ESRA ELİBÜYÜK DOES DISTANCE AFFECT MEMORY PREDICTIONS Bilkent University 2016

DOES DISTANCE AFFECT MEMORY PREDICTIONS by ACTIVATING BELIEFS ABOUT PERCEPTUAL FLUENCY

A Master's Thesis

by
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June 2016

To my lovely parents Ercan and Dilek Elibüyük

They are my biggest opportunity in life. I hope this achievement will complete the dream that you had for me all those many years ago when you chose to give me the best education you could

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by

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June 2016

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Psychology

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ABSTRACT

DOES DISTANCE AFFECT MEMORY PREDICTIONS?

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People predict their future memory performance to be better for the perceptually fluent stimuli than for the disfluent ones. For instance, their memory confidence is higher for the words written in large fonts than small fonts (Rhodes and Castel, 2008). This effect was previously believed to stem from experiential difficulty in encoding of the disfluent stimuli. However, a recent study showed that, one's beliefs and theories, rather than experiential difficulty, make the major contribution to the effect of perceptual fluency on people's memory predictions (Mueller, Dunlosky, Tauber and Rhodes, 2014). The close relationship between spatial distance and perceptual fluency increases the likelihood that spatial distance affects people's memory predictions in the absence of experiential difficulty. The present study investigated the effect of perceived spatial distance on people's judgments of learning (JOLs) and actual memory performance in two experiments. The perceived spatial distance of stimuli was manipulated by showing the stimuli at either top or bottom positions on a scene with depth perspective. At the same time, the depth cue was expected to produce physical size illusion enabling comparing the effects of perceived spatial distance and perceived size on JOLs. Results revealed no effect of perceived spatial distance or perceived size on JOLs and memory performance when tested with words (Experiment 1) or objects (Experiment 2). The null results for perceived size and JOLs were believed to stem from the size differences within the stimuli.

Keywords: Memory, Metamemory, Perceptual Size, Spatial Distance

ÖZET

UZAKLIK ALGISI BELLEK TAHMİNLERİNİ ETKİLER Mİ?

Elibüyük, Esra
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İnsanlar gelecekteki bellek performanslarının algısal olarak akıcı uyaranlar için, akıcı olmayanlara nazaran, daha iyi olacağını öngörürler. Örneğin, bellek eminlikleri, büyük puntolarla yazılmış kelimeler için, küçük yazılmışlara kıyasla daha yüksektir (Rhodes & Castel. 2008). Daha önceden bu etkinin, uyaranın öğrenilmesi sırasında yaşanan deneyimsel zorluklardan kaynaklandığı düşünülmekteydi. Ancak yeni bir çalışmanın gösterdiği üzere, algısal akıcılığın insanların öğrenme tahminlerine etkisine esas katkıyı, deneyimsel zorluklar değil, kişinin inanç ve teorileri yapmaktadır (Mueller, Dunlosky, Tauber and Rhodes, 2014). Algısal akıcılık ve konumsal uzaklık arasındaki yakın ilişki, deneyimsel zorlukların yokluğunda, konumsal uzaklığın insanların bellek tahminlerini etkilemesi olasılığını arttırır. Bu çalışma, algılanan konumsal uzaklığın insanların öğrenme tahminlerine ve gerçek bellek performanslarına etkisini iki deneyde incelemiştir. Uyaranların algılanan konumsal uzaklığı, uyaranları derinlik algısı olan bir sahne üzerinde aşağı ya da yukarı pozisyonlarda göstererek manipüle edildi. Bu derinlik ipucunun, aynı zamanda fiziksel boyut yanılgısı yaratarak, algılanan konumsal uzaklık ve algılanan boyutun öğrenme tahminlerine etkisini karşılaştırmaya imkan sağlaması beklendi. Sonuçlar kelimeler (Deney 1) ya da objelerle (Deney 2) sınandığında, algılanan konumsal uzaklığın ve algılanan boyutun öğrenme tahminlerine ve bellek performansına bir etkisi olmadığını gösterdi. Algılanan boyut ve öğrenme tahminleri için olan hükümsüz sonuçların uyaranlar arasındaki boyut farklılığından kaynaklandığı düşünülmektedir.

Anahtar Kelimeler: Algısal Boyut, Bellek, Konumsal Uzaklık, Üst Bellek

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CHAPTER I

INTRODUCTION

"The best we can do is a compromise: learn to recognize situations in which mistakes are likely and try harder to avoid significant mistakes when the stakes are high" (Kahneman, 2011: 28). With these words Kahneman points to the inescapability of cognitive illusions and highlights the importance of factors leading to these illusions. Judgments are one of the domains that can be affected by cognitive illusions. As an example, perceptual fluency, experiential ease or speed in perceiving the stimuli is one factor that causes people to make incorrect memory predictions.

Rhodes and Castel (2008) claimed that the perceptual characteristics of to be learned stimuli are one factor affecting people's judgments about their subsequent learning, referred to as the perceptual fluency hypothesis. They presented participants with some study words that were written in either 48pt (large) or 18pt (small) fonts. The experiment showed people have a tendency to report higher confidence for their subsequent memory performance for the large-font words than the small-font words. The "font-size effect" has been thought to stem from the experiential ease associated with perceptually fluent items. However, a recent study by Mueller, et al. (2014) showed an absence of experiential difficulty in participants' perception of small font words. Moreover, participants still indicated higher confidence for large-font words than small-font words when they made memory predictions over a scenario, without being exposed to the experimental manipulation. This showed the belief, or theory-based nature, of perceptual fluency's effect on metamemory.

This study will attempt to explore the origin of the beliefs associated with perceptual fluency's effect, specifically the size effect. Spatial distance is one factor that determines objects’ perceptual fluency. As a stimuli’s spatial distance from the observer increase, its perceptual fluency decreases. Therefore, it was argued that beliefs associated with the font-size effect were about spatial distance. The effect of perceived spatial distance on peoples’ confidence judgments and memory performance will be investigated in two experiments. The perceived spatial distance of stimuli from the observer was manipulated by placing the stimuli at either top or bottom positions on a scene with depth perspective. For that scene, the stimuli at the bottom position were expected to be perceived as more proximate to the observer relative to ones at top position. Furthermore, the depth cue was expected to create a physical size illusion. The stimuli at the top position on a scene with depth perspective were assumed to appear bigger in size than the ones at bottom position. Thus, the scene’s depth made it possible to compare the effects of perceived spatial distance and perceived size on people’s memory predictions and memory performance.

In the following subsections of this chapter, the literature on metamemory, perceptual fluency and spatial distance will be introduce and then the aim of the study will be described. Then in the second chapter, the aim, methodology, and results of Experiment 1 will be presented. Having discussed the result of Experiment 1 briefly in the last subsection of chapter two, in the third chapter Experiment 2 will be introduced together with its methodology, results, and discussion. In the last chapter, the general results will be discussed together with the study’s limitations, and future directions.

1.1 Cognitive Processes during Learning and Remembering

Object-level processes such as encoding, maintenance and retrieval are not the sole components of learning. Beyond these mechanisms, learning requires meta-level operations to assist these object-level processes. As a recent subject in cognitive psychology, metamemory aims to investigate both the nature and the influence of these meta-level processes on memory.

Metamemory refers to beliefs, assumptions, predictions, and heuristics about how memory operates, and as mentioned above, it is always in a bidirectional relationship with the memory processes carried at the object level. This relationship which also refers to the functions of metamemory is characterized as monitoring and control (Nelson & Narens, 1990). Monitoring refers to ones' internal observations about the quality of memory processes carried at the object-level. Questions like "Am I learning?", "Will I remember my doctor's appointment or should I take a note?" are a product of the monitoring function of metamemory. Beside these passive observations, by using subjective reports that are obtained through monitoring, metamemory actively controls and regulates the memory processes happening at the object level. It may initiate or terminate the learning; moreover, it may change or maintain the current strategies that are being used. For instance, when a mixed list of difficult and easy words is given to people, they regulate their learning such that they may allocate more study time to difficult materials (Nelson & Leonesio, 1988), or they may start learning from the easier ones (Ariel, Dunlosky & Bailey, 2009). Thus, metamemory affects learning and memory through both controlling and monitoring functions.

Even though these meta-level processes aim to enhance learning; there are situations in which they affect memory in opposite or unpredicted ways. Use of wrong strategies or false observations may lead to inconsistencies between expected and actual memory performance. For instance, when preparing for an exam, people may prefer restudying over testing. However, testing enhances memory performance more than the restudying does, creating a double-dissociation between object and meta-levels of memory (Kornell & Bjork, 2007). Thus, these metacognitive illusions increase the importance of finding sources of these errors and studying metamemory.

One way to study metamemory is to investigate judgments that participants make about their learning at the time of encoding. People start learning by determining their desired level of learning, and formulating a strategy to reach this desired level. During the elapsed time between initiation and termination of studying, they make many judgments to understand if the current level of mastery has reached the desired level. Judgments of learning (JOLs) are one type of judgment that refers to one's predictions about their subsequent memory performance during the acquisition of information. JOLs are measured during encoding by asking participants to rate their confidence in remembering the presented information on a later memory test. This confidence can be assessed either after the presentation of each item (item-by-item JOLs), or at the end of the study list by asking them to predict number of study items they will remember from each condition (aggregate JOLs).

In the literature, there are two different views about how people make their JOLs; direct-access and cue-utilization views. The direct-access view argues that people have direct access to their memory traces. Thus, they can directly monitor the strength of those traces and regulate their studying accordingly (Cohen, Sandler, & Keglevich, 1991). However, as stated previously, people's judgments are error prone, and these errors lead to metamemory illusions. If people could observe their memory traces directly, they would not make mistakes in predicting their future memory performance. Thus, this view only explains the situations in which actual and predicted memory performance were consistent, but it fails to clarify discrepancies between the two variables (Koriat & Helstrup, 2007). For this reason, the cue-utilization view is more popular than the direct-access view.

The cue-utilization view, on the other hand, emphasizes both direct and indirect effects of cues on people's judgments about their learning. These cues can be classified as intrinsic, extrinsic, and mnemonic depending on their role in learning. Intrinsic cues refer to characteristic of the study items such as ease of learning. For instance, when the degree of relatedness between word pairs increases, both people's JOLs and memory performance increase (eg: Caroll, Nelson & Kirwan, 1997; Dunlosky & Matvey 2001; Hertzog, Dunlosky,Robinson, &Kidder, 2003; Koriat & Bjork, 2005; Castel, McCabe & Roediger, 2007). Extrinsic cues, on the other hand, refer to cues about the learning conditions. The number of times that the item is studied, the duration of study time, or the type of a subsequent test can be classified as extrinsic cues that affect people's memory judgments. As an example, an increase in study items' presentation duration and the number of study trials raises people's confidence about their learning (Koriat, 1997). Both intrinsic and extrinsic cues are believed to have a direct effect on memory judgments through analytic and explicit use of one's a priori or recently formed beliefs and theories about his or her memory. Thus, they can be categorized as theory-based cues since their cores are these a priori theories or beliefs. Furthermore, they can also exert their influence indirectly through subjective experiences such as the use of mnemonic cues (Koriat, 1997).

Mnemonic cues, different than theory-based cues, are experiential. They are based on online subjective ease or difficulties that are experienced during the processing of information in a particular episode. In contrast to theory-based cues, their effects on memory judgments are indirect, automatic, heuristic-based and generally implicit (Koriat, 1997). Fluency can be categorized as a mnemonic cue. Fluency refers to the experience of subjective ease, or speed (Bjork, Dunlosky, & Kornell, 2013) and is generally associated with increased confidence judgments in the literature (Begg, Duft, Lanode, Melnick & Sanvito, 1989). If an item is processed, perceived or retrieved more easily as compared to another item, it usually produces higher confidence ratings than the other item.

One type of processing fluency is the retrieval fluency. It refers to experienced ease or speed with retrieving and reporting the information from long-term memory. In a classic study, participants reported higher confidence for the answers to trivia questions that they retrieved from semantic memory in a short time. However, participants' actual memory performance was better for the items that they spent more time to retrieve (Benjamin, Bjork & Schwartz, 1998). Encoding fluency, similar to retrieval fluency, refers to the experience of ease or speed during learning. In an experiment, participants were presented with some unrelated word pairs and asked to form an image of them during learning. In order to measure their memory confidence, participants were asked to make a confidence rating after each item's presentation, and then they were given a memory test on those pairs. Results showed that as the latency of image formation decreased, people's confidence in their subsequent memory performance increased. However, participants' memory performance was not affected by the image formation's delay (Hertzog, et al., 2003). Thus, fluency during encoding also increases peoples' confidence about their memory, despite the fact that it has no effect on actual memory.

In addition to encoding and retrieval fluency, the ease of perception affects JOLs. A recent hypothesis about perceptual fluency argues that while making memory predictions, people also use the physical characteristics of the study items, such as their size, intensity, and presentation duration (Rhodes & Castel, 2008). A number of studies showed that the ease (Rhodes and Castel, 2009; Yue, Castel and Bjork, 2013) and speed of perception for the study items are positively correlated with increased confidence for those items (Besken & Mulligan, 2013; Besken & Mulligan, 2014; Susser, Jin & Mulligan, 2015; Besken, 2016); however, ease of perception either does not affect the actual memory performance or leads to better memory for the items that are more difficult to perceive. These dissociations and double dissociations between the actual and predicted memory performance clearly show how perceptual fluency may lead to memory illusions.

To sum up, in the course of learning, people observe the information processing happening underneath and make number of judgments about it that will influences their learning strategies. JOLs are one of these judgments and they are thought to be influenced by two sources of information: beliefs and/or subjective experiences during the processing of information. Perceptual fluency is one of these cues that were believed to be mostly experience-based (Rhodes & Castel, 2008). However, currently there is a disagreement in the literature on whether it could be theory-based instead or experience-based (Mueller, et al., 2014). Since, perceptual fluency is one of the cues that clearly demonstrates the mismatch between memory predictions and memory performance, it is important to further explain its mechanism.

Having introduced the metamemory literature briefly, this paper will now further investigate the effects of perceptual fluency on metamemory and memory, and will introduce the discussion in the literature about its bases.

1.2 Is Perceptual Fluency a Belief – Based or an Experiential Cue?

Rhodes and Castel (2008) observed the effect of study items’ physical appearance on JOLs and they came up with the perceptual-fluency hypothesis. The perceptual-fluency hypothesis argues that the physical characteristics of the items-to-be-studied, such as their size, intensity and presentation duration affect people’s JOLs. In their study, they manipulated the font-size of the to-be-learned stimuli in a way that participants studied an equal number of large-font (48 pt) and small-font (18 pt) words during the study phase. After the presentation of each word, participants' memory confidence was assessed through item-by-item JOLs. After completing a 5-minute filler task, they were asked to remember as many words as they could from the study list in a free-recall test. Results showed that people have a tendency to give higher JOLs when the words were written in large-fonts than small-fonts. However, their memory performance did not differ for large or small font words. Furthermore, the following experiments showed that the font-size effect persisted even when participants were given a chance to understand the irrelevance of font-size through different manipulations. In Experiment 2, they were presented with two study-test cycles. In Experiment 4, they were overtly warned that the font size does not affect memory performance at the beginning of the experiment. In Experiment 3, an additional variable that was more diagnostic of future memory performance was added to the design. Regardless of these manipulations, the font-size effect for the memory predictions in all these additional manipulations endured. Thus, Rhodes and Castel (2008) claimed that perceptual fluency increased people's confidence about their subsequent performance by creating an experience of perceptual ease.

These findings were replicated numerous times with other manipulations of perceptual fluency in both the visual and auditory domains. For instance, in one study, participants listened to study words presented with either high-volume or low-volume (Rhodes & Castel, 2009). Then their item-by-item JOLs and memory performance on a free recall test were compared. As predicted, whereas participants' confidence ratings were higher for the loud study words, their memory performance was same for both loud and quiet words. Furthermore, when they were asked about which words they would like to restudy, in order to observe the effect of perceptual fluency on the control function of metamemory, they wanted to restudy quiet words more than the loud ones (Rhodes & Castel, 2009). Similarly, in another study, the perceptual fluency hypothesis was tested through manipulating the typeface clarity of the study words. Yue et al. (2013) presented the study words in either clear or blurred way. Consistent with the previous findings, participants gave higher JOLs to clear words than blurred words, even when they were given plenty of time to process each stimulus. Not surprisingly, the memory performance was not affected by typeface clarity. Typically, clear and blurred words were remembered to the same degree.

These studies clearly show that perceptual fluency affects metamemory judgments but not actual memory performance. However, there are also findings in the literature showing that some level of perceptual difficulty, in other words disfluency, may lead to deeper processing of information and enhanced memory performance. As an example, when the fluency of learning materials is manipulated through the use of easy (100% black Arial) or difficult (60% gray Bodoni) to read fonts, actual memory performance benefits from disfluency in both laboratory and classroom settings (Diemand-Yauman, Oppenheimer, & Vaughan, 2011). Unfortunately, people are either indifferent to this effect, or they insist on believing the imaginary benefits of fluency on memory.

One study shows that perceptual fluency may not always be taken into account in memory predictions. In a study by Sungkhasettee, Friedman and Castel (2011), study words were presented in a 180 degree rotated (inverted) position in the disfluent condition and an upright position in the fluent condition. Participants' item-by-item JOLs and memory performance on the free recall test were measured. While people remembered more of the inverted words, their confidence judgments did not differ across inverted and upright words. Furthermore, when participants were given 3 study-test sessions, in order to enable them to realize the benefits of inversion, their memory predictions became more accurate with repeated practice but they were still insensitive to the inversion manipulation. This indicates that people have a tendency to ignore the positive effect of disfluency on their memory.

Furthermore, Besken and Mulligan showed dissociated effects of perceptual fluency on people's memory confidence, and memory performance in both visual (2013) and auditory modalities (2014). In one of their studies, they manipulated the fluency of visual words by shortening the presentation duration of study words in a mixed-list design. In the more disfluent perceptual interference condition, words were shown for 83 ms and then backward masked with rows of Xs. In the more fluent intact condition, words were presented for the duration of 2500 ms, followed by a free-recall test. Results indicated a double-crossed dissociation between memory and metamemory, as measured by aggregate JOLs. While people gave higher JOLs to the intact words than the words in the perceptual interference condition, they remembered more words from the perceptual interference condition. More importantly, participants' rates of accurate identifications were higher for intact words than backward-masked words. These findings point to an experiential ease with processing the fluent words in comparison to disfluent ones and supports the effect of experiential difficulties during processing of information on metamemory judgments (Besken & Mulligan, 2013). The same pattern of findings was also observed in the auditory modality. When people heard study words that were either intact or inter-spliced with silences, they indicated more confidence for the intact words than the words inter-spliced with silences. However, words in the inter-spliced silence condition induced deeper processing of information and produced better performance in both free recall and recognition tests. Moreover, people's response latency for naming of the items during encoding was positively correlated with their confidence responses, highlighting the experiential aspects of perceptual fluency (Besken & Mulligan, 2014).

In sum, these studies show that perceptual fluency typically increases people's confidence about their future memory performance. Moreover, since perceptual fluency actually does not generally affect memory, it is a cue that leads to metamemory illusions. The studies above also claim that the core of perceptual fluency is online subjective experiences, such as the ease or difficulty in perceiving the item (eg. Rhodes & Castel, 2008; 2009). Furthermore, studies that use objective measures of fluency, such as identification accuracy and/or identification latency also supports this view and show that perceptual fluency is more likely to be an experience-based cue rather than a theory-based cue (Besken & Mulligan, 2013; 2014). However, a recent study on font-size effects challenged this view, and drew attention to the contribution of beliefs on perceptual fluency.

Mueller et al. (2014) aimed to investigate whether the font-size effect (Rhodes and Castel, 2008) was due to the subjective ease in processing the study items or due to participants' beliefs about the font-size. In Experiment 1, they presented participants with large (48pt) and small (18 pt) font words on a lexical decision task. Participants' response latency in categorizing the presented string of letters as words or non-words, and their item-by-item JOLs were measured. Results showed that whereas participants' response latencies on the lexical decision task were the same for stimuli that were written in large or small fonts, their JOLs were still higher for large stimuli. This absence of a difference in participants' processing time for large- and small-font words ruled out the presumed effect of subjective experiences on font-size effect. Furthermore, in Experiment 3, the participants were given online scenarios in which groups of students were assigned to learn list of words that were written in either small or large fonts. The participants' task was to estimate the memory performance of the students in the scenario for both large and small font words. As expected, participants' memory performance estimations were higher for the large font words than small font words. The higher confidence ratings for large than small-font words was also observed in Experiment 4, in which participants were asked to make their confidence ratings before they saw each study item during encoding (Pre-JOLs). Mueller et al. (2014) concluded that font-size effect can influence memory predictions even when participants were not exposed to the experimental procedure. This indicates that the effect of font-size on metamemory judgments can be a result of people's previously or currently formed beliefs rather than their experiences during the processing of information.

This view of perceptual fluency also received support from other recent studies in the area. In a study by Susser et al. (2015), participants' processing speed for study words was manipulated through priming them either with matched or mismatched words. In the matched condition, before the presentation of each study word, the exactly identical word was presented to participants for a very short time. In the mismatch condition, on the other hand, study words were primed with different words. Matched primes were expected to increase people's processing of the study words. Results showed that when the primes were presented for a very short time (32 ms) that do not reach to participant's awareness level, study words with matched primes were processed faster by participants. However, neither participants' confidence ratings nor their memory performance increased for those words. On the other hand, when the matched or mismatched primes were presented for relatively longer time (200 ms), participants processed the words consciously and produced higher confidence for the words that are presented with matched primes. As expected, there was no effect of priming on participants' memory performance. This shows that beliefs rather than experience of perceptual fluency affect people's JOLs. And these beliefs are activated only when they are obvious or when they reach the threshold for awareness.

To sum up, contrary to what was believed before, the effect of perceptual fluency on metamemory seems to stem from beliefs and theories that were either previously held or recently formed. Furthermore, in a study by Besken (2016), it was shown that even when there is an independent contribution of experiential difficulty to perceptual fluency, beliefs can still affect JOLs. In this study, participants were shown some pictures to learn. In generate conditions, some parts of those pictures were deleted. Disfluency caused by deletion was expected to force participants to engage in a deeper processing of the stimuli, and result in better memory performance for those pictures. In the intact condition, on the other hand, all parts of the pictures were apparent. Participants' identification latencies for the shown pictures were measured as an indicator of their experiential difficulty in encoding the stimuli. Also, their item-by-item JOLs and memory performance were measured. Results showed a positive correlation between the difference in participants' identification latencies and the difference in their JOLs for generate and intact pictures. Furthermore, there was a significant partial effect of identification latency on JOLs. These showed that both beliefs and experiential difficulty have independent contributions to the effect of perceptual fluency on memory predictions.

Since these conclusions are strongly congruent with the theory-based nature of perceptual fluency, the next phase in perceptual fluency research should focus on questioning the origins of these beliefs. What these beliefs are about can be questioned in two ways. First, these beliefs can be specifically about the experimental manipulations. For instance, in a study where font-size is manipulated, the beliefs can be specifically about the font-size such as "bigger words can be remembered better". Another example of it from different manipulation of perceptual fluency can be “blurred words are less likely to be remembered”. Secondly, they can be globally about the perceptual fluency and the same global belief might have being activated by different fluency manipulations. If the latter is the case, the beliefs that are responsible for people’s increased memory confidence for perceptually fluent items should be activated by a perceived spatial distance manipulation. In other words, without any difference in experiential difficulty in encoding, just presenting stimuli at spatially proximate positions should increase people’s confidence in their future memory performance through activating beliefs about perceptual fluency.

Having concluded that the effect of perceptual fluency on metamemory judgments can mostly be compensated by theory-based processes, rather than experience-based processes, this paper will now argue why beliefs leading to this effect can be about spatial proximity and distance.

1.3 The Close Relation between Perceptual Fluency and Distance

People use distance judgments in their daily life in order to navigate around, and interact accurately with the surrounding objects. For this reason, spatial distance, is in a close relationship with the people’s higher level cognitive processes as an environmental cue, such as decisions. This relationship is both objective and subjective. For instance, the increase in the number of environmental cues perceived during travel, such as road signs, travel time, and travel effort are both objectively and subjectively correlated with the increased distance estimations (Montello, 1997). These estimation decisions are so automatic that even when the object in the spatial areas is novel to the observer, or when the observer lacks the visual ability to observe the environment, they still function well and allow the observer to accomplish the task (Haber & Levin, 2001). In this sense, distance judgments have a direct influence on people’s decisions.

On the other hand, distance judgments might indirectly affect people’s judgments by activating theories about perceptual fluency. Distance and perceptual fluency are in a bidirectional relationship between each other. Disfluency of an objects is related to higher estimates of its distance from the observer (Alter & Oppenheimer, 2008). Similarly, distance of the objects from the observer also determine the observer’s experience of perceptual fluency. As objects get distant from the observer, perceptual fluency diminishes. Objects become smaller in size, and they become blurred. Thus, as the spatial distance increases, perceptual fluency decreases naturally.

Spatial distance might also exert its effect through fluency. People favor fluency and use it in making their life choices and decisions (Oppenheimer, 2008). Alter and Oppenheimer (2009) argue that higher order cognitive processes affect people's affective judgments, such as truth, liking, and confidence by activating their domain-specific naïve theories. In this framework, spatial processing of information is one of the higher order tasks that might affect confidence judgments. For instance, when people are presented with two three-dimensional shapes, one is rotated and the other is upright and asked to decide if they are same or different, participants' confidence ratings are lower for the shapes that require more mental spatial rotation compared with the ones that require less rotation (Unkelbach, 2006).

Beside confidence judgments, spatial distance also determines the optimal level for efficient information processing by establishing different mental construal levels for different kinds of stimuli (Alter & Oppenheimer, 2008). While objects that are very similar to their referent objects are low in construal, words are high in construal for being abstract. Based on this, Amit, Algom and Trope (2009) thought that there should be an effect of physical distance on psychological distance and this should result in different effect of spatial distance on information processing speeds for pictures and words. To enlarge upon, they argued that objects that are distant from the observer produce larger psychological distance; thus, people represent distant objects abstractly. Since pictures and words differ in a way that pictures are more specific to their referent objects, and words are more abstract and they represent a category, they are processed faster in different mediums (positions). Pictures are hypothesized to be processed better at proximate positions with their detailed nature. Words, on the other hand, are thought to be processed in distant positions more efficiently, congruent with their abstractness. In their study, Amit et al. (2009) tested this hypothesis by manipulating the spatial distance of the objects by presenting them on the top or bottom positions of the scenes with a depth cue. These scenes were sometimes pictures of rivers, valleys and other times they were just two converging lines enabling depth perception. On these scenes, objects in the upper positions (thus, pictorially more distant) appeared as more distant from the observer, the ones in lower positions appeared more proximate to the observer. Participants' response latencies in classification and categorization tasks were shorter for the proximate objects than the distal objects. For words, there was no significant effect of position on task performance. To sum, spatial proximity enhanced information processing of the objects, but not of words.

The way of Amit et al's (2009) manipulating the spatial distance of stimuli, showing them on a scene with a depth perspective, is common in the field. In its most basic forms, these scenes consist of two convergent lines that look like intersecting at a distant background (eg. Amit et al., 2009). In enriched forms, they can be pictures of a hall, river, path, etc (eg. Murray, Boyaci, & Kersten, 2006). However, task of estimating distance of the objects evolved to function well in three dimensional settings and showing objects on a two dimensional setting leads to distortions in size estimation of the objects (Fisher, 1970). This phenomenon was first introduced in the literature by Mario Ponzo in 1912 (as cited in Fisher, 1970) and is known as the Ponzo illusion. In the Ponzo illusion, two identical objects are placed either on top or at the bottom of a scene with depth perspective. Even though the retinal size of the object is exactly the same in both positions, the one at the top position (distant) position looks bigger than the one at the bottom position (proximate). In a study by Murray et al. (2006), people were asked to judge the size of the objects at the top and bottom positions on a depth scene. Participants estimated the size of the top objects to be 17% bigger than the ones at bottom position. Furthermore, their area of activation in Primary Visual Cortex (V1) was also larger for top objects on a depth perspective. Thus, manipulation of spatial distance automatically leads to manipulation of the size of the objects in 2D settings. This effect should be considered in experimental designs.

To conclude, distance has an indirect effect on both information processing through psychological distance and in decision making through fluency. The relationship between perceptual fluency and spatial distance is bidirectional. Turning back to the discussion for the origin or nature of the beliefs in the effect of perceptual fluency on metamemory judgments, there is reason to think that beliefs about spatial distance might also affect metacognitive judgments. Results of perceptual fluency manipulations on the size or blurriness of the study items seem to support this argument. If participants were mostly using a belief rather than experience-based difficulty caused by disfluency, this belief might possibly be about distance. As stated before, things get bigger as they get closer, and they get smaller and blurred as they get further. In other words, they lose their perceptual fluency as they depart from the observer. Thus, participants might be assuming the fluent study items to be placed at proximate positions automatically and might be giving higher confidence for the proximity. The aim of the present study is to test this hypothesis by manipulating the positions of the study items without actually creating an experiential difficulty in perceiving them. If this manipulation leads to a difference between the participants' JOLs for the study items at proximate and distal positions, this will support the hypothesis that people hold beliefs about fluency and these beliefs are mostly about spatial distance.

1.4 The Present Study

The present study aims to fill the gap in the literature about the origins of the beliefs for the perceptual fluency effect. The discussion about the sources of cues during metamemory judgments indicated that perceptual fluency is a cue that exerts its effect mostly though beliefs or theories rather than experiences (Mueller et al., 2014). Thus, finding the nature or origin of this belief is important to better understand people's metacognitive processes during learning.

Looking at variables that are related with the levels of perceptual fluency might be a good strategy to find the origin of this belief. Distance estimation in this sense can be a good variable because of its robust correlation with the perceptual fluency of the objects. In the literature, there are studies showing how spatial cues can affect people's confidence judgments (Unkelbach, 2006), and specifically distance can influence people's information processing (Amit et al., 2009). Thus, the increased confidence ratings for fluent stimuli in perceptual fluency studies like the font-size effect (Rhodes & Castel, 2008) or blurriness (Yue et al., 2013) may be due to beliefs about the perceived proximity or distance of the objects.

To test this idea, the perceived distance of study items was manipulated in two experiments by presenting study items to participants on a scene that either had depth perspective or not. As mentioned above, the placement of the objects on the top or the bottom in scenes with depth cues cause the objects at lower positions to appear more proximate, and the objects at upper positions to appear more distant to the observer. Moreover, due to the Ponzo illusion, depth cues lead objects at top positions to look bigger in size than the ones at bottom positions when they were shown on the scene with depth perspective. Thus, use of that scene also provides us with an opportunity to test beliefs about font size effect (Rhodes & Castel, 2008) in addition to distance.

If people are using beliefs about distance for their memory predictions, their confidence rating should differ for proximate and distant study items. Since perceptual fluency increases with proximity, we predict higher confidence ratings for the study items that are placed on bottom (proximate) position than top position (distant), only when stimuli are presented on a depth scene. On the other hand, if people hold specific beliefs about experimental procedures, such as “bigger fonts are more likely to be remembered”, their confidence ratings should be sensitive to size differences between top and bottom stimuli caused by the Ponzo illusion. Thus, they should give higher confidence ratings for the objects at the top (distant) position since they appear bigger, only when there is a depth scene, but there should be no difference between confidence ratings when there is no depth cue.

For the memory measures, there should be no difference in the actual memory performance due to perceived size of the items, since perceived size is not a cue that affects memory performance (Rhodes & Castel, 2008). Similarly, perceived spatial distance might not influence the memory performance. Amit et al. (2009) showed that perceived distance of the stimuli may speed up information processing depending on the type of stimuli. Whereas pictures are processed faster at proximate positions, words are processed marginally faster at distant positions. If slower processing speed of stimuli was an indication of deeper or effortful processing, it might lead to enhanced memory performance. However, faster information processing may not always be an indicator of effortful processing. For instance, in Yue et al.’s study with blurred words (2013), if it was measured, blurriness could lead to slower identification of the words by participants. However, it did not lead to enhanced memory performance. Both blurred and clear words were remembered to the same degree by the participants. Similarly, perceived distance dependent processing speed of stimuli, was not expected to have an effect on participants’ memory performance when tested with words in Experiment 1 and with object pictures in Experiment 2. Thus, the memory performance of the participants was expected to be same across the two position and the two perspective conditions of the both experiments.

CHAPTER II

EXPERIMENT 1

The aim of the Experiment 1 was to investigate whether the belief associated with perceptual fluency's effect on metamemory judgments is related to distance. Previous studies showed that perceptually fluent study items increase peoples' confidence about their memory (eg. Rhodes & Castel, 2008; 2009, Yue et al., 2013). If the source of the effect was beliefs rather than experiential difficulty, this belief might be about the distance. Thus, as spatial distance of the object from the perceiver increase, their memory confidence should decrease. Thus, JOLs were expected to be higher for the words at the bottom position when the background picture provided depth perspective.

On the other hand, if this belief is specifically about the perceptual size, JOLs should be sensitive to the size differences between the words that were presented at the top and bottom positions due to the Ponzo illusion. As stated before, objects that are placed at the top position of depth-conveying scene look 17% percent bigger in size than the ones at the bottom positions (Murray et al., 2006). Since the words at the top of the scene with a depth perspective look larger as compared to the ones at bottom, words at the top position should produce higher JOLs than the ones at bottom. This effect should not be observable when the study words were presented on a scene without depth perspective.

To sum, the position of the stimuli was expected to affect JOLs only when they were presented on a background with depth perspective. When study words were presented on a background without depth perspective, JOLs were not predicted to differ as a function of position. Independent from the JOLs, participants' memory performance was not expected to differ due to size difference caused by the Ponzo illusion on perspective-present conditions, because both large and small font words produce similar memory performance (Rhodes & Castel, 2008). Similarly, perceived spatial distance should not affect participants' memory. As stated before, there is a study showing that words are processed marginally faster at distant positions than at proximate ones (Amit et al., 2009). However, proximity might not always initiate deeper processing leading to enhanced memory performance. Thus, memory performance should not be affected by manipulating the perceived spatial distance in the experiment.

Experiment 1 consists of three phases. In the first phase of the experiment participants were asked to learn some words for a later memory test. Study words were presented in top and bottom positions either on a scene with depth cues (Hall) or a scene without depth cues (Wall). After the presentation of each item, participants' item-by-item JOLs were measured. In the second phase, participants were given 4 minutes filler task and then on the last phase their memory performance was tested with a free-recall task.

2.1 Method

2.1.1 Participants

Participants were 24 undergraduate students (9 males, and 15 females) from İhsan Doğramacı Bilkent University. They participated for an exchange for course credit. Their ages ranged between 18 and 30. Since both instructions and materials were prepared in Turkish, participants were native Turkish speakers. Moreover, they had normal or corrected-to-normal vision due to the visual nature of the experiment.

2.1.2 Materials and Design

Perceptual spatial distance in the encoding condition was manipulated within subjects by placing the study items at either the top or bottom position on one of two background images. One of these images was depicting the front face of a wall (Wall), and the other was showing a hallway, (Hall) (see Appendix A). It can be seen that the Hall background provides a depth cue via perspective projection. Thus, objects placed at the top of the scene are perceived more distant to the observer, and similarly the ones at the bottom position seem more proximate. On the Wall background, on the other hand, there is no depth from perspective projection. Thus, position manipulations do not lead to a difference in perceived spatial distance on that scene. For that reason, this scene was used to control for the possible position effect. Both Hall and Wall images were obtained from a previous study by Murray et al. (2006). The original images were colored. In order to match them with the black nature of study items, they were converted to black-and-white by using GIMP GNU Image Manipulation Program (Version 2.8.16; Kimball & Matiss, 2015).

In order to minimize the size differences among the words to-be-used, only five-letter words were included in the study. Forty-eight words were chosen from Göz (2003) according to their frequency of occurrence to control their memorability. The mean word frequency was 69.52 (SD = 5.94). The words that were used in the experiment can be seen at Appendix B. Four of them were presented at the beginning, and another four presented at the end of the main study list to control for the primacy and the recency effects. The main study list was composed of 40 critical words. The words were separated into four separate lists, whose mean word frequency ranged between 68.3 and 68.8. Then, each group of words were assigned to one of the four conditions of the experiment in a within–subjects design (e.g. perspective present at the top or perspective absent at the bottom). These lists were counterbalanced across participants such that all four lists were presented at each level of perspective and position to an equal number of participants.

The experiment was generated by using E-Prime Studio (Version 2.0.10.252; Psychology Software Tools, 2015). In all conditions, the study words were presented in boldface, black, Courier New, and 48 pt type fonts. In the top conditions, the stimuli's coordinates were 67 % along the X-direction and 18 % along the Y-direction, whereas in bottom positions, they were 32 % along the X-direction, and 85 % along the Y-direction. On the perspective present conditions, the stimuli were presented on the Hall image, and in the perspective-absent conditions, they were presented on the Wall image, resulting in words presented in ten perspective absent

(Wall)-top, ten perspective absent (Wall)-bottom, ten perspective present (Hall)-top, and ten perspective present (Hall)-bottom conditions. Presentation order was random such that over every four trials, participants saw one perspective present-top, one perspective absent-top, one perspective present-bottom, and one perspective absent-bottom condition.

Lastly, for the distractor phase, a list with word-fragments Turkey's cities was generated. There were 80 cities in the list and one extra was solved as an example. The list can be seen at Appendix C.

2.1.3 Procedure

Participants were tested individually on computers at Bilkent University, in the Cognitive Testing Room. They were seated approximately 100 cm away from the monitor. Each test session last approximately 25 minutes.

The experiment consisted of three phases: study, distractor and testing phases. In the study phase, participants were asked to learn study words that would appear at different backgrounds and positions on the screen for a later memory test. Each word was displayed on the screen for four seconds. Then, the program automatically proceeded onto a different screen for JOLs. Participants were asked to rate their confidence that they would remember the item in a later memory test on a scale from 0 to 100. A rating of 0 referred to no confidence that the participant would remember the item, and a rating of 100 indicated that they were certain that they would remember the item. Participants were given no time limitation to make their confidence ratings. They typed in their confidence ratings using the keyboard. Once they pressed Enter, they proceeded onto a new trial. The design and procedure for the study phase can be seen in Figure 1.

In the second phase of the experiment, participants were manually given a list of the 80 cities of Turkey. In that list, some letters of the city names were missing. Participants were asked to fill these gaps for 4 minutes. Their scores were not calculated, and were not included in the analyses.

Finally, in the last phase of the experiment, participants engaged in a free recall task. They were asked to type the name of the words that were presented during the first phase of the experiment onto the computer screen as accurately as they could, using the keyboard. They were informed the order of retrieval was not important and that they can recall the words in any order. They were given 5 minutes to complete the task. They could also terminate this phase by pressing ESC button. Participants were given no feedback on their recall.

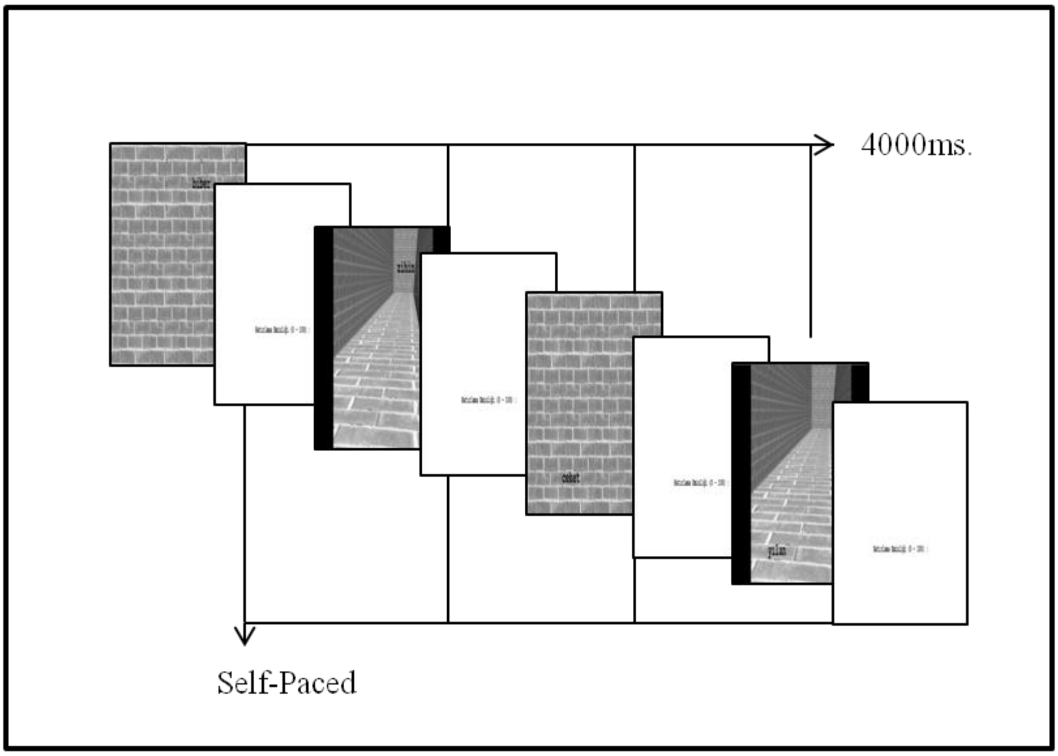

Figure1. The Design and Procedure for the Study Phase of Experiment 1.

2.2 Results

All analyses were conducted at alpha level .05. Each participant’s mean JOLs and mean memory performance for four conditions were calculated separately. Confidence responses that were bigger than 100 and were not numeric were excluded from the analyses. .03% of the data were missing for JOLs. The mean JOLs and memory performances across four conditions can be seen at Table 1 with the standard deviations in parentheses.

Table 1. Mean Memory Predictions and Memory Performances with Standard Deviations (in Parentheses) across the four Conditions of Experiment 1

Condition	JOLs	Memory Performance
Perspective Present – Top	55.09 (26.84)	.23 (.42)
Perspective Present - Bottom	51.01 (27.99)	.30 (.46)
Perspective Absent – Top	52.06 (26.84)	.23 (.42)
Perspective Absent - Bottom	51.09 (26.98)	.24 (.43)

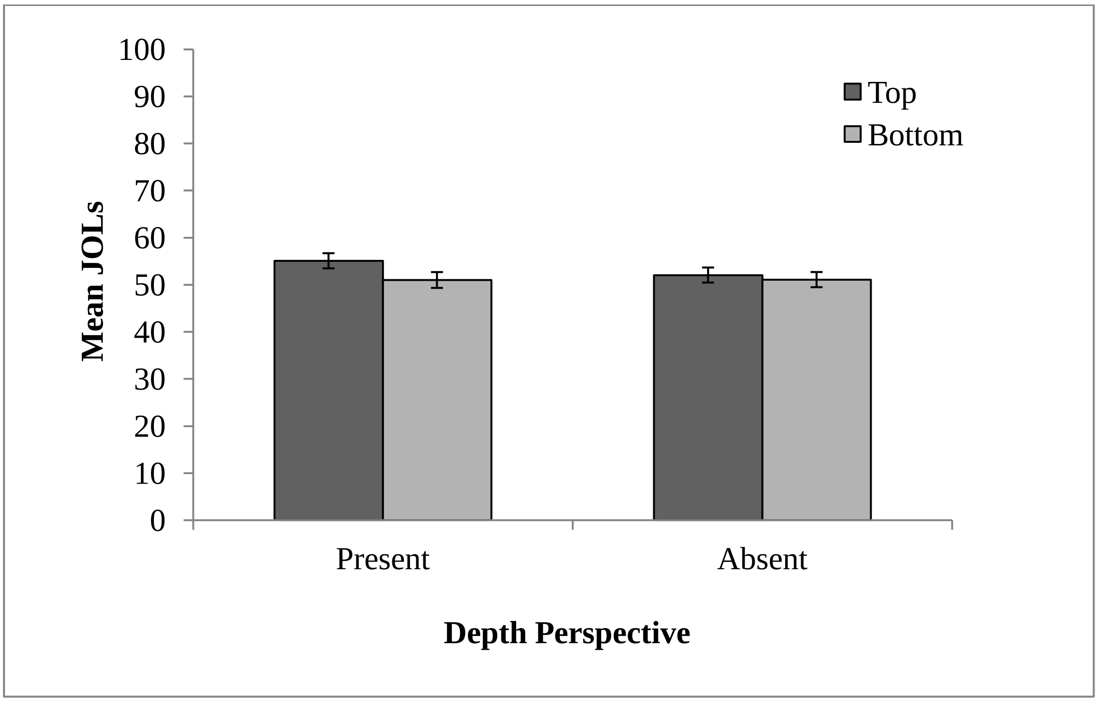

Figure 2. Mean JOLs for Top and Bottom Words across two Perspective Conditions in Experiment 1. Error bars show +/- 1 standard error.

Figure 2 shows the mean JOLs for top and bottom words across perspective present and absent conditions of the experiment. It can be seen that, in general people’s confidence ratings were similar across the four conditions. However, for the top conditions, participants reported slightly higher confidence. This increase in their confidence seems to be more obvious for the perspective present condition where stimuli look distant on a picture of a hall. A repeated measures ANOVA was conducted to test the main effects of perspective and position on JOLs. It revealed significant main effects for neither position (*F* (1,23) = 0.46, *p* = .83, *MSE* = 78.410, η^2 = .002) nor perspective (*F* (1,23) = 1.192, *p* = .29, *MSE* = 57.978, η^2= .049). Furthermore, there was no significant interaction between perspective and position (*F* (1,23) = .095, *p* = .76, *MSE* =67.454, η^2 = .004). Thus, neither the presence of a perspective cue nor position of the words on the background affected people’s confidence about their memory performance. They reported similar confidence ratings for both proximate and distant or top and bottom positioned words.

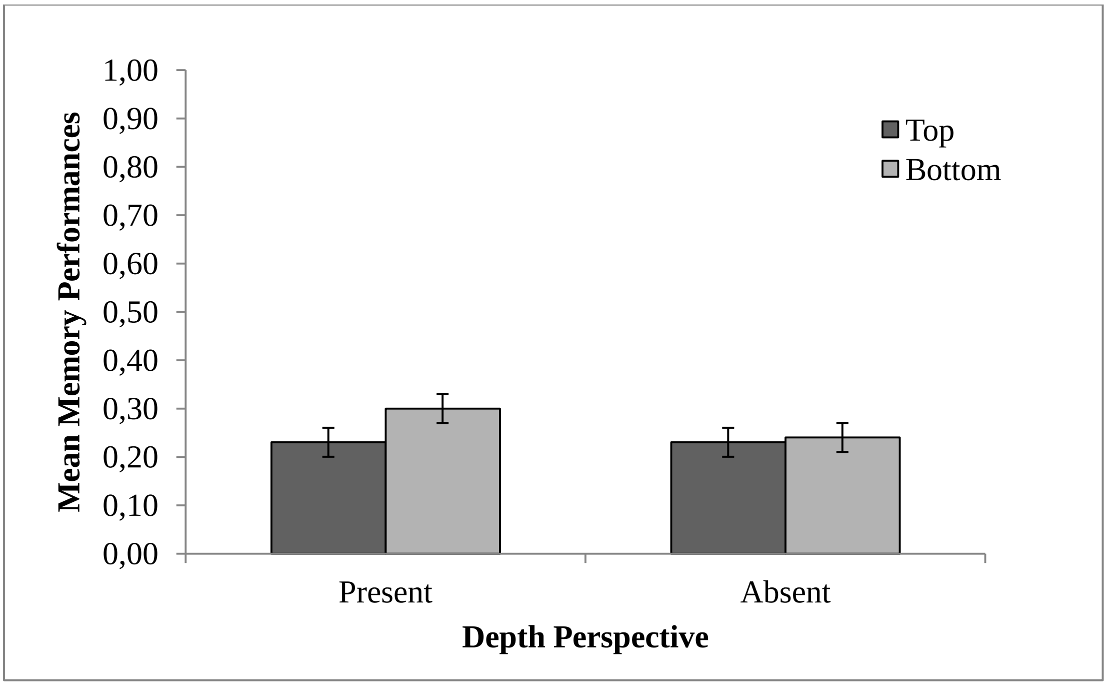

Figure 3. Mean Memory Performances for Top and Bottom Words across two Perspective Conditions in Experiment 1. Error bars show +/- 1 standard error.

Figure 3 shows participants’ mean memory performances across conditions of the experiment. It can be seen that, in general participants’ memory performances were similar across the three conditions. However, their performance appears to be better for the words at the bottom position when they were presented on the background with the depth perspective. A repeated measures ANOVA was conducted for people’s mean memory performance with position and depth perspective as the repeated variables. It revealed no significant main effect of perspective (*F* (1,23) =

.788, p = .136, MSE =.030, η^2 = .033) on memory performance. Thus, participants did remember the same amount of words from the two backgrounds (Hall and Wall). The position, on the other hand, had a surprising marginal effect on participants' memory performance (F (1,23) = 3.702, p = .07, MSE = .015, η^2 = .139). Words at the bottom positions were remembered better than the ones at the bottom position. An independent samples t-test indicated that the memory difference between the words at top and bottom positions was greater in the perspective present conditions (MD = -.08, SE = .03, t (23) = -2.87, p = .01, Cohen's d = -.80) than the perspective absent conditions (MD = -.02, SE = .04, t (23) = -.45, p = .66, Cohen's d = -.12), However, the interaction between perspective and position did not have a significant effect on participants' memory performance (F (1,23) = 2.12, p = .159, MSE = .011, η^2 = .084). In other words, the marginal effect of position on memory performance did not depend on the presence of a depth perspective.

2.3 Discussion

This experiment attempted to investigate the effects of distance on people's predicted and actual memory performance. To manipulate perceived distance, the study words were presented on a background with and without depth perspective either at the top or the bottom positions. In the perspective present condition, the words at the bottom positions were expected to appear more proximate to the observer while the ones at the top positions to appear more distant. Furthermore, due to the Ponzo Illusion, objects at the top position with the depth perspective present condition were assumed to look bigger in size than the ones at bottom position. To measure participants' memory confidence, their item-by-item JOLs were assessed.

JOLs were expected to differ between the perspective-present and perspective-absent conditions since perspective present conditions enabled the possible effect of perceived spatial distance. This effect could be seen in two opposite ways. First, JOLs could be higher for bottom words indicating the effect of proximity on people's memory confidence. If people held beliefs about distance, this belief could initiate an experience of perceptual fluency. This, in turn, could increase participants' confidence about their learning. However, if people did not hold beliefs about perceived spatial distance, instead they were using a specific belief about size, such as “large-font words are remembered more than small-font words”, they could rate their confidence higher for the top words in the perspective-present conditions compared to perspective-present bottom and the two perspective-absent conditions. In other words, their JOLs could be higher for top words that were presented on the scene with the depth perspective, since they looked bigger in size than the ones at the bottom.

The results of the Experiment 1 did not indicate a significant effect of perceived spatial distance on people’s memory predictions. Participants’ memory predictions were same for the words at top and bottom positions in perspective present conditions. However, the trend was favoring the effect of perceived size. The JOLs were slightly higher for the words at the top position of a scene with depth perspective compared to the other conditions. Thus, words that were assumed to look bigger in size increased people’s memory confidence. If the difference and interaction between position and perspective were significant, the finding would support the argument that beliefs about size affect people’s memory judgments (Mueller et al., 2014).

There can be two reasons for the null results regarding the JOLs. First, since both position and perspective were manipulated within subjects, participants rarely saw two perspective present conditions successively. Thus, the frequent changes within the two perspective conditions could have been distracting participants’ attention, and prevented them from realizing the differences in the perceptual size of the words for bottom and top in perspective present conditions. Secondly, words might be less prone to the Ponzo illusion. Whereas people frequently make distance estimates for objects, they rarely estimate word distances in daily life. In the literature also, the Ponzo illusion is generally tested through the use of 2-D and 3-D shapes or objects (e.g. Fisher, 1970; Murray et al, 2006; Prinzmetal, Shimamura, and Mikolinski, 2001). Amit et al. (2009)’s study manipulated the distance of words through the Ponzo Illusion. However, it aimed to compare different effects of distance on information processing of words and objects through classification and classification tasks. Furthermore, they argued that their participants were not able to realize the size difference between top and bottom stimuli presented on a scene with depth perspective. However, in their follow up experiments they still felt a need to shrink the physical size of the stimuli at upper positions. Therefore, it is not certain if the Ponzo illusion produces the same amount of size illusion for words as it does for objects. Furthermore, there is a sense in believing that visual size illusions should be more effective when used for objects. Thus, the observed insignificant effect of perspective on peoples' confidence ratings can be due to assumed weakness in the magnitude of size illusions for words.

Similar to JOLs, the presence or the absence of a depth perspective on the background did not affect the memorability of presented words. On the other hand, there was a marginal effect of position on memory performance. Bottom words were remembered to a greater extent than top words. If the interaction between position and perspective was significant and bottom words were remembered better in only perspective present conditions, the findings would be congruent with the previous study by Amit et al. (2009). In the study, it was claimed that words are processed faster at distant positions. Thus, slower processing speed for proximate words could be an indicator of effortful and deeper processing of the stimuli. This could explain the enhanced memory performance for the bottom words. However, in the present experiment, the interaction was not significant. Furthermore, the processing speed of the stimuli was not measured. Thus, the absence of this dependent variable in the design prevents us from drawing an exact conclusion about the enhanced memory for proximate words. The increased memory performance for proximate words can also be due to their location being occasionally more optimal for learning. People may just have a learning advantage for words positioned at the bottom of the display.

CHAPTER III

EXPERIMENT 2

Experiment 2 aimed to test the effect of distance on peoples' actual and predicted memory performance by improving the design of Experiment 1. In Experiment 1, the perceived distance manipulation, or the Ponzo Illusion might not have produced size illusions or depth illusions at the desired magnitudes. Therefore, results indicated the absence of perceived spatial distance and perceived size effect on metamemory and memory. To enhance the magnitude of the Ponzo illusion, three changes have been made in the experiment's design.

First, subsequent changes across the four conditions were minimized by manipulating perspective conditions between subjects rather than within subjects. This was important since the effect that was expected to be observed was belief-based (Mueller et al., 2014). Thus, the manipulations should reach participants' awareness level to activate the belief. In the former design, participants were rarely able to see two perspective present conditions consecutively. This might have prevented them from perceiving the size manipulation in the experiment. The between subjects manipulation of perspective conditions was expected to enhance participants' awareness of the experimental manipulation. Furthermore, in Experiment 1, participants' JOLs were assessed on different display screens than the ones used to provide depth cues and study stimuli. Thus, subsequent changes between different scenes were thought to be a factor that might distract participants' attention. For this reason, in the Experiment 2, participants JOLs were measured on a display in which the depth scene was still present, but stimulus was absent. The change in interface was assumed to increase participants' probability of realizing both perceived size and perceived distance manipulation.

Secondly, pictures of animate or inanimate objects rather than words were used in Experiment 2, since spatial distance estimation could be more functional and coherent for objects than words. In daily life, people do not need to estimate the distance of the words, however, they have to do this regularly for objects in order to interact with them efficiently. Furthermore, words and pictures are different in nature and in the amount of perceptual information they provide to people.

Words and pictures are different in both quantity and quality. Quantitatively, words and pictures initiate different processes during encoding. Whereas in processing of words verbal codes are used, for pictures both verbal and imagery codes are known to be used (Paivio, 1975). That is why peoples' memory performance is better for pictures than words (Paivio & Csabo, 1973). Furthermore, qualitatively pictures are different from words in their nature since they are higher in visual quality and more coherent with perceptual experiences. For instance, while words represent their referent objects more abstractly, pictures represent their referent objects in a more detailed and concrete way (Amit et al., 2009). Thus, due to their enriched visual quality, pictures are believed to provide more perceptual cues to people in metamemory and memory experiments than words (Besken, 2016). Thus, switching from words to pictures in Experiment 2 should increase the magnitude of the distance manipulation (Ponzo illusion) that was used.

Lastly, in Experiment 1, it was observed that showing stimuli on the bottom positions are more optimal for people's learning. However, the lack of an experience-based difficulty measure in the design preculded a concrete explanation for the marginally significant effect. In previous studies, participants' speed and accuracy in identifying the study stimuli were used as an objective measure of participants' difficulty in perceiving the stimuli. Higher speed and less accuracy in identification refers to deeper processing of the information which is known to lead to enhanced memory performance in some cases (Besken & Mulligan, 2013; Besken, 2016; Susser et al., 2015). Thus, in the present design, participants' speed of identification was measured to see if the increased memory performance in any condition can be explained through the experiential difficulty associated with the manipulation.

In sum, Experiment 2 tests the effects of perceived spatial distance and perceived size on participants' identification speed, confidence about their memory, and memory performance. Perceived size should not have an effect on participants' identification speed since font-size was shown not to affect people's speed in processing of the stimuli in previous research (Mueller et al., 2014). On the other hand, perceived spatial distance might have an effect on identification speed. Specifically, people may be faster in identifying the objects when they were presented at the bottom (proximate) position on a depth scene. In a previous study in the literature, pictures were found to be processed faster at proximate positions than distant positions (Amit et al, 2009). Consequently, in the present experiment, participants could be faster in identification when the study objects are presented at the bottom (proximate) position, only on a scene with depth perspective. Thus, if participants realize the increased identification speed for bottom objects on perspective present conditions, their JOLs might be higher for those proximate objects. Thus, this could reflect whether participants' experiential ease with processing of the proximate stimuli can explain their increased JOLs with increasing proximity.

If participants' identification speeds do not change across top and bottom objects in perspective present conditions, they might still report higher JOLs for the ones at the bottom due to proximity. Proximity might induce overconfidence in participants by activating beliefs about perceptual fluency. This would demonstrate the belief-based perceived spatial distance effect on metamemory. On the other hand, if perceived size has an effect on people's memory confidence, participants might indicate higher JOLs for the top objects that were presented with depth perspective. Those objects were expected to look bigger in size than the ones at bottom position due to the Ponzo illusion. Thus, if perceived size increases people's confidence without affecting their memory performance as expected, it would show that participants use beliefs about perceptual fluency in a way that is specific to experimental manipulation, such as through size differences.

In each situation, participants' memory performance was not expected to differ in any conditions. As mentioned before, it is already known that perceived size does not have an effect on people’s memory performance (Rhodes & Castel, 2008). Similarly, perceived spatial distance of the stimuli should result in equal memory performance for both top (distant) and bottom (proximate) objects that are presented on a scene with depth perspective. Participants can be relatively slower in identifying the top (distant) objects at perspective present conditions. However, as it was discussed in Experiment 1, it is not always an indicator of deeper or more effortful processing. In sum, neither perceived size, nor perceived spatial distance were expected to affect participants’ memory performance.

Lastly, for the control conditions in which study objects were shown at either of the top or bottom positions on a scene without depth perspective, it was not expected that any differences would be found in participants’ identification speed, confidence judgments, or memory performance.

3.1 Method

3.1.1 Participants

Participants were 49 students (19 males, and 30 females) from İhsan Doğramacı Bilkent University. They participated for an exchange of course credit. They were all native Turkish speakers, with normal or corrected-to-normal vision, between the ages of 18-30. Since one participant could not identify 85% of the objects during encoding, his data was excluded from all analyses. An additional participant was tested to replace this missing data. This replacement did not change the pattern of results.

3.1.2 Materials and Design

Perspective and position were two independent variables of the experiment with two levels. Differently than Experiment 1, perspective (Present vs. Absent) was manipulated between subjects. Position (Top vs. Bottom), manipulated within subjects, as in Experiment 1.

Perspective was manipulated in this experiment by showing the study items on different backgrounds. These backgrounds were a picture of a hall in the perspective present condition, and a picture of a wall in the perspective absent condition (see Appendix D). They were similar to the ones that were used in Experiment 1 with two exceptions. First, in order to enhance participants' perceptual experience of depth perspective, colored background pictures were used rather than black and white pictures. Second, in the first experiment the focal spot of the hall picture was slightly shifted to the right. For the present experiment, this hall image was edited and its focal spot shifted to the center of the scene. This version prevented the possible confounding effect of peoples' bias for the right. For instance, pedestrians prefer walking on the right side of the road in a number of places, like museums, shopping malls, etc. since it seems less costly in terms of the effort they will spend (Bitgood, Davey, Huang, & Fung, 2012).

Study items were 56 colored pictures of common objects and livings such as clothes, animals, foods, or tools. All pictures were obtained from A Pool of Pairs of Related Objects database (POPORO; Kovalenko, Chaumon & Busch, 2012). Since the experiment includes a size manipulation, pictures were chosen according to the original size of the animate or inanimate objects that the pictures depicted. All selected pictures represented objects that were bigger than one's palm and smaller than a 30 x 30 cm box in real life. They were all resized to 100 x 100 pixels. Two of them were used in practice trials to familiarize participants with the experimental procedures. Additionally, eight of them were presented either at the beginning or at the end of the study list in order to control for the recency and the primacy effects. The main study list consisted of 48 critical items. A pilot study with 11 participants was conducted with these 48 pictures to ensure that the participants can identify these objects accurately on a colored background, and name them in the same way on a vast majority of trials. For the main list the object identification accuracy was 95% (N = 11, M = 10.48, SD = 0.03). Thus, pilot participants identified the presented objects accurately on 95% of the trials and named them with the same name. The mean letter length of the objects' names was 5.88 (SD = 0.06). To assign the stimuli to the two positions of the study, two versions of the study list were prepared. First, 48 pictures were divided into two group in a way that each was composed of 24 objects. The mean accurate object identification rates of these groups were 10.50 and

10.40. Moreover, the mean numbers of letters that participants needed to type in order to identify those objects in these groups were 5.88 and 5.79. In sum, these groups were not different than each other in their mean accurate object identification rates and mean object name lengths. Thus, between groups differences were not expected to confound the results. Then each group of objects was assigned to one of the two within subjects conditions (position) of the study (e.g. top and bottom). These lists were counterbalanced across participants in a way that both lists were presented to the same number of participants in both top and bottom positions.

The experiment was scripted in E-Prime Studio (Version 2.0.10.252; Psychology Software Tools, 2015). In all conditions, the horizontal coordinates of stimuli were at 50% of the screen width, and their backgrounds were transparent. On the other hand, their vertical coordinates were 53% of the screen height in the bottom conditions, and 32 % in the top conditions. Similar to Experiment 1, object pictures were placed on the hall background in the perspective present conditions, and placed on the wall background in perspective absent conditions. Each participant saw 24 trials of objects at top positions, and 24 trials of objects at bottom positions, either on a hall or a wall background. The order of the trials was randomized such that one type of stimulus never appeared more than twice in a row. Participants were randomly assigned to either perspective present or to the perspective absent condition.

For the distraction phase, the same procedure as in Experiment 1 was employed where a list with word-fragments of Turkey's cities were filled in.

3.1.3 Procedure

The procedure was very similar to the Experiment 1 except for some changes in the encoding phase. Again, participants who were seated approximately 100 cm away from the computer screen were tested individually in the testing room. Experiment consisted of study, distractor, and test phases.

In the study phase, participants were shown 54 pictures of the objects on different backgrounds one by one. Similar to Experiment 1, their main goal was to learn the name of these objects for the memory test at the last phase of the experiment.

Different from Experiment 1, the stimuli were presented for 7 seconds on the screen. When each object picture appeared on the screen, participants were asked to identify these objects and type in their names as quickly and accurately as possible. They were given a total of seven seconds from the onset of the image to type in the name. As soon as they were done with typing, they were asked to press the Enter key to save their answers. When they did, the background of their answers turned to maroon to inform participants about completion of the identification task. The program recorded two measures of latency. The first one was the time that the participants took in order to start typing from the onset of the image. The second measure was the time that the participant took to type in the response (from the first key press till they pressed Enter). This was done to measure whether the perceived distance leads to differential levels of difficulty in identifying the stimuli. Participants were not given feedback about the accuracy of their identifications. Once seven seconds elapsed from the onset of the trial, the object on the background disappeared and participants were asked to make a confidence rating for their memory performance (JOL) for that object. Similar to Experiment 1, JOLs were assessed by asking the participants to rate their confidence out of 100 that they would remember the name of the object at the testing phase of experiment. In this rating scale, 0 referred to “not confident at all”, 100 indicated “very confident”. Participants were encouraged to use the whole scale while making their JOLs. After typing their confidence ratings through the keyboard onto the screen, they proceeded onto the next trial by pressing the Enter button. JOL ratings were self-paced. The procedure and design of the study can be seen at Figure 4.

Having completed the study phase, participants engaged in a 4-minute distractor phase. The distractor phase was the same as in Experiment 1. Again their scores were not calculated and were not included in any of the analyses.

Finally, during the test phase, participants were asked to remember the name of the objects they saw during the study phase of the experiment. They typed in their responses through the keyboard onto the screen. When they finished typing the name of each object, they pressed the Enter button to save their answer and started typing another object’s name. They were informed that during retrieval, the order of presentation during the learning phase was not important. They were given 5 minutes for the free recall task. They could also terminate this phase earlier by pressing ESC button. They were given no feedback on their memory performance.

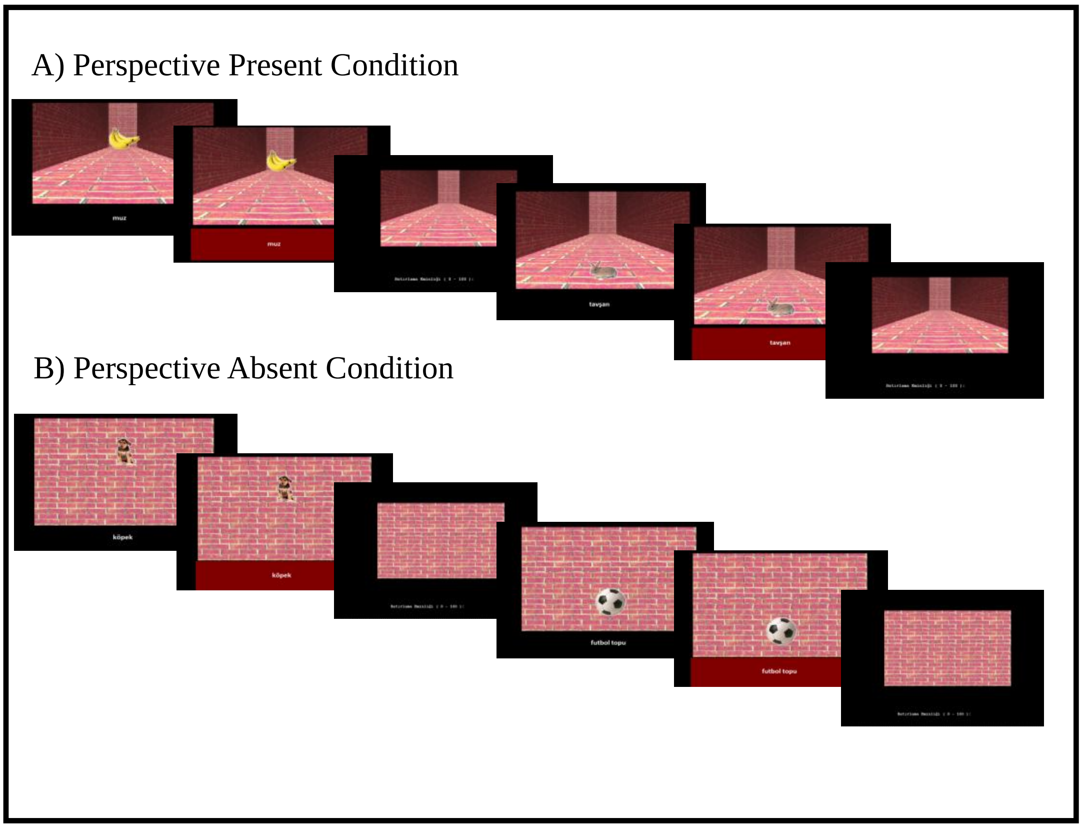

Figure 4. The Design and Procedure at the Study Phase of Experiment 2.

3.2 Results

For all analyses the alpha level was set to .05. Exclusion of confidence responses that were bigger than 100 and were not numeric resulted in 96% valid JOLs to be used in the analyses. Participants were needed to identify at least 80% of the items in each condition to be included in the analyses. They identified 96% of the objects accurately in the perspective absent-top, perspective absent- bottom, and perspective present- top conditions. For the perspective present- bottom conditions, this number was 94%. There were no differences in identification rates between the objects that were presented in the top and bottom positions as revealed by a sign test (*p* =.61). Furthermore, An independent samples sign test with position as the within subjects and perspective as the between subjects variable indicated that rates of accurate identifications for the objects at the top (*p* =.73) and the bottom positions (*p* =.20) were same across perspective present and perspective absent conditions.

Participants' difficulty in identifying the objects was measured through their first key response latencies in typing the names of the objects on the keyboard. Synonyms of the names were counted as accurate answers. Inaccurate identifications were excluded from the analyses. Thus, the data for 96% of the total trials were included in the analyses. In the experiment, participants' speed in typing the name of the objects was measured in milliseconds. Therefore, small differences in reaction time were likely to produce extreme differences within the data. In these situations, the use of the median instead of the mean enables a more valid estimate of central tendencies (Whelan, 2008). The median identification latencies were calculated for each condition of the study. They can be seen in Table 2. A mixed ANOVA with the position as the repeated measure and the perspective as the between subjects variable was conducted to test the effect of perspective and position on participants' identification latencies. There was no main effect of perspective on identification latencies (F (1, 46) =.151, p = .67, MSE = 88189.971, η^2 =.003). This shows that participants identified the objects with a similar speed across different the backgrounds (Hall or Wall). However, there was a significant main effect of position on identification latency (F (1,46) = 4.921 , p = .03, MSE = 7678.270, η^2 = .097). Participants identified the objects that were presented at the bottom positions faster than ones presented at the top (MD = 39.68, SE = 18.25, t (47) = 2.174, p =.03, Cohen's d = .91). The effect of interaction between perspective and position was not statistically significant (F(1,46) = 2.946, p = .09, MSE = 7678.270, η^2 = .06).

Furthermore, participants' median total time spent on typing the name of the objects was calculated for each condition. The median total typing times can be seen in Appendix E. A mixed ANOVA with position as the repeated measure and perspective as the between subjects variable revealed no significant main effect of either perspective (F (1,46) = .06, p = .81, MSE = 199703.471, η^2 = .001) or position (F (1,46) = .497, p = .49, MSE = 16040.126, η^2 = .01) on participants' total typing time. The interaction between position and perspective on participants' total typing time was not statistically significant (F (1,46) = .221, p = .64, MSE = 16040.126, η^2

= .005). Thus, people spent equal amounts of time typing the names of the objects in the different conditions.

Table 2. Mean Identification Latencies, JOLs, and Memory Performance across four Conditions with Standard Deviations in Experiment 2

		Conditions			
		Perspective Present		Perspective Absent	
Measures		Top	Bottom	Top	Bottom
Identification Latencies	*M*	1591.23	1582.25	1598.38	1528.00
	SD	229.92	223.11	228.48	194.42
JOLs	*M*	55.47	57.68	59.11	58.93
	SD	17.09	18.44	21.41	20.57
Memory Performance	*M*	.41	.38	.46	.43
	SD	.11	.11	.15	.15

Note. Identification latencies show participants' median first key latency in milliseconds. JOLs = Judgments of Learning. Memory performance reflects the proportion of correct recall for accurately identified objects (Conditionalized).

Participants' memory confidence was measured via item-by-item JOLs. Figure 5 shows the mean JOLs for accurately identified objects across each condition. In order to test the main effects of perspective and position, A mixed ANOVA with position as the repeated measure and perspective as the between subjects variable was conducted on the participants' mean JOLs. It revealed no significant main effect of position on JOLs ($F(1,46) = .291$, $p = .59$, $MSE = 12.934$, $\eta^2 = .006$). Thus participants reported similar confidence ratings for the objects presented at the top and bottom. Furthermore, there was no main effect of perspective on mean JOLs ($F(1,46) = .320$, $p = .58$, $MSE = 708.160$, $\eta^2 = .007$). In other words, people did not indicate different confidence ratings for the objects presented on a background with or without depth perspective. Lastly, the interaction between perspective and position did not affect people's confidence ratings ($F(1,46) = .608$, $p = .44$, $MSE = 12.934$, $\eta^2 = .013$).

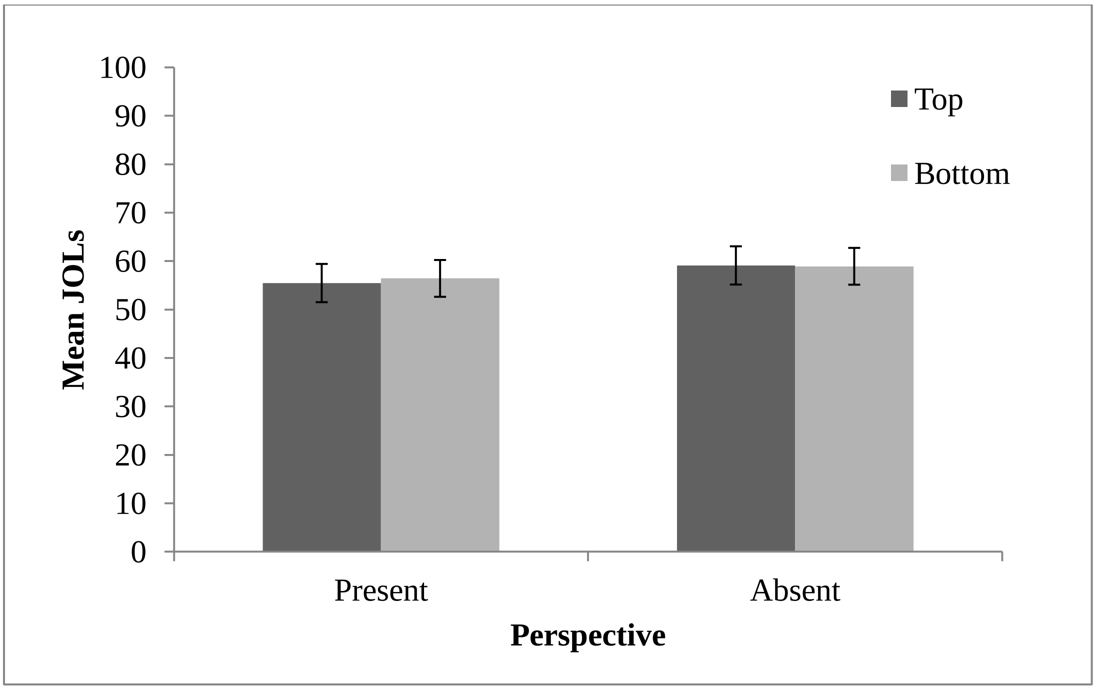

Figure 5. The Mean JOLs for Accurately Identified Objects across two Perspective and two Position Conditions. Error bars show +/- 1 standard error.

For memory, participants' memory performance for the entire list was calculated without excluding their memory performance for inaccurately identified items. Then each subjects' proportion of correct recalls was calculated by dividing their mean performances for top and bottom positions respectively by the total number of accurate identifications for top and bottom positions separately. The means and standard deviations (in parentheses) of the proportion of correct recalls for top and bottom objects across perspective present and absent conditions can be seen in Appendix E. A mixed ANOVA with position as the repeated measures and perspective as the between subjects variable revealed no significant main effect of position (*F* (1,46) = 1.306, *p* = .26, *MSE* =.010, η^2 = .028) or perspective (*F* (1,46) = 785.838, *p* = .12, *MSE* =.022, η^2 = .052) on participants proportions of correct recalls. Moreover, there was no significant interaction between perspective and position (*F*(1,46) = .088, *p* = .77, *MSE* =.010, η^2 = .002).

Furthermore, in order to analyze participants' memory performance for the objects they identified accurately, the memory data was conditionalized. For instance, if a participant had identified the duck as a swan and remembered swan instead of duck in the memory test, his score for the swan was not included in the conditionalized memory data. Participants' total number of accurate identifications and mean memory performance for the objects that were identified accurately were calculated separately for the top and bottom positions. Then, by dividing each subject's mean memory performance for top and bottom positions by the number of accurate identifications for top and bottom positions respectively, the conditionalized proportion of correct recalls was calculated. The proportions of the correct recalls for conditionalized data for top and bottom positions across the two perspective conditions can be seen in Figure 6.

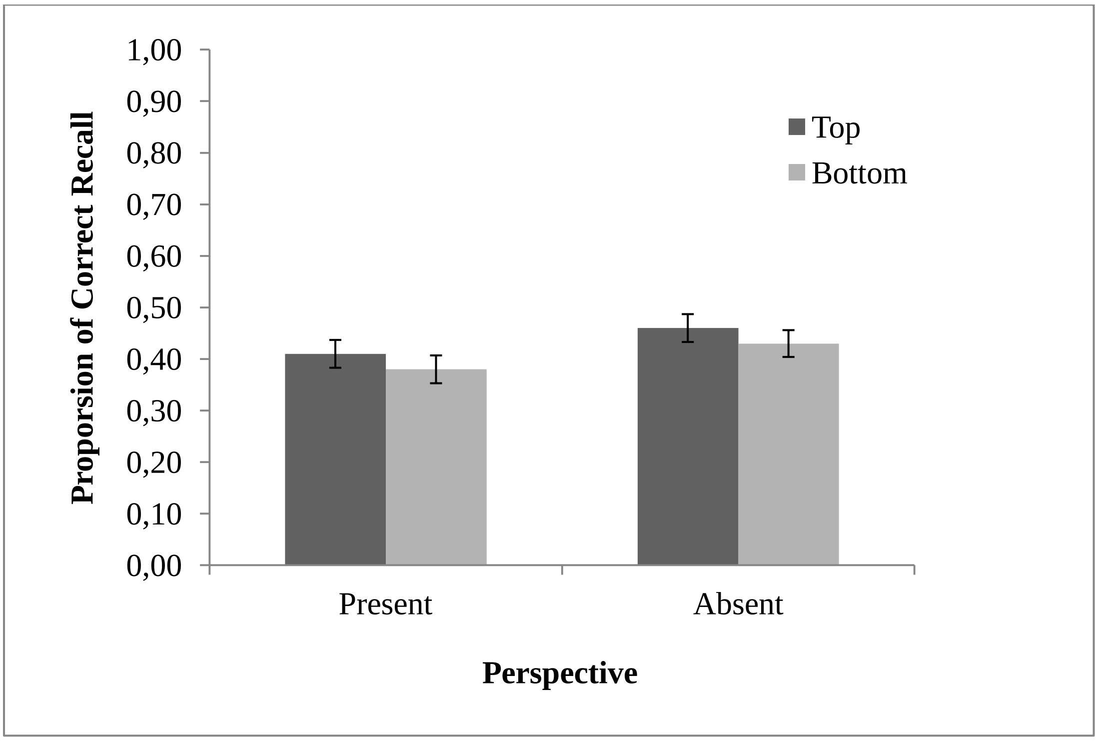

Figure 6. Proportion of Correct Recall for Accurately Identified Objects across the two Perspective and two Position conditions. Error bars show +/- 1 standard error.

A mixed ANOVA with position as the repeated measure and perspective as the between subjects variable was conducted to test the effects of perspective and position on participants' conditionalized proportion of correct recalls. It revealed neither a significant main effect of position (*F*(1,46) = 2.268, p = .14, *MSE* =.010, η^2 = .047) nor perspective (*F*(1,46) =2.017, p = .16, *MSE* = .024, η^2 = .042) on recall. Furthermore, there was no significant interaction between position and perspective on memory performance (*F*(1,46) = .002, p = .96, *MSE* =.010, η^2 = .000). Thus, participants remembered similar amounts of objects from all conditions.

To summarize, both recall proportion correct conditionalized upon correct identification and unconditionalized data for memory performance showed that position and perspective do not have effects on the memorability of items. Participants remembered both the objects presented at the top and bottom to the same degree. Furthermore, this pattern of result did not change when objects were presented on a display with depth perspective or not.

3.3 Discussion

Experiment 2 aimed to investigate the effects of perceived spatial distance and perceived size on people's memory judgments and memory performance for objects. Improvements in the design of Experiment 2, and the switch from words to objects were expected to resolve the problems of insignificant effects for perceived spatial distance and size difference on JOLs from Experiment 1. However, it did not.

The only significant result was the main effect of position on peoples' identification latency. Participants identified the objects that were presented in the bottom position faster than the ones at top positions. This difference would reflect the effect of perceived spatial distance if it was significant only at perspective present conditions. In other words, a significant interaction between position and perspective on people's identification speed could mean people have a tendency to identify objects faster when they were proximate. Thus, one possible explanation for the faster identification of bottom objects can be that these objects at bottom positions were circumstantially more optimal for identification. Thus, it points to a preference rather than an influence.

Even though participants identified bottom objects faster than the top ones, this experiential ease did not affect their memory confidence. Their JOLs were the same across all conditions of the study. There was neither an effect of perceived spatial distance, nor of size difference on JOLs. This means that participants did not use experiential difficulty in identification, beliefs about distance, or beliefs about size as a cue while making their memory judgments. Furthermore, in Experiment 1, the JOLs were slightly and insignificantly higher for the words at the top positions with depth perspective. The trend was believed to reflect an effect of perceptual size on people’s memory judgments, since those words were assumed to look bigger in size due to the Ponzo illusion. The reformations in the design of Experiment 2 were expected to uplift the trend to a significant level. However, it disappeared in Experiment 2 when participants were tested with objects. Thus, the results of Experiment 2 did not provide any cue for an effect of beliefs about perceived size on people’s memory judgments.

The major reason for the absence of the trend in Experiment 2 could be the switch from words to objects. Despite the effort to minimize the size difference within the objects in the study list, the objects’ sizes in people’s memory were still different from each other. In other words, even though object pictures were chosen among objects that are meeting our size criteria, there were still some size differences among them in participants’ memory. For instance, a pine apple is still smaller than a penguin even though they are both still bigger than one’s palm and smaller than 30 x 30 boxes. Furthermore, in a study by Haber and Levin (2001) it was shown that, when people are asked to estimate size of the familiar objects, they do not initiate a process including distance estimation. In contrast, they use the information about size of these objects in their memory. Only, when people face with novel stimuli, they take the spatial distance of the stimuli into account while estimating the size of the objects. This shows, size perception and distance perception are not always dependent on each other. Since the objects that were used in the experiment were all very common to participants, participants might not be influenced by the size illusion produced by the Ponzo illusion. In sum, variations within the size of the study objects might have entangled the visibility of the size manipulation.

Lastly, there was no significant effect of perceived size or perceived spatial distance on people’s memory performance as expected. Participants remembered slightly more of the objects from top positions than bottoms. This tendency was more prominent in perspective absent conditions. If the interaction between position and perspective was significant, it could be argued that the top objects on perspective absent conditions induced deeper processing that was cued by participants' slower identifications. Therefore, they were remembered to a greater extent than the ones in other conditions. However, it was not significant. The null results for memory performance in the experiment are similar to the ones observed in previous studies investigating the effect of perceptual fluency on memory performance (e.g. Rhodes & Castel, 2008; 2009; Yue et al., 2013; Mueller et al., 2014).

CHAPTER IV

GENERAL DISCUSSION

The aim of the present study was to explore and explain the origin of the beliefs associated with the effect of perceptual fluency on metamemory and memory. Specifically, beliefs that increase participants' memory confidence for perceptually fluent stimuli were expected to be about spatial distance rather than being specific to experimental manipulations, such as perceived size. The assumed positive correlation between the perceptual fluency and spatial proximity was believed to point to increased memory confidence for proximity.

In two experiments, the perceived distance of the study stimuli from the learners was manipulated by showing stimuli in either top or bottom positions of a background with depth perspective. In this background, while the stimuli at the bottom position appeared more proximate to the learner, the ones at the top positions were expected to appear more distant. Thus, participants were expected to indicate higher confidence for the stimuli at bottom if they were using beliefs about spatial distance in making their memory predictions. On the other hand, perspective present conditions also produced a Ponzo illusion such that the stimuli at the top position of that scene seem assumed to look bigger in size than the ones at the bottom positions. The perceptual size illusion ensured the comparison of the effect of perceived spatial distance and perceived size on people's beliefs about perceptual fluency. Thus, participants were expected to give higher confidence ratings for the stimuli at the top position on a depth perspective if they were using beliefs about size, rather than distance.

For the actual memory performance, both the perceived size difference and perceived spatial distance were not expected to influence participants' actual memory performance. In the literature there are evidences showing that writing study words in larger fonts increases participants' confidence in their learning, without affecting their actual memory performance (Rhodes & Castel, 2008; Mueller et al, 2014). Thus, our expectations for the effect perceived distance and memory performance was congruent with the literature. Beside perceived size, in the literature there is no study showing an effect of perceived distance on memory performance. In a study by Amit et al. (2009) it was shown that objects were processed slower when they were perceptively distant from observers. However, slower processing is not always an indicator of deeper processing. Even though they can be processed slowly, it is not necessary to produce enhanced memory performance. Thus, beside the perceived size, our prediction for the perceived spatial distance and memory was also congruent with the literature.

In two experiments, participants' item-by-item JOLs and performance on free recall tasks were measured for the study items presented at the top and the bottom positions of a background with or without depth perspective. Results revealed that the perceived spatial distance does not have a significant effect on people's memory confidence. Thus, proximity did not increase people's memory confidence through activating beliefs about perceptual fluency as expected. Participants' memory confidence was same for both top and bottom positions across perspective present and absent conditions when tested with words (Experiment 1) or with pictures (Experiment 2). Thus, even though the perceived distance manipulation was assumed to be obvious for participants, they did not use it as a cue while making their memory judgments.

The insignificant effect of perceived spatial distance on metamemory highlights the importance of experiential difficulty in perceptual fluency. In two experiments, perceived distance of the stimuli was manipulated in such a way that objects at proximate or distant positions were not different in the level of experiential difficulty they initiate. In other words, they were physically the same stimuli. Furthermore, our distance manipulation should be obvious to them since at the beginning of the study they were all informed that the experiment aims to test effects of different backgrounds and positions on memory. Furthermore, despite using the relationship between spatial distance and perceptual fluency in their everyday life to interact accurately with their environment, they did not use it as a cue in their learning. The reason for this could be the lack of experiential difficulty associated with any condition of the experiments. In nature, things get harder to perceive as they depart. However, there was assumed to be no experiential difficulty associated with distance. Furthermore, in the previous studies of perceptual fluency, participants were able to experience so called difficulty at first hand (e.g. Besken & Mulligan, 2013; Yue et al, 2013; Besken, 2016). However, in the present study, difficulty was primed through a distance manipulation. In other words, the cue of experiential difficulty was second-hand information for participants and it was implicit. This might explain participants' preference to not use spatial distance as a source of information while making their judgments.

To solve this problem, in the future studies study stimuli can be shown in different physical sizes in proximate and distant positions. Specifically, the size of the stimuli that will be presented at distant position can be reduced. Thus, ones at distant positions can appear smaller in size than the ones at proximate positions. Amit et al. (2009) in their third and fourth experiments used this method. Their stimuli at the distant positions were 20% smaller in size than the ones at the proximate positions. Furthermore, in their fifth experiment they showed that this size difference between stimuli does not affect the participants' processing speed when objects were shown on a neutral scene with no depth cue. Thus, in order to retest the effect of perceived spatial distance on memory judgments, the same strategy can be used in future studies. Moreover, small size difference are not expected to have a confounding effect on results.

Beside the perceived spatial distance, perceived size also did not affect participants' memory predictions. It was unexpected since it is known that people report higher confidence for their memory for the large words than small font words (Rhodes & Castel, 2008). In Experiment 1, the top words presented on the depth perspective background received slightly higher confidence ratings from the participants. The reason for it was thought to be their size being relatively bigger than the ones at bottom. However, this difference was not statistically significant and it is not known if participants were able to realize the size difference. Furthermore, in Experiment 2, when the same effect was tested with objects together with improvements in the design, the trend of increased confidence for perceptually bigger stimuli completely disappeared. The reason for it can be the small size differences between the objects that were used in the study. Even though pictures were all the same size, the sizes of the objects they represent were still different in one's memory. In more detail, objects that were used in the study were in size bigger than one's palm, and smaller than 30 x 30 cm box yet a glove is still smaller than a puppy in people's memory. Therefore, size difference within the objects probably limited the magnitude of the Ponzo illusion. In other words, the magnitude of the Ponzo illusion was too small to reach participants' threshold of awareness to affect their judgments. As was mentioned in the introduction, in order to manipulate people's judgments, it should reach to their threshold of awareness (Susser et al., 2015).

To solve this problem, in the future studies, stimuli can be chosen according to more strict criteria for the size. If pictures of familiar objects are going to be used as stimuli, they should all be the same size. However, it might be hard to find enough objects of the same size. At this point, using unfamiliar objects might solve the problem. Haber and Levin (2001) in their study showed that while making size estimates, people tend to use the stored size information in their memory, only when those objects were common or familiar to them. Thus, using unfamiliar objects, or ambiguous 2-D or 3-D shapes can be more appropriate to test the effect of perceived size on metamemory with the pictures.

On the other hand, another strategy can be using words instead of objects. Words, when chosen among the ones with same letter lengths are more similar to each other in terms of their footprint. Thus, they might be a better option for investigating the effect of small size differences. Consistent with this claim, in Experiment 1, there was an insignificant effect of perceived size difference on people's memory judgments. The between subjects manipulation of perspective could have increased the effect to a significant level. However, changing from the words to object pictures in Experiment 2 disabled testing the hypothesis. Therefore, in a future study, the Experiment 2 can be replicated by using words instead of object pictures.

Lastly, for the memory performance there was no significant effect of perceived size or perceived spatial distance on participant's actual memory performance. The finding for perceived size and memory was expected and coherent with the previous research showing the insignificant effect of size on memory (Rhodes & Castel, 2008; Mueller et al., 2014). Furthermore, the insignificant effect of perceived spatial distance was also expected since in the literature there is no evidence for it. In some situations in which manipulation of perceptual fluency leads to difficulty in perception, like inversion, effortful processing produces enhanced memory performance (Sungkhasettee et al.,2011). However, in the present study, perceptual fluency of the stimuli was manipulated through a visual illusion. Specifically, the Ponzo illusion caused the objects at top positions to look bigger in size on the depth perspective background while they were physically the same size with the ones at the bottom positions. Thus, there was not a factor that was likely to produce difficulty in perception. Therefore, the equivalent memory performance for stimuli was not surprising.

On the other hand, in Experiment 1, the words in the bottom position were remembered slightly better than the ones at the top positions. However, this position effect was only marginally significant. Furthermore, when increased memory for bottom stimuli retested with object pictures in Experiment 2, the trend changed in a way that stimuli at top positions were remembered slightly better. Thus, the increased memory performance for the bottom words in Experiment 1 and the top objects in Experiment 2 were just a coincidence of these stimuli appearing in a more optimal position for learning in those conditions. In Experiment 2, the stimuli at bottom positions were surprisingly identified faster by participants. However, it is not known if the effect of position on identification speed can explain the slightly better performance for the top positions in that experiment. The analyses for it were not conducted since the memory difference between top and bottom positions was not statistically significant. If the difference for memory was significant, it could be tested if memory performance correlates with participants’ speed in identifying the stimuli.

Beside the ones that were mentioned above, one of the major limitation of the current study was trying to test two opposing hypothesis in same perspective conditions. If people were holding beliefs about perceived spatial distance, they were supposed to indicate higher confidence for the objects at the bottom (proximate) position on a scene with depth perspective. In contrast, if they were used to hold beliefs specifically about the perceived size, they were supposed to indicate higher confidence for the ones at the top position on a depth perspective for looking bigger in size. Thus, the two opposing effects might have cancelled the effect of each other and produced null results for both.

In order to eliminate the possible effect of perceived size on perceived spatial distance manipulation, the objects at top positions can be shown in a smaller size. Firstly, in a pilot study, participants can be asked to adjust the size of the stimuli at the top position to the one at the proximate position. The method of adjustment is commonly used in studies on visual size illusions (eg. Murray et al., 2006). Having determined the apparent size difference between top and bottom stimuli on depth perspective, objects then can be presented in such a way that the ones at the top positions were downsized for that amount. This would clear up the effect of perceptual size difference from the effect of perceived spatial distance.

To sum up, the present study aimed to investigate the origin of the beliefs associated with the perceptual fluency effect on metamemory and memory. Since these beliefs sometimes lead learners to monitor their learning falsely, and end up with inadequate learning, exploring the origins of these beliefs was important. In this sense, it was the first study in the literature that attempted to define what these beliefs are about, rather than solely observing their effects. When Rhodes and Castel (2008) introduced the perceptual fluency hypothesis for the first time, they pointed out its relationship with spatial distance. However, in the literature, no study directly attempted to explore the effect of perceived distance on metamemory in the absence of experiential disfluency. The present study revealed that perceived spatial distance does not affect peoples’ judgments about their memories. Furthermore, it highlighted the fact that experiential difficulty is an important factor for initiating perceptual fluency’s effect on metamemory.

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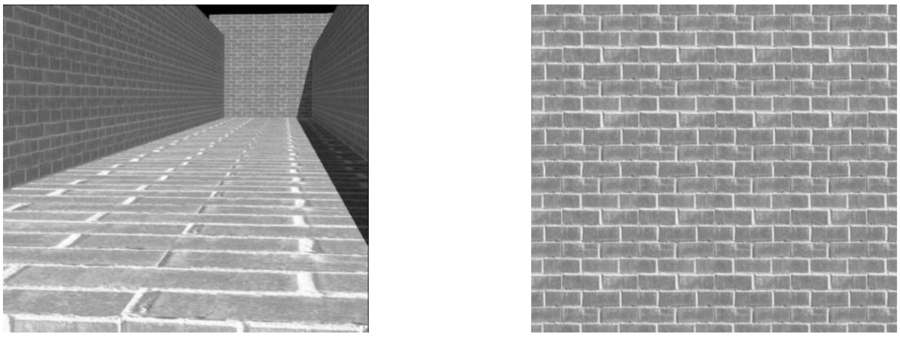
APPENDICES

APPENDIX A

BACKGROUND IMAGES OF EXPERIMENT 1



A) Hall

B) Wall

APPENDIX B

STUDY WORDS AND WORD FREQUENCIES (Göz, 2003)

Study Words	Word Frequencies	Study Words	Word Frequencies
limon	60	çarşı	60
yılan	61	kasım	62
konuk	64	cephe	64
eylül	75	makam	66
kadeh	65	barış	67
tepsi	69	koyun	69
havuz	71	şerit	71
katil	68	boğaz	75
bahar	74	biber	73
pasta	79	türkü	79
konak	60	aslan	60
gümüş	61	deyim	60
hisse	64	ceket	64
sezon	66	bulut	66
cisim	68	evren	68
sıfır	69	çamur	69
albüm	78	hapis	71
düğme	75	liman	76
kanat	74	sahil	73
sergi	71	teyze	79
evlat	78	yapıt	78
zihin	77	kuram	77
fizik	72	şüphe	70
çukur	70	yargı	71

APPENDIX C

DISTRACTOR TASK

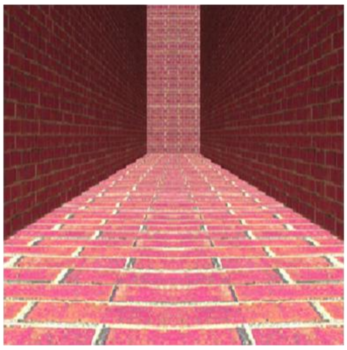
Örn.
KAHRAMANMARAŞ
_ A N _ _ K _ _ E
İ _ _ L
_ U _
Ç _ _ K _ _ _
M _ N _ _ A
K _ _ S _ R _
E _ İ _ N _
B _ L _ C _ K
T _ _ _ T
S _ V _ S
B _ R T _ _
K _ _ A _ A _
O _ D _
B _ _ U
V _ N
K _ _ Y _
_ _ K _ _ E _ İ _
_ N _ A _ A
İ _ M _ _
S _ K _ R _ A
E _ _ Z _ Ğ
A _ D _ N

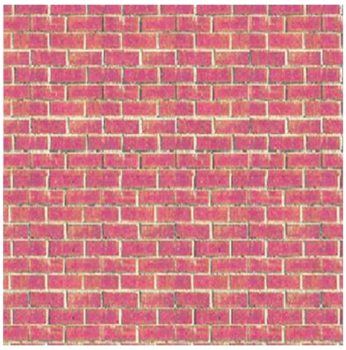
M _ _ _ T _ A
K _ R _ E _ _ R
_ R _ _ R _ _
_ İ _ _ İ _
A _ _ O _
T _ _ İ _ D _ _
_ İ İ _ _
Y _ L _ _ _
_ O _ _ M
A _ T _ İ _
K _ _ A _ _ K
D _ N _ _ L _
_ Ğ _ _ R
A _ D _ H _ _
N _ Ğ _ _
_ M _ S _ _
A _ R _
İ _ T _ N B _ L
T _ _ B _ _ N
H _ K _ A _ _
K _ R _
Y _ Z _ A _
_ İ _ E

A _ T _ _ Y _
G _ _ İ A _ T _ _
K _ _ A _ L _
B _ N _ Ö _
A _ S _ R _ Y
B _ _ _ A N
_ A _ S _ N
Z _ N G _ _ D _ _
_ E _ _ _ H _ R
E _ Z _ _ _ A _
Ş _ _ N _ K
K A _ _ A _ _ N _
D _ Y _ _ B _ _ I _
B _ _ B _ _ T
_ İ R _ _ U N
A _ _ Y _ _ A N
G _ _ _ Ş _ A _ E
_ Ü _ A _ Y _
K _ _ I _ _ A L _
T _ N _ E _ _
K _ R _ L _ _ E _ İ
S _ _ O _
B _ L _ _ E _ İ _

APPENDIX D

BACKGROUND IMAGES OF EXPERIMENT 2


A) Hall


B) Wall

APPENDIX E

EXTRA DATA OF EXPERIMENT 2

	Total Typing Time for Positions		Memory Performance for Positions	
Conditions	Top	Bottom	Top	Bottom
Perspective Present	1529.0833	1523.0208	.41	.40
	(337.16493)	(310.27272)	(.12)	(.11)
Perspective Absent	1518.8542	1488.4792	.46	.43
	(358.83875)	(304.58627)	(.14)	(.14)

Note. Total typing times reflect the duration between participants' initiation and termination of typing the name of the objects during the identification task. Memory performances show participant's mean proportion of accurate recalls for the entire list of objects.