. When making an 'old' decision, after pressing the button, confidence ratings on a three-point slider were displayed (1: Maybe Old, 2: Most Probably Old, 3: Absolutely Old). Similarly, when making a 'new' decision, confidence ratings on three-point slider were shown (1: Maybe New, 2: Most Probably New, 3: Absolutely New).

2.5 PILOT EXPERIMENT

A pilot study was conducted to determine whether the pictures have worked for analog and propositional encoding. We expected that if the manipulations were effective, then both analog and propositional encoding should be observed. Otherwise, it would be unreasonable to expect a difference in the number of false recollections between propositional and analog encoding conditions.

During the pilot study, only propositional and analog conditions were applied. In other words, natural-looking and blocking codes conditions were not used in the pilot experiment. The reason for this is that if pictures are conditionally propositional or analog encoded, then the other conditions should also work. In brief, the pilot study was conducted to verify that the basic two conditions were met.

The pilot study was carried out with 40 participants who were included in both conditions. A total of 10 pictures were used, and each participant encoded two different pictures in each condition. Each picture was shown to 4 people in both propositional and analog conditions, resulting in a total of 4 propositional and 4 encodings per

picture. The aim of this procedure was to reduce error rates that may occur due to possible memory overload in one participant.

Following the pilot study, we analyzed the participants' old and new decisions to the three foils and one original pictures during the recognition phase. These foils were categorized as reversal, displacement, and novelty. Based on the logic of propositional condition in this study, we expected participants to make new decisions for displacement and novelty categories, while making old decisions for reversal and original categories. Similarly, based on the reason for analog condition, we expected participants to make new decisions for reversal and novelty categories, while making old decisions for displacement and original picture categories. The results obtained for propositional and analog conditions are shown in Table 4 and Table 5.

Table 4: Number of Decisions on Only Propositional Encoding Condition

Pictures	**Number of New Decisions for Displacement Foil**	**Number of Old Decisions for Reversal Foil**	**Number of New Decisions for Novelty Foil**	**Number of Old Decisions for Original Target**
Picture 1	3	0	3	2
Picture 2	4	2	2	4
Picture 3	2	2	4	2
Picture 4	1	0	3	1
Picture 5	2	2	2	3
Picture 6	4	2	3	2
Picture 7	1	3	3	2
Picture 8	2	2	4	3
Picture 9	3	2	3	4
Picture 10	3	2	4	1

Table 5: Number of Decisions on Only Analog Encoding Condition

Pictures	Number of New Decisions for Reversal Foil	Number of Old Decisions for Displacement Foil	Number of New Decisions for Novelty Foil	Number of Old Decisions for Original Target
Picture 1	3	2	3	1
Picture 2	2	1	3	3
Picture 3	1	1	1	1
Picture 4	2	1	2	1
Picture 5	2	2	4	2
Picture 6	2	2	2	1
Picture 7	2	4	3	4
Picture 8	0	3	4	3
Picture 9	1	0	4	2
Picture 10	2	2	3	3

This pilot study was conducted to determine if each picture was encoded in an analog and propositional way. To achieve this, we analyzed the participants' responses to each picture in two conditions. As a result of this analysis, we identified which pictures would be used in the main study.

Picture 1

In the propositional condition, the results showed 3 new decisions and 0 old decisions for displacement foil. Also, there was a 1 decision that confidence rate was evaluated as new even though the participant's response was old. However, 4 new decisions and 0 old decisions were obtained for reversal foil. In the analog condition, 3 new decisions and 0 old decisions were obtained for reversal picture. Also, there was a 1 decision that confidence rate was evaluated as new even though participant's response was old. There were 2 old decisions and 1 new decision were obtained for displacement foil. Also, there was a 1 decision that confidence rate was evaluated as new even though participant's response was old. According to the propositional results, we can say that responses given to displacement foil were obtained in line with our expectation. However, it was noticed that reversal change was easily detected by the participants in propositional condition. The analog condition results were consistent with our expectation because there were more new decisions for reversal foil than for displacement foil. The reversal foil was quite noticeable in two conditions for picture 1. The reason may be that reversal change was made in the foreground of the field of the picture. Possibly, if the reversal change was made on objects which are

in the background of the picture, the results can be obtained as consistent with the logic. However, the participants did not see only one picture in the main experiment. Hence, we though this advantage for reversal foil can decrease in a picture set. Therefore, we decided to include the first picture in the main experiment.

Picture 2

In the propositional condition, 4 new decisions and 0 old decision were obtained for displacement foil, and 2 new and 2 old decisions were obtained for reversal foil. In the analog condition, 2 new and 2 old decisions were obtained for reversal foil, and 3 new and 1 old decision were obtained for displacement foil. According to these, responses in propositional condition were consistent with our expectation because there were more new decisions for displacement picture than for reversal picture in the propositional condition. On the other hand, in the analog condition, there were more new decisions for displacement than new decisions for reversal foil, which was not in line with the aim. The displacement foil was quite noticeable in two conditions for picture 2. Despite this, we decided to include this picture in the main experiment to be tested with a larger picture set.

Picture 3

In the propositional condition, 2 new and 2 old decisions were obtained for displacement foil, and 2 new and 2 old decisions were obtained for reversal foil. In the analog condition, 1 new and 3 old decisions was obtained for reversal foil, and 3 new and 1 old decision were obtained for displacement foil. This picture had been used in the study of Talaslı (1990) and the manipulations had worked according to the purpose of the experiment. Therefore, although the results from the pilot study did not support our logic clearly, we decided to include this picture in the main study.

Picture 4

In the propositional condition, 1 new and 2 old decisions were obtained for displacement foil. Also, there was a 1 decision that confidence rate was evaluated as old even though participant's response was new for displacement foil. There were 4 new and 0 old decisions were obtained for reversal foil. In the analog condition, 2 new decisions and 1 old decision were obtained for reversal foil, and 2 new and 1 old

decision were obtained for displacement foil. And, in analog condition the confidence rate did not obtain from one participant due to technical reasons. Therefore, decisions given to reverse and displacement foil were evaluated based on 3 pictures. According to the results, it seemed that our expectation did not support in the propositional condition. Also, in this picture, there were 3 new decisions for original picture in the propositional condition. Considering all of these results obtained from this picture, we decided to exclude it from the main study.

Picture 5

In the propositional condition, 2 new and 2 old decisions were obtained for displacement foil, and 2 new and 2 old decisions were obtained for reversal foil. In the analog condition, 2 new decisions were obtained for reversal foil. Also, there was a 1 decision that confidence rate was evaluated as old even though participant's response was new for displacement foil and there was a 1 missing data. There were 2 new and 2 old decisions were obtained for displacement foil. According to these unclear results, we decided to include this picture in the main study for testing with more participants.

Picture 6

In the propositional condition, 4 new and 0 old decisions were obtained for displacement foil, and 1 new and 2 old decisions were obtained for reversal foil. Also, there was a 1 decision that confidence rate was evaluated as new even though participant's response was old for reversal foil. In the analog condition, 2 new and 2 old decisions were obtained for reversal foil, and 2 new and 2 old decisions were obtained for displacement foil. The results from the analog condition were not conclusive, but we can infer that our expectation may work for the propositional condition because there were more new decisions for displacement than reversal foil. Overall, we decided to include this picture in the main study.

Picture 7

In the propositional condition, 1 new and 1 old decision were obtained for displacement foil. Also, there was a 1 decision that confidence rate was evaluated as new even though participant's response was old for displacement foil and there was a 1 missing data. There were 3 old decisions were obtained for reversal foil. Also, there

was a 1 decision that confidence rate was evaluated as new even though participant's response was old for displacement foil. In the analog condition, 2 new and 2 old decisions were obtained for reversal foil, and 0 new decision and 4 old decisions were obtained for displacement foil. Overall, we can say that our expectation seemed to work in analog condition whereas there were unclear results in propositional condition. Therefore, we decided to include this picture in the main study.

Picture 8

In the propositional condition, 2 new and 2 old decisions were obtained for displacement foil, and 2 new and 2 old decisions were obtained for reversal foil. In the analog condition, 0 new decision and 4 old decisions were obtained for reversal foil, and 1 new decision and 3 old decisions were obtained for displacement foil. These results were contradictory to our initial aim. Thus, we decided to exclude this picture from the main study.

Picture 9

In the propositional condition, 3 new and 1 old decision were obtained for displacement foil. There were 1 new and 2 old decisions were obtained for reversal foil. Also, there was a 1 missing data for reversal foil. In the analog condition, 1 new decision and 3 old decisions were obtained for reversal foil, and 4 new decisions and 0 old decision were obtained for displacement foil. Based on the result of analog condition, our expectation may not work consistently with our aim, as the displacement change was easily noticeable by participants in this condition. Therefore, we decided to exclude this picture from the main study.

Picture 10

In the propositional condition, 3 new and 1 old decision were obtained for displacement foil. There were 0 new and 2 old decisions were obtained for reversal foil. Also, there was 2 missing data for reversal foil. In the analog condition, 2 new decisions and 1 old decision were obtained for reversal foil. Also, there was a 1 decision that confidence rate was evaluated as new even though participant's response was old for reversal. There were 2 new and 2 old decisions were obtained for displacement foil. Based on the results of the propositional condition, our expectation

seemed to work well, with more new decisions for displacement foil than for reversal foil. There were no new decisions for reversal foil. Despite the unclear results of the analog condition, we decided to include this picture in the main study to test with more participants.

At the end of the pilot study, three pictures were excluded from the picture set. We decided to carry out the main experiment with 7 pictures. Some pictures did not exclude from the picture set because we wanted to obtain results of them in larger picture set. In the pilot study, each participant was shown only one picture. For this reason, some reversal or displacement changes may had been noticeable. The other reason of some pictures did not exclude from the picture set because there were unclear results in terms of our expectation. So, we decided to obtain results of these pictures with more participants. The pictures 4, 8, and 9 were excluded from the picture set. The exclusion reason of picture 8 was the analog condition results seemed to against our expectation as have no new decision on reversal foils. Also, the exclusion reason of picture 9 was the analog condition results seemed that have more decisions on displacement foils than reversal foils. The picture 4 did not include in the main study because we considered responses of the original picture in propositional condition.

CHAPTER IV

RESULTS

In this chapter, the results of the analysis are reported. The main purpose of the study was to assess how encoding manipulations affect false recollection performance of pictures. In the scope of this study, we expected differences in old decisions based on conditions. Accordingly, false recollections were counted toward the hypotheses.

Before the analysis, two of the pictures were removed due to a technical problem. The analysis of main experiment proceeded with the remaining five pictures. In total, we analyzed differences in old decisions for 20 pictures.

Firstly, a 4x4 mixed-design analysis of variance (ANOVA) and a number of paired-sample t-tests were conducted to compare the main effects of the encoding type and foil category and investigate the interaction effect between the encoding type and foil category on false recollections. All analyses were conducted using the Statistical Package for Social Sciences (SPSS) for Windows, Version 29.

3.1 RESULTS OF ANOVA REGARDING THE EFFECTS OF ENCODING TYPE AND FOIL CATEGORY ON FALSE RECOLLECTION

To detect outliers, z scores were calculated. According to Field (2018: 339), values higher than 3.29 or lower than -3.29 are considered outliers. In the result of this analysis, no outliers were detected.

In the study, the main effects of encoding type and foil category on false recollections were examined. Therefore, the "old" responses given to foil pictures were considered the dependent variable. To explore the effect, a 4 (encoding type: propositional, analog, neither, and natural looking) x 4 (foil category: displacement, reversal, novelty, original) mixed-design ANOVA was conducted. The encoding type was the between-subject, while foil category was the within-subject design. The sphericity assumption was met for foil category.

There was no main effect of encoding type on false recollection ($F(3, 76) = 1.30$, $p > .05$, $\eta_p^2 = .049$). So, there were no significant differences among propositional

code (M = 2.59, SD = .159), analog code (M = 2.71, SD =.151), neither coding (M = 2.33, SD = .155), and natural looking condition (M = 2.41, SD = .155). There was a main effect of foil category on false recollection ($F(3, 228) = 26.96$, $p < .001$, $\eta_p^2 = .262$). The old responses given to original foils (M = 3.05, SD = .122) were higher than the old responses given to reverse foils (M =2.98, SD = .126). The old responses given to reverse foils (M =2.98, SD = .126) also were higher than the old responses given to displacement foils (M = 2.12, SD = .113). And, the old responses given to displacement foils (M = 2.12, SD = .113) were higher than the old responses given to novelty foils (M = 1.90, SD = .137). Also, there was no significant interaction effect of encoding type and foil category on false recollection ($F(9, 228) = .94$, $p > .05$, $\eta_p^2 = .036$). Based on the hypotheses, the planned comparisons were conducted.

3.2 RESULTS OF PAIRED-SAMPLES T-TESTS

3.2.1 Possible Comparisons within Conditions

Paired-samples t-tests were conducted to examine the differentiation of old responses (false recollections) to foil categories in each condition. For each condition, old responses to foil category were compared with each other. These comparisons aimed to test the hypotheses suggesting that old decisions differed based on foil categories within the same condition. A total of six comparisons were examined for each encoding condition. In order to determine the significance level, Holm's sequential Bonferroni procedure was applied. After correction, the significance values were set at .008, .01, .012, .016, .025, .05, respectively.

For each encoding condition, six separate analyses were conducted. First, all possible comparisons across old decisions to foil categories for the only propositional encoding condition were executed. Second, all possible comparisons across old decisions to foil categories for the only analog encoding condition were conducted. Then, all possible comparisons across old decisions to foil categories for neither code is used condition were performed. Lastly, all possible comparisons across old decisions to foil categories for the natural looking conditions were conducted.

3.2.1.1 The Comparisons across Reverse and Displacement Pictures for Old Decisions

According to the results of the planned comparison conducted on the basis of the hypotheses, for the propositional condition, there was a significant difference between old decisions for reverse foils (M = 3.32, SD = 1.29) and displacement foils (M = 2.00, SD = 1.16), $t(18) = 3.44$, $p < .01$ (.05/5), in accordance with the Holm's sequential Bonferroni procedure. The result supported Hypothesis 1. For the analog condition, according to the results of the paired-samples t-tests, there was no significant difference between old decisions given to reverse foils (M = 3.00, SD = 1.23) and displacement foils (M = 2.48, SD = .93), $t(20) = 1.76$, $p > .016$ (.05/3), in accordance with the Holm's sequential Bonferroni procedure. The result did not support Hypothesis 2. For neither code is used condition, paired-samples t-tests results showed that there was no significant difference between old decisions given to reverse (M = 2.60, SD = 1.19) and displacement foils (M = 2.20, SD = 1.97), $t(19) = 1.09$, $p >$ .016 (.05/3), in accordance with the Holm's sequential Bonferroni procedure. The result supported Hypothesis 3. For natural looking condition, paired-samples t-tests results showed that there was a significant difference between old decisions given to reverse (M = 3.00, SD = .73) and displacement foils (M = 1.80, SD = .70), $t(19) = 5.34$, $p < .008$ (.05/6), in accordance with the Holm's sequential Bonferroni procedure . So, Hypothesis 4 was not confirmed.

3.2.1.2 The Comparisons of Reverse, Displacement, and Original Images with Novelty Images

For the propositional condition, according to the results of the paired-samples t-tests, there was a significant difference between old decisions for reverse foils (M = 3.32, SD = 1.29) and novelty foils (M = 1.95, SD = 1.13), $t(18) = 4.19$, $p < .008$ (.05/6) in accordance with the Holm's sequential Bonferroni procedure. Oppositely, for this condition, the results showed that there was no significant difference between old decisions for displacement foils (M = 2.00, SD = 1.16) and novelty foils (M = 1.95, SD = 1.13), $t(18) = .14$, $p >$ .025 (.05/2) in accordance with the Holm's sequential Bonferroni procedure. Additionally, according to results of paired-sample t-tests for this condition, there was a significant difference between old decisions for original foils (M = 3.11, SD = 1.10)

and novelty foils (M = 1.95, SD = 1.13), $t(18) = -3.76$, $p < .008$ (.05/6) in accordance with the Holm's sequential Bonferroni procedure.

For the analog condition, according to the results of the paired-samples t-tests, there was a significant difference between old decisions for reverse foils (M = 3.00, SD = 1.23) and novelty foils (M = 2.05, SD = 1.20), $t(20) = 2.85$, $p < .012$ (.05/4) in accordance with the Holm's sequential Bonferroni procedure. Oppositely, for this condition, there was no significant difference between old decisions for displacement foils (M = 2.48, SD = .93) and novelty foils (M = 2.05, SD = 1.20), $t(20) = 1.40$, $p > .025$ (.05/2) in accordance with the Holm's sequential Bonferroni procedure. Additionally, according to results of paired-sample t-tests for this condition, there was a significant difference between old decisions for original foils (M = 3.33, SD = .91) and novelty foils (M = 2.05, SD = 1.20), $t(20) = -4.26$, $p < .008$ (.05/6) in accordance with the Holm's sequential Bonferroni procedure.

For neither code used condition, according to the results of the paired-samples t-tests, there was no significant difference between old decisions for reverse foils (M = 2.60, SD = 1.19) and novelty foils (M = 1.85, SD = 1.31), $t(19) = 2.26$, $p > .01$ (.05/5) in accordance with the Holm's sequential Bonferroni procedure. Also, for this condition, there was no significant difference between old decisions for displacement foils (M = 2.20, SD = 1.20) and novelty foils (M = 1.85, SD = 1.31), $t(19) = .94$, $p > .025$ (.05/2) in accordance with the Holm's sequential Bonferroni procedure. Additionally, according to results of paired-sample t-tests for this condition, there was a significant difference between old decisions for original foils (M = 2.65, SD = 1.23) and novelty foils (M = 1.85, SD = 1.31), $t(19) = -3.24$, $p < .008$ (.05/6) in accordance with the Holm's sequential Bonferroni procedure.

For the natural looking condition, according to the results of the paired-samples t-tests, there was a significant difference between old decisions for reverse foils (M = 3.00, SD = .73) and novelty foils (M = 1.75, SD = 1.25), $t(19) = 3.77$, $p < .008$ (.05/6) in accordance with the Holm's sequential Bonferroni procedure. Oppositely, for this condition, there was no significant difference between old decisions for displacement foils (M = 1.80, SD = .70) and novelty foils (M = 1.75, SD = 1.25), $t(19) = .20$, $p > .012$ (.05/4) in accordance with the Holm's sequential Bonferroni procedure. Additionally, according to results of paired-sample t-tests for this condition, there was a significant difference between old

decisions for original foils (M = 3.10, SD = 1.12) and novelty foils (M = 1.75, SD = 1.25), $t(19) = -4.48$, $p < .008$ (.05/6) in accordance with the Holm's sequential Bonferroni procedure.

All of these results regarding the comparison between novelty and other foil categories were consistent. In all conditions, old decisions given to reverse and original foils were higher than those for novelty foils. This difference was statistically significant except for the neither code is used condition. In the neither code is used condition, the difference between old decisions given to reverse and novelty foils was insignificant although there were more old responses for reverse foils than novelty foils. Additionally, there were no significant difference between old decisions given to novelty and displacement foils. These results partially supported Hypothesis 5.

3.2.2 Other Findings

In addition to the main hypotheses, differences between old responses given to reverse, displacement, and novelty foils as well as original foils were also analyzed.

For the propositional encoding condition, according to the results, there was no significant difference between old decisions for reverse foils (M = 3.32, SD = 1.29) and original foils (M = 3.11, SD = 1.10), $t(18) = .64$, $p > .016$ (.05/3) in accordance with the Holm's sequential Bonferroni procedure. Additionally, there was a significant difference between old decisions for displacement foils (M = 2.00, SD = 1.16) and original foils (M = 3.11, SD = 1.10), $t(18) = -2.96$, $p < .012$ (.05/4) in accordance with the Holm's sequential Bonferroni procedure.

In the analog encoding condition, according to the results, there was no significant difference between old decisions for reverse foils (M = 3.00, SD = 1.23) and original foils (M = 3.33, SD = .91), $t(20) = -1.28$, $p > .05$ (.05/1) in accordance with the Holm's sequential Bonferroni procedure. Also, there was a significant difference between old decisions for displacement foils (M = 2.48, SD = .93) and original foils (M = 3.33, SD = .91), $t(20) = -3.18$, $p < .01$ (.05/5) in accordance with the Holm's sequential Bonferroni procedure.

For the neither code is used condition, the results showed that old responses given to reverse foils (M = 2.60, SD = 1.19) were not significantly different from old responses given to original foils (M = 2.65, SD = 1.23), $t(19) = -.14$, $p > .05$ (.05/1) in

accordance with the Holm's sequential Bonferroni procedure. Moreover, there was no significant difference between old decisions for displacement (M = 2.20, SD = 1.20) and original foils, $t(19) = -1.14$, $p > .016$ (.05/3) in accordance with the Holm's sequential Bonferroni procedure.

The results of the last condition, which was the natural looking condition, showed that old decisions given to reverse foils (M = 3.00, SD = .73) did not significantly differ from old decisions given to original foils (M = 3.10, SD = 1.12), $t(19) = -.36$, $p > .01$ (.05/2) in accordance with the Holm's sequential Bonferroni procedure. There was a significant difference between old decisions given to displacement foils (M = 1.80, SD = .70) and original foils, $t(19) = -4.61$, $p < .008$ (.05/6) in accordance with the Holm's sequential Bonferroni procedure.

In total, except for neither code is used condition, there were no significant differences between old decisions given to reverse and original foils; and there were significant differences between old decisions given to displacement and original foils. The old responses of all comparisons are shown in Table 6 and Figure 7.

Table 6: Old Decisions Given to Foil Category across Conditions

	Reversal	Displacement	Novelty	Original
Prop	63	38	37	59
Analog	63	52	43	70
Neither code	52	44	37	53
Natural	60	36	35	62

Note: These are raw data.

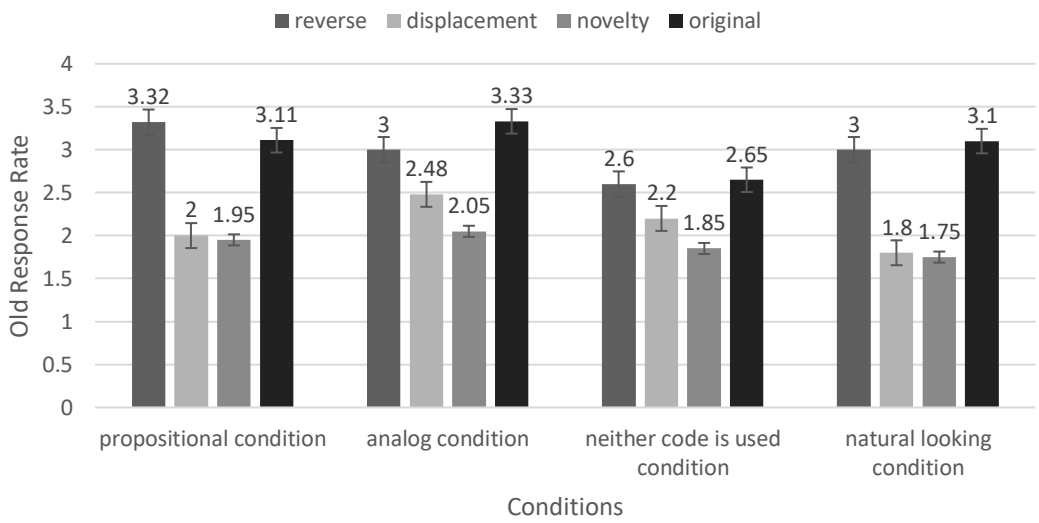


Figure 7: The Means of Old Responses for Encoding Conditions

3.3 DRAWING ROC CURVES

In the ROC curves, the x-axis depicts false alarm rates, representing old responses given to new pictures, while the y-axis illustrates hit rates, indicating old responses given to old pictures (Macmillan and Creelman 2005: 9). Curves that come close to the upper left corner of the graph indicate higher memory accuracy. In the study, we collected number of false alarm from the foil category, and hit rates were collected from original pictures. For each encoding condition, distinct ROC curves were drawn (see Figures 8, 9, 10, 11). The curves included all three foil categories.

The curve for displacement and novelty foils appeared closer to each other than reverse foils, especially in propositional and natural looking conditions. Also, it can be seen easily that the curve of reverse foil was lower than the other curves in all conditions. Since the curve was notably far from the upper left corner, the accuracy for reverse pictures was lower than the accuracy for displacement and novelty pictures.

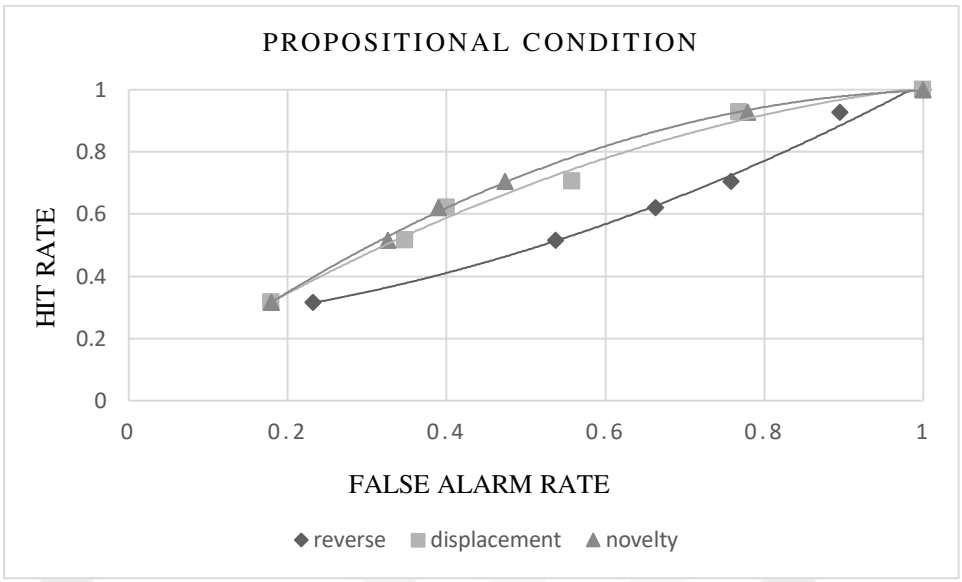


Figure 8. ROC Curves for Foil Category in Propositional Condition

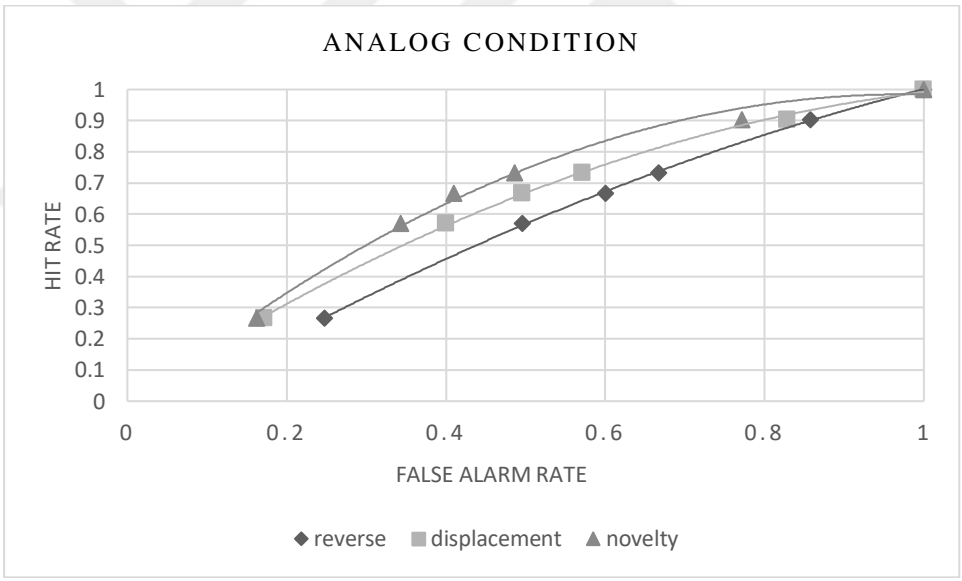


Figure 9. ROC Curves for Foil Category in Analog Condition

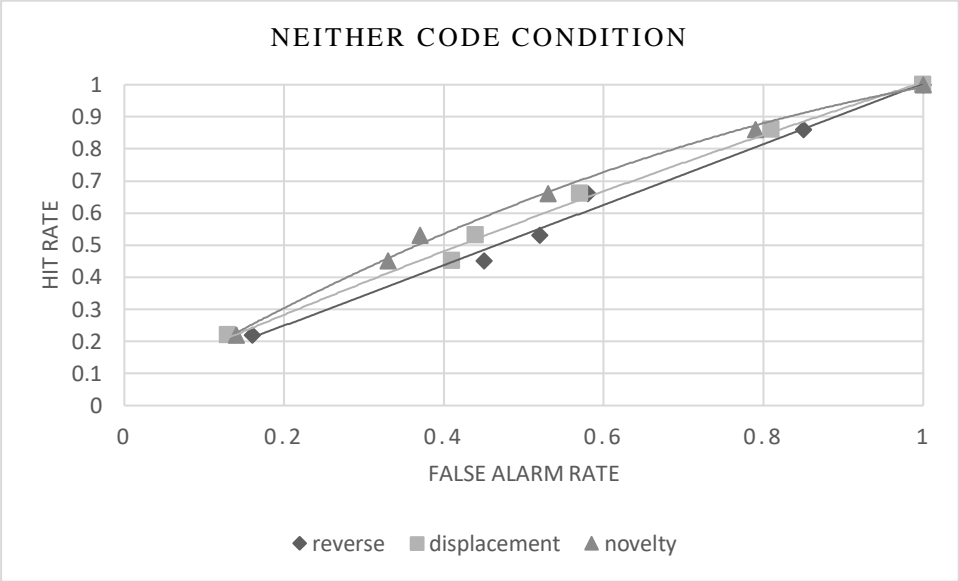


Figure 10. ROC Curves for Foil Category in Neither Code is Used Condition

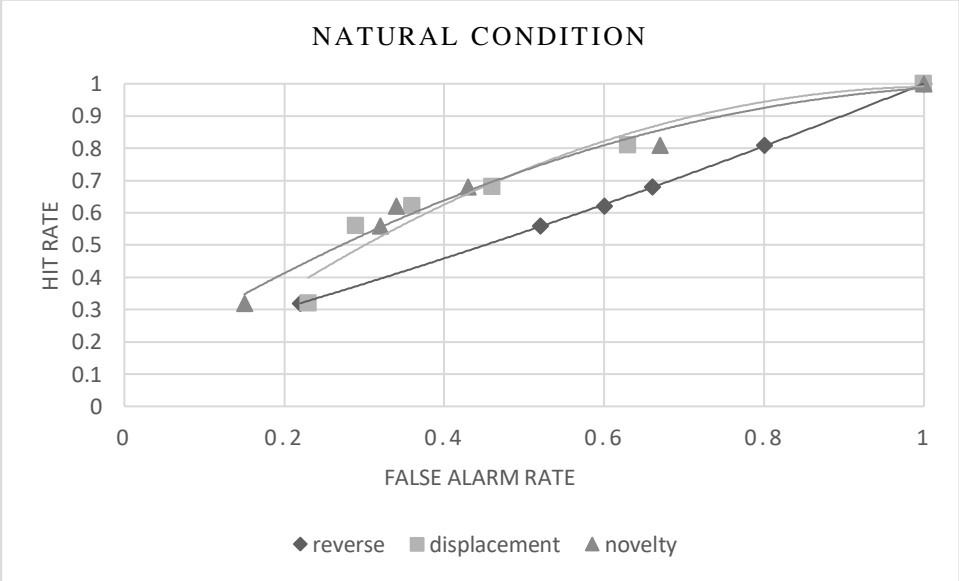


Figure 11. ROC Curves for Foil Category in Natural Looking Condition

CHAPTER V

DISCUSSION

The main purpose of this study was to investigate how encoding manipulations affect the false recollection performance of pictures. For this aim, it explored the impact of encoding conditions on old decisions given to the foil categories. In this chapter, how encoding manipulations affect false recollection performance is discussed based on the results of the present study.

In the extent of this study, a picture set consisting of ten pictures was created. Three of the pictures were eliminated in the pilot study, and two were removed from the analysis. Therefore, the analyses were conducted with the remaining five pictures. In a classical recognition paradigm, participants decide whether or not the pictures were seen in the study phase. Then, old responses given to new (non-studied) stimuli are calculated as false alarms. However, in the present study, it was expected that old decisions (number of false alarms) would differ based on conditions. In accordance with this purpose, the ANOVA analyses were conducted to observe the main effects of encoding type and foil category, and the interaction effect between them on false recollection. Later, the planned paired samples t-tests were also applied to investigate the differences for experimental conditions in terms of the old responses given to foil categories.

4.1 EVALUATION OF THE FINDINGS REGARDING ANOVA ANALYSES

In this study, the main effects of encoding type and foil category on false recollection were examined. Results showed that there was no main effect of encoding type on false recollection. Thus, encoding conditions did not differ from each other in terms of false recollection performance in our experiment. On the other hand, there was a main effect of foil category on false recollection, indicating that the old responses given to the pictures under the foil category differed from each other. There was no interaction effect between encoding type and foil category. Although this differentiation was not found to be significant, the planned paired samples t-tests were

conducted, and the results were evaluated below.

4.2 EVALUATION OF THE FINDINGS REGARDING PAIRED SAMPLES T-TEST ANALYSES

4.2.1 Evaluation of Responses to Reverse and Displacement Foils within the Extent of the Hypotheses

The current study also examined the false memory production in foil category, which included reverse, displacement, novelty, and original pictures. The old decisions acquired from foil categories were used as measurements.

In our study, we hypothesized that the propositional encoding would lead to an increase in old decisions given to reverse foils compared to displacement foils. In other words, it was expected that there would be more false recollections in reverse pictures than displacement pictures. The results of paired samples t-tests indeed showed that in the propositional condition, there were more old decisions for reverse foils than for the displacement foils. Talaslı (1990) demonstrated that if the analog code is manipulated, the propositional code is rendered strong, similar to our propositional condition. Thus, it was assumed that reverse changes could not be detected via the propositional code. In the propositional condition, results were consistent with Talaslı's (1990) assertion because old decisions given to reverse foils were higher than for displacement foils.

It is crucial to state that there was no significant encoding effect on false recollection. If this result cannot be explained by the encoding effect, it can be explained as follows: As Hollingworth and Henderson (2002) mentioned, the orientation of an object is unlikely to be coded. A propositional relationship on the orientation of an object is not mostly established while looking at a picture. Accordingly, participants could establish more easily propositional relations that are relevant to object's position than the orientation of objects. It may be reason that there were fewer false recollections for displacement foils.

For the analog condition, the results showed that although the difference was insignificant there were more old responses given to reverse foils than displacement foils. In the analog encoding condition, it was assumed that the propositional code was manipulated. So, we expected that establishing propositional relationships would become more difficult. In this way, we anticipated more false recollections would

emerge in displacement foils than in reverse foils. However, the paired samples t-test result did not support our expectation. This finding was similar to the propositional encoding conditions.

These findings may also be explained based on position specificity. The existing literature on this topic has exhibited that if the position of the target object is manipulated, detection of this change becomes easier (e.g., Kahneman et al. 1992). If the test options are presented at the target's original location, recognition of objects becomes more accurate (Hollingworth 2006). The findings of Hollingworth (2006) showed that there was no interaction between test object's position (same or different) and discrimination type (token or orientation). Thus, either token changes detection or orientation changes detection did not differ each other according to position. Based on this result, we can make an inference that object position change plays a more critical role in recognizing a picture than discrimination type. Moreover, we know that propositional relationships can be established about the position of objects (Gronau et al. 2008). Participants can intentionally make this type of association when encoding a picture. Especially in some pictures (picture 2 and picture 7), we noticed that fewer old decisions were given to displacement foils compared to other pictures. The potential reason may be that displacement changes in these two pictures were very noticeable for participants. In this respect, some pictures may have an advantage in terms of false recollection. In other fronts, based on the ANOVA results of our study, encoding type did not significantly affect the false recollection performance. The manipulation may not distort the propositional encoding. Hence, participants could establish relationships about objects' positions. We obtained converging explanations for the result of false recollections given to displacement foils.

For the 'neither code is used' condition, it was hypothesized that old responses given to reverse and displacement foils would not be significantly different each other. In this condition, no significant difference in terms of false recollection performance was expected between these two foils. This condition involved propositional and analog manipulation simultaneously. Hence, it was assumed that establishing propositional relationship and encoding in an analog way would become difficult. Results showed that there was no significant difference between old decisions given to reverse and displacement foils. So, our hypothesis was also confirmed in this

encoding condition, suggesting that propositional and analog codes were equally attenuated in this condition. It is crucial to note that old responses given to displacement foils were less than those given to reverse foils, although this differentiation was not statistically significant. This finding may be attributed to similar reasons observed in the propositional and analog conditions.

In the 'natural looking' condition, we also expected that there would be no significant difference between old decisions given to reverse and displacement foils. This assumption was based on the idea that these two codes (propositional and analog) were equally strong in this condition. However, the result did not support this prediction. The findings revealed that significantly more old decisions were given to reverse foils than to displacement foils. Thus, more false recollections occurred with reverse foils than with displacement foils. These results were similar to the outcomes in the other conditions, indicating that participants were more likely to decide in favor of old for reverse foils than for displacement foils.

In this case, it can be concluded that the detection of reverse changes was more challenging than that of displacement foils. Hollingworth (2005), in experiment 1 and experiment 3, investigated the detection of rotation and token changes (where the target was replaced by another) under immediate test and delayed test conditions. In the immediate test condition, test pictures were given immediately after exposure to the studied picture. In delayed test condition, test items were presented after all scenes had been presented. Results showed that delay manipulation did not produce a reliable main effect on correct detection performance. Also, there was no reliable main effect of change type (rotation and token). However, there was an advantage for rotation change detection in the immediate test condition. There was a reliable drop in orientation change detection performance from the immediate to delayed test, especially this effect increased if the delay was 24 hours. In our experiment, we did not use an immediate test paradigm; instead, we calculated old responses (false recollections) given to each foil with a delayed test. This may provide another explanation as to why reverse foils were recognized as older than displacement foils. Hollingworth (2005) suggested that orientation information might be less robust than token dimensions such as color, shape, and texture.

According to the results, differences between old decisions given to reverse

and displacement foils were significant in the propositional and natural encoding conditions. Although there was no significant difference between these two foils, the same result was also obtained in the analog encoding and neither code is used condition, where old decisions given to displacement foils were fewer than reverse foils. We predicted this difference to occur in the propositional condition, but it also emerged in the other conditions. The manipulation in analog encoding, which was applied, could not sufficiently restrain the propositional code. Alternatively, participants may have noticed displacement changes easily despite the manipulation. Besides, this difference was most evident in the natural condition. This may indicate that in the absence of any manipulation, fewer false recollections may occur in displacement foils than in reverse foils.

4.2.2 Evaluation of Responses to Novelty Foils within the Extent of the Hypotheses

In this study, we hypothesized that in all four encoding conditions, old responses given to reverse, displacement, and original foils would be higher than old responses given to novelty foils. In other saying, more false recollections were expected in reverse, displacement, and original pictures than in novelty pictures. According to the change detection literature, recognition performance can also be measured through the replacement of target objects with different objects (e.g., Brady et al. 2008; Hollingworth and Henderson 2002; Hollingworth et al. 2001; Utochkin and Brady 2020). As mentioned before, token change can be applied in various ways in studies. In one method, distractor objects are chosen from a different category than the target object, or distractor objects are chosen from the same category as the target object. Objects from the same category are more visually similar to the target objects than objects from different categories (Hollingworth and Henderson 2002). Another method involves determining whether distractor objects are consistent or inconsistent with the scene (e.g., Hollingworth and Henderson 2003). In our study, we used objects from both same and different categories. For example, in one picture, a target object (tree) was changed with an object (pine tree) from the same category. However, for another picture, a target object (mill) was changed with an object (house) from a different category. Additionally, none of the pictures included inconsistent objects

with the picture theme.

Consistently, our results were the same in terms of comparing novelty and other foil pictures in all conditions. It was found that significantly more old decisions were given to reverse and original foils than to novelty foils, except only in the 'neither code is used' condition. In the 'neither code is used condition', although the difference was insignificant, there were more old responses to reverse foils than to novelty foils. Additionally, in our experiment, there was no significant difference between old decisions given to displacement and novelty foils. The results showed that displacement foils were at least as well detected as novelty foils. Additionally, it can be said that novelty foils were not be strong distractor than displacement foils. In other words, displacement foils may be as strong a distractor as novelty changes. In a study (Hollingworth 2006), there was no reliable main effect of orientation changes and token changes. So, the detection of orientation and token changes did not significantly differ in this experiment. However, we obtained a reliable difference between reverse and novelty changes in pictures. This inconsistent result can be explained as reversal changes in our experiment were quite different from orientation changes in that experiment.

Based on the Talaslı's (1990) experiment, we also assumed that novelty changes can be detected by both propositional and analog codes. This kind of change can stimulate both codes. Our results indeed showed that novelty changes were detected by two codes compared to other changes. There were fewer false recollections in novelty foils, especially in the natural condition. Accordingly, we can infer that when there was no manipulation, both propositional and analog codes can be active simultaneously, corresponding to Talaslı's (1990) assertion.

4.2.3 Evaluations of Other Results

Among the non-hypothesized findings, we analyzed the differences in old responses (false recollections) given to reverse, displacement, and original foils.

In the propositional, analog, and natural encoding conditions, the results showed no significant differences between old decisions given to reverse and original foils, whereas there were significant differences between decisions for displacement and original foils. More old decisions were given to original foils than to displacement

foils. In other words, old decisions given to displacement foils were fewer than those given to original foils. Moreover, the differences between old decisions for displacement foils and original foils were most evident in the natural looking condition. This implies that more false recollections can occur in original pictures than in displacement pictures when there is no manipulation in encoding. Additionally, old responses given to reverse foils did not significantly differ from original foils, suggesting that the participants may have evaluated the reverse pictures as old pictures.

On the other hand, in the 'neither code is used' condition, there were no significant differences between either reverse or displacement foils and original foils. However, although it was not statistically significant, there was fewer old decisions given to displacement foils than to original foils, similar to the other three conditions. Reverse and original foil decisions were almost equal to each other.

According to the results, we can say that participants tended to recognize reverse foils as almost identical to original foils, while they evaluated displacement foils as almost identical to novelty foils. This result may be explained by the notion that reverse foils were not strong distractors compared to original pictures. The participants tended to give old decisions almost equally for reverse and original foils, and these decisions were significantly fewer than for displacement and novelty foils.

4.3 LIMITATIONS AND SUGGESTIONS FOR FUTURE STUDIES

There are some limitations of our study. First of all, we created pictorial stimuli for the present study. Although we took into consideration some criteria in the process of drawing pictures, recognition performance may have been affected by some pictures. For example, there were very few false recollections that occurred on displacement foils. The possible reason for this is that the displacement change was quite noticeable for participants. On the other hand, novelty foils were not as strong a distractor as displacement foils. The creation of stimuli might be the reason why the expected significant findings between encoding conditions were not obtained.

Another limitation has concerned the creation of pictures, particularly in our third picture's displacement foil. Ideally, the home and the tree were to be swapped for the displacement foil. However, in addition to this transposition, the home was also vertically reversed. This mistake was noticed after the analyses. Consequently, we

proceeded to analyze the data without considering the responses to the third picture. Upon analysis, we observed that there was no significant difference in any of the comparisons. Based on this result, we can conclude that this error did not significantly impact the overall evaluation of the study. It appears that our participants noticed more easily the displacement change (between the home and the tree) than the reverse change (home).

Another limitation could stem from the manipulation methods of stimuli. The pictures were manipulated according to the methods of Talaslı's (1990) experiment. In his study, he developed some equipment to present the pictures. However, we used a computer program for drawing grid pattern, slicing pictures, and presenting them. The thickness of the grid pattern and number of slices of pictures were not exactly the same as in his study. The manipulations methods were the same as him, but there were some technical changes in the implementation of manipulations.

In Hollingworth and Henderson's (2002) study, they investigated whether scene representation is retained from previously fixated and attended objects, contrary to the assumption of the visual transience hypothesis. This hypothesis claims that visual object representation decays rapidly after attention is withdrawn from an object. Results showed that if participants had previously attended to the target objects, they accurately discriminated type, token, or orientation changes. Additionally, a crucial finding was that the recognition session involved refixation of the target object to detect changes. This is important in terms of our study because we did not monitor eye movements. Thus, we did not ensure whether participants fixated on the target objects during study and recognition sessions. Additionally, we did not ensure whether participants equally paid attention to all pictures, although we instructed them to do so.

Talaslı (1990) made changes in four different areas of a single picture, but he used only one picture. This control helped prevent uncertainty about whether participants looked at the target object. However, the abundance of our picture set prevented us from making changes to every area of each image. The control we implemented to address this potential problem involved applying changes in different parts of each picture. Nevertheless, future studies could explore eye movements on objects when measuring false recollections in visual stimuli.

Another constraint could the existence of non-visual representations for detecting rotation changes (Hollingworth and Henderson 2002). This suggests that participants may produce propositional descriptions about the orientation of objects. Even if it was possible, participants did not know which objects were the target objects, and they lacked information about the nature of the changes. Therefore, similar to the assertion of Hollingworth and Henderson (2002), in our study, it seems unlikely that participants could establish quite detailed verbal propositions for each object in each picture.

In our study, we did not analyze reaction time results, which could be a suggestion for future studies. Based on the results of this study, it can be hypothesized that there is higher reaction time for reverse changes compared to displacement and novelty changes. Moreover, in this study, we did not control the order of presentation of foil pictures in recognition session. For instance, do the old responses to displacement, reverse, and novelty foils differ depending on the presentation order of these pictures?

4.4 CONCLUSION

In the early literature on pictorial memory (Nickerson 1968; Shepard 1967; Standing 1973), participants remembered based on broad categorical information about a picture. The results of this current study were also coherent with the hypothesis that there is a robust memory for visual details.

The consistent findings were obtained in terms of foil category. Through this research, we conclude that reverse changes can produce more false recollections than displacement and novelty changes, whereas displacement and novelty pictures can produce fewer false recollections than reverse and original foils.

The primary aim of this study was to show that propositional and analog codes are active while coding a picture. These both codes are specialized for distinct information about the picture. Despite the absence of a main effect of encoding condition results, this study had a crucial research question for false memory literature. Accordingly, it was hypothesized that false recollection performance may be predictable by which code is predominantly encoded.

REFERENCES

ANGLIN Gary J. and LEVIE Howard W. (1985), "Role of Visual Richness in Picture Recognition Memory", *Perceptual and Motor Skills,* Vol. 61, No. 3f, pp. 1303-1306. doi: 10.2466/pms.1985.61.3f.1303.

ARBIB Michael (1992), "Schema Theory", *The Encyclopedia of Artificial Intelligence,* Vol.2 pp. 1427-1443.

ATKINSON Richard C. and SHIFFRIN Richard M. (1968), "Human Memory: A Proposed System and its Control Processes", *In, Psychology of Learning and Motivation: Advances in Research and Theory,* Ed. KW Spence, pp. 89-195, Academic Press, New York.

BARTLETT Sir Frederic C. (1932), *Remembering: A Study in Experimental and Social Psychology*, Cambridge University Press, New York.

BELLHOUSE-KING Mathew W. and STANDING Lionel G. (2007), "Recognition Memory for Concrete, Regular, Abstract, and Diverse Abstract Pictures", *Perceptual and Motor Skills,* Vol 104, No. 3, pp. 758-762. doi: 10.2466/pms.104.3.758-762.

BERNSTEIN Daniel M., LANEY Cara, MORRIS Erin K., LOFTUS Elizabeth F. (2005), "False Memories about Food can Lead to Food Avoidance", *Social Cognition,* Vol.23, No. 1, pp. 11-34. doi: 10.1521/soco.23.1.11.59195.

BESSETTE-SYMONS Brandy A. (2017), "The Robustness of False Memory for Emotional Pictures", *Memory,* Vol. 26, No. 2, pp. 171-188.

BOAG Simon (2006), "Freudian Repression, the Common View, and Pathological Science", *Review of General Psychology,* Vol. 10, No. 1, pp. 74-86. doi: 10.1037/1089-2680.10.1.74.

BORGES Marilyn A., STEPNOWKSY Mary Ann and HOLT Leland H. (1977), "Recall and Recognition of Words and Pictures by Adults and Children", *Bulletin of The Psychonomic Society,* Vol. 9, No. 2, pp. 113-114.

BRADY Timothy F., KONKLE Talia and ALVAREZ George A. (2011), "A Review of Visual Memory Capacity: Beyond Individual Items and Toward Structured Representations", *Journal of Vision,* Vol. 11, No. 5, pp. 1-34.

BRADY Timothy F., KONKLE Talia, ALVAREZ George A. and OLIVA Aude (2008), "Visual Long-Term Memory has a Massive Storage Capacity for Objects Details", *Proceedings of The National Academy of Sciences,* Vol.105, No. 38, pp. 14325-14329.

CLARK James M. and PAIVIO Allan (1987), "A Dual Coding Perspective on Encoding Processes", *In, Imagery and Related Mnemonic Processes: Theories, Individual Differences, and Applications,* Ed. M. A. McDaniel, M. Pressley, pp. 5-33, New York, NY: Springer-Verlag.

CLARK James M. and PAIVIO Allan (1991), "Dual Coding Theory and Education", *Educational Psychology Review,* Vol. 3, No. 3, pp. 149-210.

COHEN Michael D. and BACDAYAN Paul (1994), "Organizational Routines Are Stored as Procedural Memory: Evidence from a Laboratory Study", *Organization Science*, Vol. 5, No. 4, pp. 554-568. doi: 10.1287/orsc.5.4.554.

DOZOIS David J. A. and BECK Aaron T. (2008), "Cognitive Schemas, Beliefs and Assumptions", *In, Risk Factors in Depression,* Ed. K. S. Dobson, D. Dozois, pp. 119-143, San Diego, CA: Academic Press. doi: 10.1016/B978-0-08-045078-0.00006-X.

DRIVDAHL Sarah B. and ZARAGOZA Maria S. (2001), "The Role of Perceptual Elaboration and Individual Differences in the Creation of False Memories for Suggested Events", *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition,* Vol. 15 No. 3, 265-281. doi: 10.1002/acp.701.

EBBINGHAUS Hermann (1885), *Über das gedächtnis: untersuchungen zur experimentellen psychologie,* Duncker & Humblot, Leipzig.

FIELD Andy (2018), *Discovering Statistics Using IBM SPSS Statistics*, Fifth Edition, Sage, London.

FRENCH L., GARRY M. And LOFTUS E. (2009), *False Memories: A Kind of Confabulation in non-clinical. Confabulation: Views from Neuroscience, psychiatry, psychology, and philosophy,* Ed. W. Hirstein, pp. 33-66. Oxford University Press, Oxford.

FREYD Jennifer J. (1987), "Dynamic Mental Representations", *Psychological Review,* Vol. 94, No. 4, pp. 427-438.

FRIEDMAN A. (1979), "Framing Pictures: The Role of Knowledge in Automatized Encoding and Memory for Gist", *Journal of Experimental Psychology: General,* Vol. 108, No.3, pp. 316-355.

GALLO David A. (2010), "False Memories and Fantastic Beliefs: 15 Years of the DRM Illusion", *Memory & Cognition,* Vol. 38, No. 7, pp. 833-848. doi: 10.3758/MC.38.7.833.

GARRY Maryanne and GERRIE Matthew P. (2005), "When Photographs Create False Memories", *Current Directions in Psychological Science,* Vol. 14, No. 6, pp. 321-325.

GARRY Maryanne, MANNING Charles G., LOFTUS Elizabeth F. and SHERMAN Steven J. (1996), "Imagination Inflation: Imagining a Childhood Events Inflates Confidence that it Occurred", *Psychonomic Bulletin & Review,* Vol. 3, No. 2, pp. 208-214.

GARRY Maryanne and POLASCHEK Devon L., (2000), "Imagination and Memory", *Current Directions in Psychological Science,* Vol. 9, No. 1, pp. 6-10. doi: 10.1111/1467-8721.00048.

GARRY Maryanne and WADE Kimberley A. (2005), "Narratives Produce More False Memories than Photographs", *Psychonomic Bulletin & Review,* Vol. 12, No. 2, pp. 359-366.

GLEAVES David H., SMITH Steven M., BUTLER Lisa D. and SPIEGEL David (2004), "False and Recovered Memories in the Laboratory and Clinic: A Review of Experimental and Clinical Evidence", *Clinical Psychology: Science and Practice*, Vol. 11, No. 1, pp. 3-28. doi: 10.1093/clipsy.bph055.

GRAF Peter and SCHACTER Daniel L. (1985), "Implicit and Explicit Memory for New Associations in Normal and Amnesic Subjects", *Journal of Experimental Psychology: Learning, Memory, and Cognition*, Vol. 11, No. 3, pp. 501-518. PMID: 3160813.

GRONAU N., NETA M. and BAR M. (2008), "Integrated Contextual Representation for Objects' Identities and Their Locations", *Journal of Cognitive Neuroscience,* Vol. 20, No. 3, pp. 371-388.

HENDERSON John M., WEEKS JR P. A. and HOLLINGWORTH Andrew (1999), "The Effects of Semantic Consistency on Eye Movements During Complex Scene Viewing", *Journal of Experimental Psychology: Human Perception and Performance,* Vol. 25, No. 1, pp. 210-228.

HOLLINGWORTH Andrew (2005), "The Relationship between Online Visual Representation of a Scene and Long-Term Scene Memory", *Journal of Experimental Psychology: Learning, Memory, and Cognition,* Vol. 31, No. 3, pp. 396-411.

HOLLINGWORTH Andrew (2006), "Scene and Position Specificity in Visual Memory for Objects", *Journal of Experimental Psychology: Learning, Memory, and Cognition,* Vol. 32, No. 1, pp. 58-69.

HOLLINGWORTH Andrew and HENDERSON John M. (2002), "Accurate Visual Memory for Previously Attended Objects in Natural Scenes", *Journal of Experimental Psychology: Human Perception and Performance,* Vol. 28, No. 1, pp. 113-136.

HOLLINGWORTH Andrew and HENDERSON John M. (2003), "Testing a Conceptual Locus for The Inconsistent Object Change Detection Advantage in Real-World Scenes", *Memory & Cognition,* Vol. 31, No. 6, pp. 930-940.

HOLLINGWORTH Andrew, WILLIAMS Carrick C. and HENDERSON John M. (2001), "To See and Remember: Visually Specific Information is Retained in Memory from Previously Attended Objects in Natural Scenes", *Psychonomic Bulletin & Review,* Vol. 8, No. 4, pp- 761-768.

HOWE Mark L. and KNOTT Lauren M. (2015), "The Fallibility of Memory in Judicial Processes: Lessons from the Past and Their Modern Consequences", *Memory*, Vol. 23, No. 5, pp. 633-656. doi: 10.1080/09658211.2015.1010709.

JELINEK Lena, HOTTENROTT Birgit, RANDJBAR Sarah, PETERS Maarten J. and MORITZ Steffen (2009), "Visual False Memories in Post-Traumatic Stress Disorder (PTSD)", *Journal of Behavioral Therapy and Experimental Psychiatry,* Vol. 40, No. 2, pp. 374-383. doi: 10.1016/j.jbtep.2009.02.003.

JOU Jerwen and FLORES Shaney (2013), "How are the False Memories Distinguishable from True Memories in the Deese-Roediger-McDermott Paradigm? A Review of the Findings", *Psychological Research,* Vol. 77, No. 6, pp. 671-686. doi: 10.1007/s00426-012-0472-6.

KAHNEMAN D., TREISMAN A. and GIBBS B. J. (1992), "The Reviewing of Object Files: Object-Specific Integration of Information", *Cognitive Psychology,* Vol. 24, No. 2, pp. 175-219.

KLATZKY Roberta L. (1975), *Human Memory: Structures and Processes,* W. H. Freeman and Company, New York, 2nd edition.

KOUTSTAAL Wilma and SCHACTER Daniel L. (1997), "Gist-Based False Recognition of Pictures in Older and Younger Adults", *Journal of Memory and Language,* Vol. 37, No. 4, pp. 555-583.

KROLL J. F. and MERVES J. S. (1986), "Lexical Access for Concrete and Abstract Words", *Journal of Experimental Psychology: Learning, Memory, and Cognition,* Vol. 12, No. 1, pp. 92.

LOFTUS Elizabeth F. (1975), "Leading Questions and the Eyewitness Report", *Cognitive Psychology,* Vol. 7, No. 4, pp. 560-572.

LOFTUS Elizabeth F. (1997), "Creating False Memories", *Scientific American,* Vol. 277, No. 3, pp. 70-75. doi: 10.2307/24995913.

LOFTUS Elizabeth F. and BELL Susan M. (1975), "Two Types of Information in Picture Memory", *Journal of Experimental Psychology: Human Learning and Memory,* Vol. 104, No. 2, pp. 103-113.

LOFTUS Elizabeth F. and DAVIS Deborah (2006), "Recovered Memories", *Annual Reviews Clinical Psychology,* Vol.2, No.1, pp. 469-498. doi: 10.1146/annurev.clinpsy.2.022305.095315.

LOFTUS Elizabeth F., MILLER David G. and BURNS Helen J. (1978), "Semantic Integration of Verbal Information into a Visual Memory", *Journal of Experimental Psychology: Human Learning and Memory*, Vol. 4, No. 1, pp. 19-31.

LOFTUS Elizabeth F. and PALMER John C. (1974), "Reconstruction of Automobile Destruction: An Example of the Interaction between Language and Memory", *Journal of Verbal Learning and Verbal Behavior,* Vol. 13, No. 5, pp. 585-589. doi: 10.1016/s0022-5371(74)80011-3.

LOFTUS Elizabeth F. and PICKRELL Jacqueline E. (1995), "The Formation of False Memories", *Psychiatric Annals*, Vol. 25, No. 12, pp. 720-725.

LOFTUS Elizabeth F. and ZANNI Guido (1975), "Eyewitness Testimony: The Influence of the Wording of a Question", *Bulletin of The Psychonomic Society,* Vol. 5, No. 1, pp. 86-88.

LUCK S. J. and HOLLINGWORTH A. (2008), *Visual Memory*, Oxford University Press, New York.

MACMILLAN Neil A. and CREELMAN Douglas C. (2005), Detection Theory: A User's Guide, Second Edition, Lawrence Erlbaum Associates Publishers, New Jersey.

MANTYLA, T. and BACMAN, L. (1992), "Aging and Memory for Expected and Unexpected Objects in Real-World Settings", *Journal of Experimental Psychology: Learning, Memory, and Cognition,* Vol. 18, No. 6, pp. 1298-1309. doi: 10.1037/0278-7393.18.6.1298

MASSARO Dominic W. And LOFTUS Geoffrey R. (1996), "Sensory and Perceptual Storage: Data and Theory", *In, Memory,* Ed. Bjork EL, Bjork RA, pp. 68-96, Academic Press, San Diego, CA. doi: 10.1016/b978-012102570-0/50005-7.

MAYER R. E. and ANDERSON R. B. (1991), "Animations Need Narrations: An Experimental Test of a Dual-Coding Hypothesis", *Journal of Educational Psychology,* Vol. 83, No. 4, pp. 484.

MCCLOSKEY Michael and ZARAGOZA Maria (1985), "Misleading Postevent Information and Memory for Events: Arguments and Evidence Against Memory Impairment Hypotheses", *Journal of Experimental Psychology: General,* Vol. 114, No. 1

MILLER Michael B. and GAZZANIGA Michael S. (1998), "Creating False Memories for Visual Scenes", *Neuropsychologia,* Vol. 36, No. 6, pp. 513-520.

MORITZ Steffen, WOODWARD Todd S. And RODRIGUEZ-RAECKE Rea (2006), "Patients with Schizophrenia do not Produce More False Memories than Controls but are More Confident in them", *Psychological Medicine,* Vol.36, No. 5, pp. 659-667. doi: 10.1017/S0033291706007252.

MUSCHALLA Beate and Schönborn Fabian (2021), "Induction of False Beliefs and False Memories in Laboratory Studies-A systematic Review", *Clinical Psychology & Psychotherapy,* Vol. 28, No. 5, pp- 1194-1209.

NAGATA Hiroshi (1986), "Recognition of Concrete and Abstract Pictures as a Function of Poststimulus Interval", *The Journal of General Psychology,* Vol. 113, No. 4, pp. 369-377. doi: 10.1080/00221309.1986.9711047.

NEISSER Ulric (1967), *Cognitive Psychology*, *Cited by,* KLATZKY Roberta (1975), *Human memory: Structures and Processes,* WH Freeman, United States of Amerika, pp. 2.

NELSON Thomas O., METZLER Jacqueline and REED David A. (1974), "Role of Details in the Long-Term Recognition of Pictures and Verbal Descriptions", *Journal of Experimental Psychology,* Vol. 102, No. 1, pp. 184-186. doi: 10.1037/h0035700.

NEWMAN E. J. and LINDSAY D. D. (2009), "False Memories: What the Hell are They for?", *Applied Cognitive Psychology: The Official Journal of The Society for Applied Research in Memory and Cognition,* Vol. 23, No. 8, pp. 1105-1121.

NICKERSON Raymond S. (1968), "A Note on Long-Term Recognition Memory for Pictorial Material", *Psychonomic Science,* Vol. 11, No. 2, pp. 58-58.

OLIVA Aude and TORRALBA Antonio (2007), "The Role of Context in Object Recognition", *Trends in Cognitive Science,* Vol. 11, No. 12, pp. 520-527, doi: 10.1016/j.tics.2007.09.009.

OTGAAR Henry, HOUBEN S.T. and HOWE M.L. (2018), "Methods of Studying False Memory", *In Handbook of Research Methods in Human Memory*, Ed. Otani H., Schwartz B., pp. 238-252, Routledge, New York.

PAIVIO Allan (1975), "Coding Distinctions and Repetition Effects in Memory", *In, Psychology of Learning and Motivation,* Vol. 9, pp. 179-214, Academic Press.

PAIVIO Allan (1978), "Relationship between Verbal and Perceptual Codes", *In, Perceptual Coding,* pp. 375-397, Academic Press. doi: 10.1016/b978-0-12-

161908-4.50017-6.

PAIVIO Allan (2014), “A Dual Coding Approach to Perception and Cognition”, *In, Modes of Perceiving and Processing Information,* pp. 39-51, Psychology Press.

PAIVIO Allan and CLARK J. M. (2006), “Dual Coding Theory and Education”, *Pathways to Literacy Achievement for High Poverty Children,* Ed. S. Neuman, pp. 1-20, The University of Michigan School of Education.

PAIVIO Allan and ERNEST Carole H. (1971), “Imagery Ability and Visual Perception of Verbal and Nonverbal Stimuli”, *Perception & Psychophysics,* Vol. 10, No. 6, pp. 429-432.

PEZDEK Kathy and CHEN Hsuan-Chih (1982), “Developmental Differences in the Role of Detail in Picture Recognition Memory”, *Journal of Experimental Child Psychology,* Vol. 33, No. 2, pp. 207-215. doi: 10.1016/0022-0965(82)90016-9.

QUILLIAN M. ROSS (1968), “Semantic Memory*”, In, Semantic Information Processing,* Ed. Marvin Minsky, pp. 227-270, MIT Press, Cambridge.

RAJARAM Suparna (1993), “Remembering and Knowing: Two Means of Access to the Personal Past”, *Memory & Cognition,* Vol. 21, No. 1, pp. 89-102.

RENSINK R. A. (2000), “The Dynamic Representation of Scenes”, *Visual Cognition,* Vol. 7, No. 1-3, pp. 17-42.

ROEDIGER III Henry L., JACOBY Derek and MCDERMOTT Kathleen (1996), “Misinformation Effects in Recall: Creating False Memories through Repeated Retrieval”, *Journal of Memory and Language*, Vol. 35, No. 2, pp. 300-318.

ROEDIGER Henry L. and MCDERMOTT Kathleen B. (1995), “Creating False Memories: Remembering Words not Presented in Lists”, *Journal of Experimental Psychology: Learning, Memory, and Cognition,* Vol. 21, No. 4, pp. 803-814.

ROEDIGER Henry L. and MCDERMOTT Kathleen B. (2000), “Tricks of Memory”, *Current Directions in Psychological Science,* Vol. 9, No. 4, pp. 123-127.

ROEDIGER Henry L., MEADE Michelle L. and BERGMAN Erik T. (2001), “Social Contagion of Memory”, *Psychonomic Bulletin & Review,* Vol. 8, No. 2, pp. 365-371.

SACCHI Dario L. M., AGNOLI Franca and LOFTUS Elizabeth F. (2007), "Changing History: Doctored Photographs Affect Memory for Past Public Events", *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition,* Vol. 21, No. 8, pp. 1005-1022. doi: 10.1002/acp.1394.

SEAMON John G., LUO Chun R., SCHLEGEL Sarah E., GREENE Sara E. and GOLDENBERG Audrey B. (2000), "False Memory for Categorized Pictures and Words: The Category Associates Procedure for Studying Memory Errors in Children and Adults", *Journal of Memory and Language,* Vol, 42, No. 1, pp. 120-146. doi: 10.1006/jmla.1999.2676.

SCHURGIN Mark W. (2018), "Visual Memory, The Long and The Short of it: A Review of Visual Working Memory and Long-Term Memory", *Attention, Perception & Psychophysics,* Vol. 80, No. 5, pp. 1035-1056. doi: 10.3758/s13414-018-1522-y.

SHEPARD Roger N. (1967), "Recognition Memory for Words, Sentences, and Pictures", *Journal of Verbal Learning and Verbal Behavior,* Vol. 6, No. 1, pp. 156-163. doi: 10.1016/s0022-5371(67)80067-7.

SHEPARD Roger N. and CHIPMAN Susan (1970), "Second-Order Isomorphism of Internal Representations: Shapes of States", *Cognitive Psychology,* Vol.1, No. 1, pp. 1-17.

SPERLING George (1960), "The Information Available in Brief Visual Presentations", *Psychological Monographs: General and Applied*, Vol. 74, No. 11, pp. 1-29, doi: 10.1037/h0093759.

STANDING Lionel (1973), "Learning 10000 Pictures", *Quarterly Journal of Experimental Psychology,* Vol. 25, No. 2, pp. 207-222.

STANDING L., CONEZIO J. and HABER R. N. (1970), "Perception and Memory for Pictures: Single-Trial Learning of 2500 Visual Stimuli", *Psychonomic Science*, Vol. 19, No. 2, pp- 73-74.

TALASLI Umur (1990), "Simultaneous Manipulation of Propositional and Analog Codes in Picture Memory", *Perceptual and Motor Skills,* Vol. 70, No. 2, pp. 403-414.

TULVING Endel (1972), “Episodic and Semantic Memory”, *In, Organization of Memory*, Ed. Endel Tulving, Wayne Donaldson, pp. 381-403, Academic Press, New York.

TULVING Endel (1985), “Memory and Consciousness”, *Canadian Psychology/Psychologie Canadienne,* Vol. 26, No. 1, pp. 1-12.

TULVING Endel (1993), “What is Episodic Memory”, *Current Directions in Psychological Science,* Vol. 2, No. 3, pp. 67-70. doi: 10.1111/1467-8721.ep10770899.

UTOCHKIN Igor S. and BRADY Timothy F. (2020), “Independent Storage of Different Features of Real-World Objects in Long-Term Memory”, *Journal of Experimental Psychology: General,* Vol. 149, No. 3, pp. 530-549.

VO M. L. H. (2021), “The Meaning and Structure of Scenes”, *Vision Research,* Vol. 181, pp. 10-20.

WADE Kimberley A., GARRY Maryanne, DON READ J. and LINDSAY Stephen (2002), “A picture is worth a thousand lies: Using False Photographs to Create False Childhood Memories”, *Psychonomic Bulletin & Review,* Vol. 9, No. 3, pp. 597-603.

WALKER I. and HULME C. (1999), “Concrete Words are Easier to Recall Than Abstract Words: Evidence for a Semantic Contribution to Short-Term Serial Recall”, *Journal of Experimental Psychology: Learning, Memory, and Cognition,* Vol. 25, No. 5, pp. 1256.

WICHMANN Felix A., SHARPE Lindsay T. and GEGENFURTNER Karl R. (2002), “The Contributions of Color to Recognition Memory for Natural Scenes”, *Journal of Experimental Psychology: Learning, Memory, and Cognition,* Vol. 28, No. 3, pp. 509-520. doi: 10.1037/0278-7393.28.3.509.

ZARAGOZA M. S. and MITCHELL K. J. (1996), “Repeated Exposure to Suggestion and The Creation of False Memories”, *Psychological Science,* Vol. 7, No. 5, pp. 294-300. doi: 10.1111/j.1467-9280.1996.tb00377.x.

APPENDICES

APPENDIX A: THE INFORMED CONSENT FORM

Çankaya Üniversitesi Sosyal Bilimler Enstitüsü Psikoloji Anabilim Dalı Bilişsel Psikoloji Yüksek Lisans programında yürütülen bu araştırma, Dr. Öğretim Üyesi Hande Kaynak danışmanlığında, Bilişsel Psikoloji Yüksek Lisans öğrencisi Elif Sinem Ertekin'in tez çalışmasının bir gereği olarak yapılmaktadır. Tez çalışması için, üniversitesi öğrencisi genç yetişkin bireylere ihtiyaç duyulmaktadır. Araştırma kapsamında, yürütülecek uygulamaların tamamı Psikolog Elif Sinem Ertekin tarafından yapılacaktır.

Bu tez çalışması, resimsel uyaranların birtakım yöntemlerle değişimlenmesiyle bellek performansına etkisini belirlemeyi amaçlamaktadır. Uygulamalar katılımcının ve araştırmacının uygun oldukları bir zaman içerisinde gerçekleşecektir. Görüşmeler tek oturumda gerçekleştirilecek olup oturumun yaklaşık süresi 30 dakika olacaktır. Uygulama boyunca katılımcıdan bilgisayar ekranında bir görev yapması istenecektir. Katılım sırasında görevlerden ya da herhangi başka bir nedenden ötürü rahatsızlık hisseden katılımcılar, cevaplama işini yarıda bırakabilirler. Böyle bir durumda katılımcıların çalışmayı uygulayan kişiye, çalışmayı tamamlayamayacaklarını söylemeleri yeterli olacaktır. Gerçekleştirilen görüşme sonrasında, uygulamanın bitiminde katılımcıya açıklama ve bilgilendirme yapılacaktır. Çalışma hakkında daha fazla bilgi almak için. Psk. Elif Sinem Ertekin (E-posta: elfsnm.21@hotmail.com) ya da Dr. Hande Kaynak (E-posta: handek@cankaya.edu.tr) ile iletişim kurulabilir.

Görüşme sırasında katılımcının izni doğrultusunda yazılı kayıtları alınacaktır. Daha sonra bu kayıtlar, katılımcının kimlik bilgileri gizli tutularak bilimsel nitelikli çalışmalarda ve eğitim amaçlı olarak kullanılabilir. Bu amaçların dışında bu kayıtlar kullanılmayacak ve başkaları ile paylaşılmayacaktır.

KATILIMCI:

ADI SOYADI:

İMZA:

APPENDIX B: DEMOGRAPHIC INFORMATION FORM

Katılımcı Kodu: ……

Cinsiyeti: Kadın ( ) Erkek ( )

Doğum Tarihi: ...../...../.....

Yaşı:

Medeni Hali: Evli ( ) Bekar ( ) Dul ( ) Boşanmış ( )

Mesleği:

Eğitim Durumu:……..

Ana Dili:…….

Sağlık Durumuna İlişkin Bilgiler

İşitme Bozukluğu: Var ( ) Yok ( )

Varsa düzeltilmiş mi?.....

Görme Bozukluğu: Var ( ) Yok ( )

Varsa düzeltilmiş mi?.....

Renk Körlüğü: Var ( ) Yok ( )

Geçirdiği Önemli Rahatsızlıklar (Psikiyatrik, Nörolojik veya Psikolojik):

.....

Varsa Psikiyatrik Hastalığın Tanı Konma Tarihi/Süresi:

.....

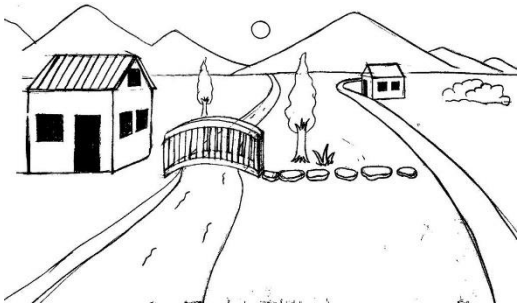
Halen Kullanmakta Olduğu İlaç: Var ( ) Yok ( )

Varsa İlacın/İlaçların Adları ve Ne Zamandan Beri Kullanıldığı:

……..

APPENDIX C: VISUAL MATERIALS

Picture 1



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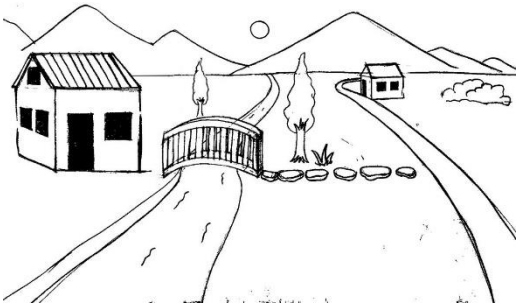
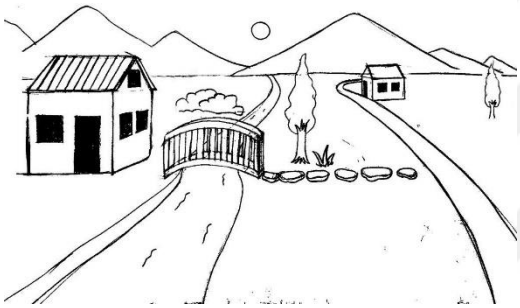


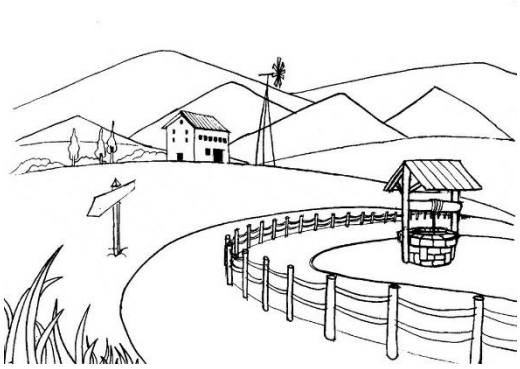
Reverse picture



Displacement picture

Novelty picture

Picture 2



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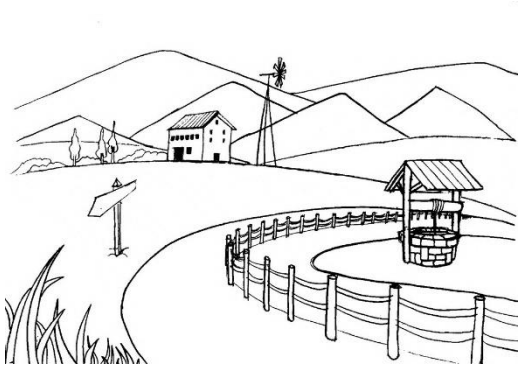

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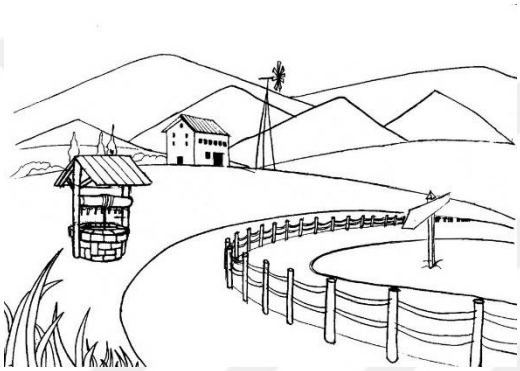

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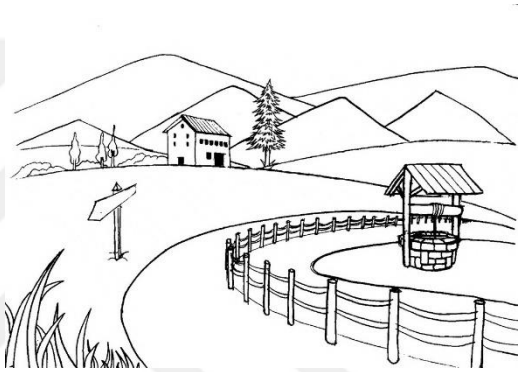

Reverse picture

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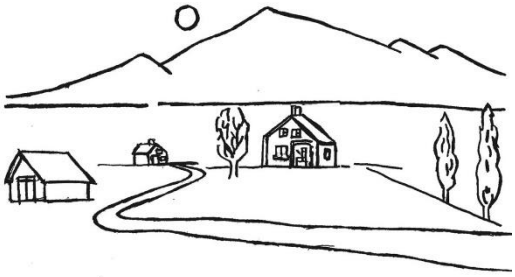

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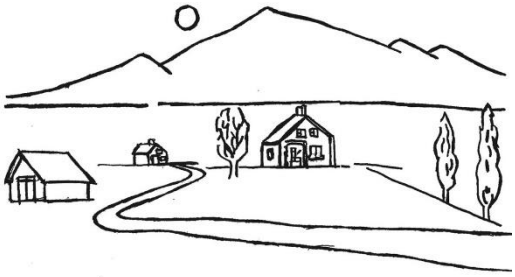
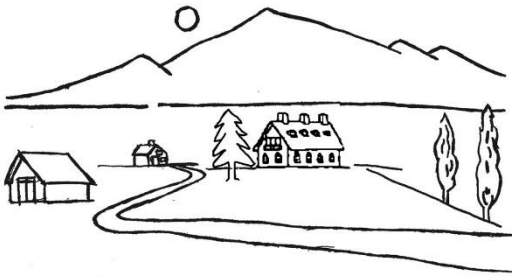


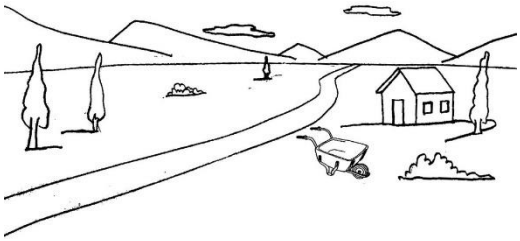
Reverse picture

Displacement picture



Novelty picture

Picture 4



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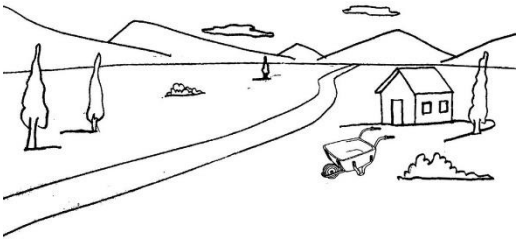
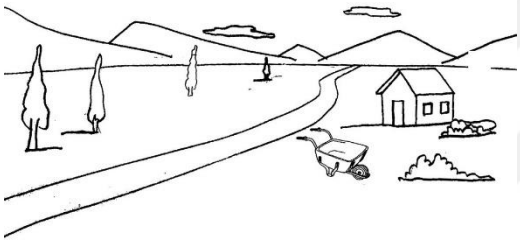
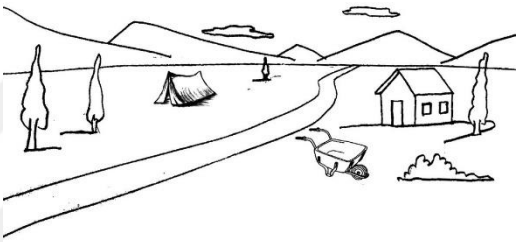


Reverse picture

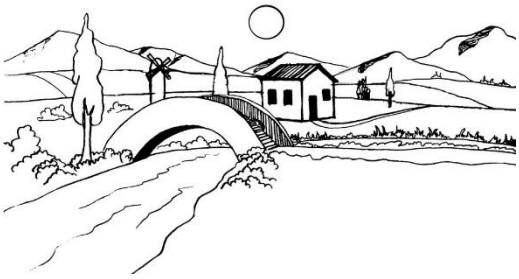


Displacement picture



Novelty picture

Picture 5



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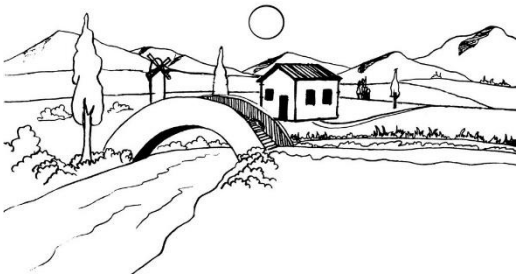
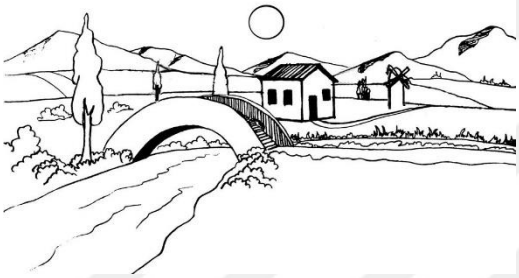


Reverse picture

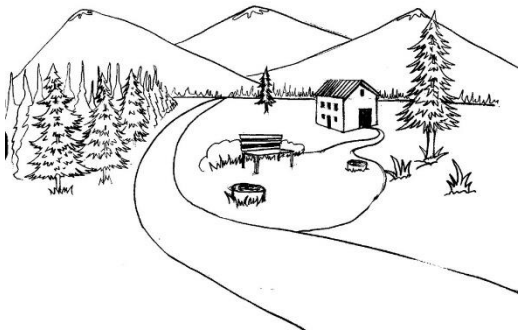


Displacement picture

Novelty picture

Picture 6

Original picture

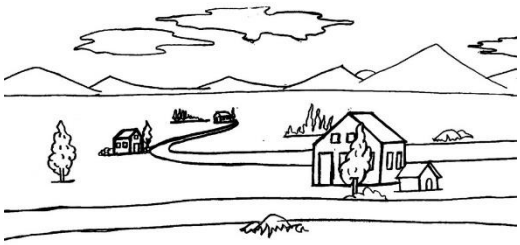


Reverse picture

Displacement picture

Novelty picture

Picture 7



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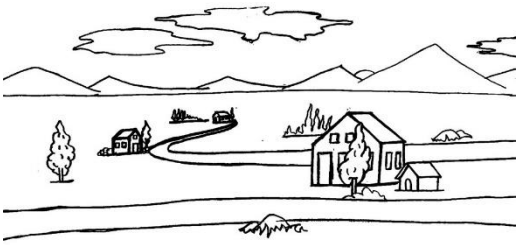

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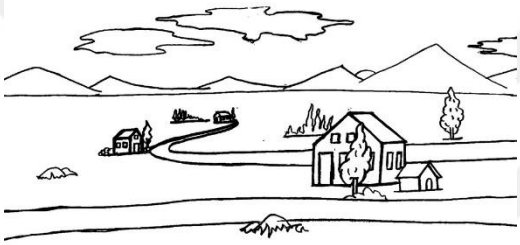

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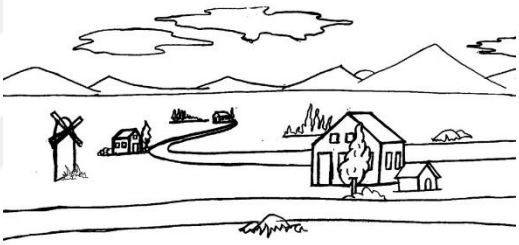

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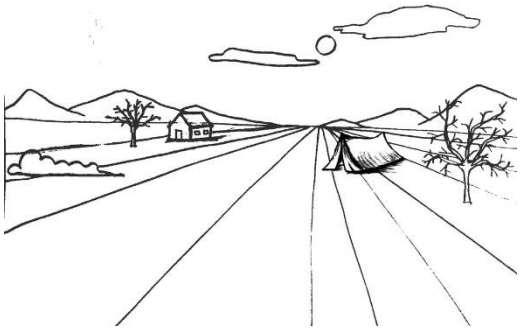

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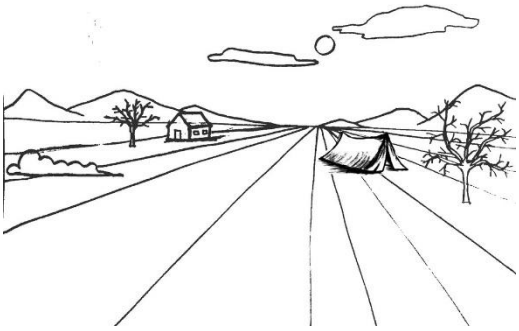

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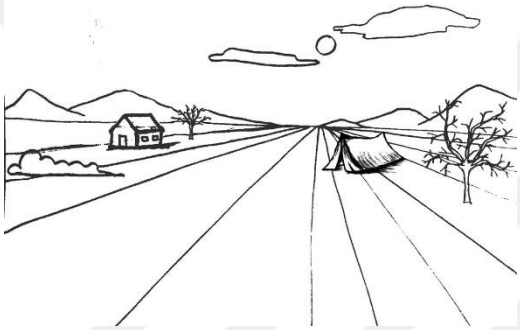

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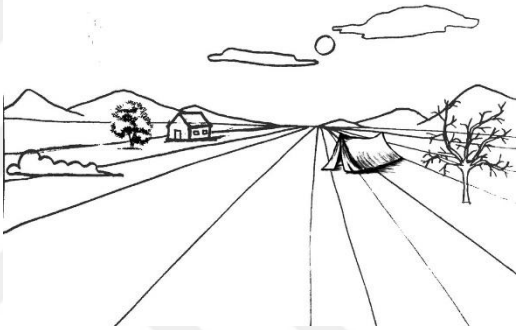

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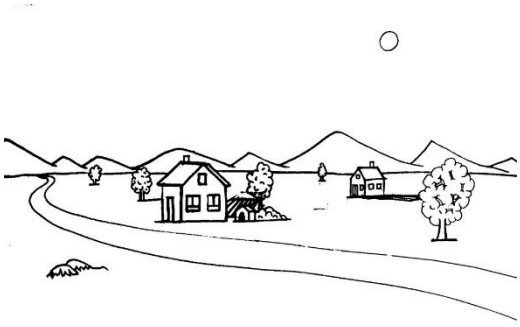
Picture 9



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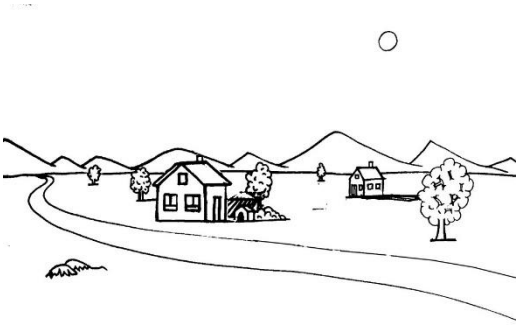

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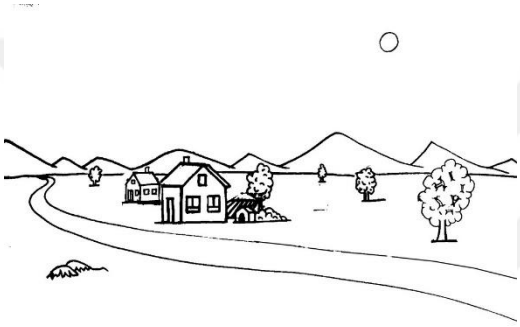

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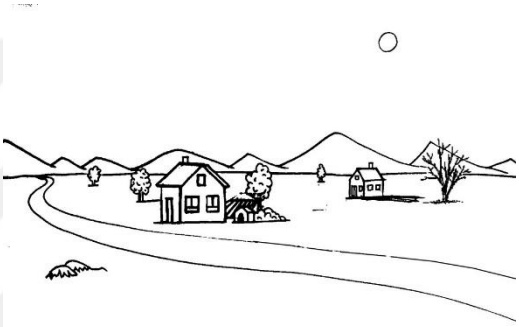

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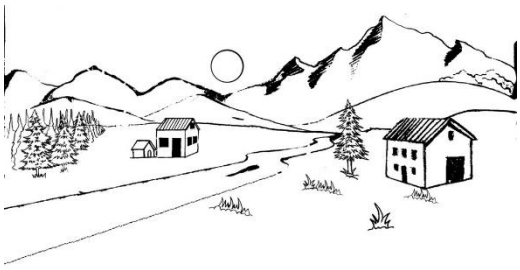
Picture 10



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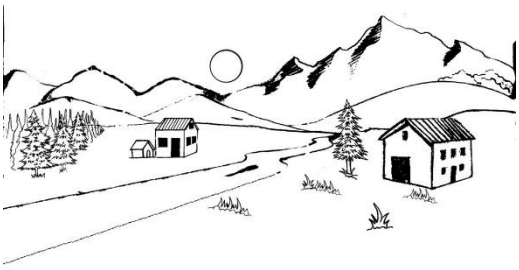

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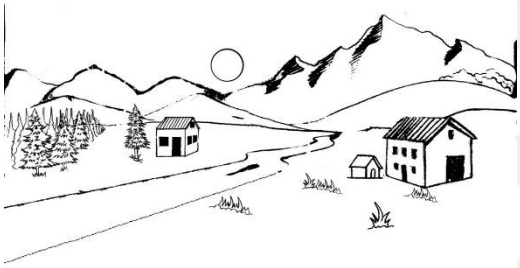

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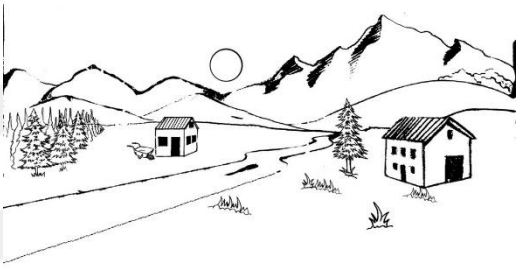

Novelty picture

APPENDIX E: INSTRUCTIONS FOR ENCODING CONDITIONS

PROPOSITIONAL CONDITION

Sayın Katılımcı,

Şimdi size bazı resimler gösterilecektir. Resimlerin üzerinde bir ızgara göreceksiniz. Her bir resmi dikkatli bir şekilde incelemeniz önemlidir. Hazırsanız ekrandaki OK sekmesine tıklayarak başlayabilirsiniz.

ANALOG CONDITION

Sayın Katılımcı,

Şimdi size bazı resimler gösterilecektir. Resimlerin her biri 8 parçaya bölünmüştür ve ekranda bu şekilde görünecektir. Her bir resmi dikkatli bir şekilde incelemeniz önemlidir. Hazırsanız ekrandaki OK sekmesine tıklayarak başlayabilirsiniz.

NEITHER CODE IS USED CONDITION

Sayın Katılımcı,

Şimdi size bazı resimler gösterilecektir. Resimlerin her biri 8 parçaya bölünmüştür ve üzerinde bir ızgara bulunmaktadır. Ekranda bu şekilde görünecektir.

Her bir resmi dikkatli bir şekilde incelemeniz önemlidir. Hazırsanız ekrandaki OK sekmesine tıklayarak başlayabilirsiniz.

NATURAL LOOKING CONDITION

Sayın Katılımcı,

Şimdi size bazı resimler gösterilecektir.

Her bir resmi dikkatli bir şekilde incelemeniz önemlidir. Hazırsanız ekrandaki OK sekmesine tıklayarak başlayabilirsiniz.

APPENDIX F: INSTRUCTIONS FOR DISTRACTOR AND RECOGNITION SESSIONS

DISTRACTOR SESSION

Sayın Katılımcı,

Şimdi size sayılar gösterilecektir.

Ekranda gördüğünüz sayılar için "Büyüktür" veya "Küçüktür" kararı vermeniz beklenmektedir. Ekranın solunda göreceğiniz sayı sağında göreceğiniz sayıdan büyük ise klavyedeki "F" tuşuna, küçük ise klavyedeki "K" tuşuna basmalısınız.

Hazırsanız ekrandaki OK sekmesine tıklayarak başlayabilirsiniz.

RECOGNITION SESSION

Çalışmanın ilk aşamasında resimler görmüştünüz. Buna eski resimler diyebiliriz. Şimdi ise size ekranda yine resimler gösterilecektir.

Gösterilecek resimlerin bazıları "Eski" resimlerdir. Resimlerin bazıları ise ilk aşamada gördüğünüz resim –yani eski resim- üzerinde yapılan değişiklikler sonucu elde edilmiş "Yeni" resimlerdir. Bunlar karışık bir şekilde tek tek ekrana gelecektir.

Sizden istediğimiz ekranda gösterilecek resmin eski resim olduğuna karar verirseniz "E"; ekranda gösterilecek resmin yeni resim olduğuna karar verirseniz "Y" tuşuna basmanızdır.

Buna ek olarak her resim için "Kararınızdan ne kadar eminsiniz?" sorusuna da yanıt vermeniz beklenmektedir. Olabildiğince hızlı aynı zamanda doğru yanıt vermeye çalışınız.