Current Research and Reviews in Psychology and Psychiatry
2024; 4(1): 54-66

ARAŞTIRMA MAKALESİ **RESEARCH ARTICLE**

The Effects of Unexpectedness and Emotional Arousal on Long-Term and Short-Term Memory

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Abstract

Objective: Memory is quite selective. Many factors (e.g. familiarity, unexpectedness, emotions) affect memory performance. The current study investigates the effects of unexpectedness and emotional arousal on long-term and short-term memory.

Method: For this aim, 125 undergraduate students were randomly assigned into 4 conditions: 2 unexpectedness (high vs. low) and 2 emotional arousal (negatively-valanced vs. positively-valanced). For unexpectedness manipulation, 9 commonly used Turkish proverbs were used. A word was removed from the middle of each proverb and proverbs were presented to the participants. Then, they were asked to mentally guess the missing word. In the next page, the missing part was filled in with a new word. Words that did not disrupt the flow of meaning and were similar to the original word extracted from the proverb were used for the low unexpected condition. While new words chosen far from the original word were used for the high unexpected condition. Two types of music (positive vs. negative valance) were used for emotional arousal. Short-term memory performance includes the number of correct words remembered after the experiment, while long-term memory includes the number of correct words remembered 24 hours after the experiment.

Results: According to the findings of the study, emotional arousal did not create a significant difference in short- and long-term memory performance. Based on measurements of both long- and short-term memory performance, low unexpected stimuli were better remembered in both long and short-term memory compared to high unexpected stimuli.

Conclusion: The result of the study showed that the low unexpected stimulus group, when combined with negative stimulation, led to increased performance in long-term memory. Thus, both stimulus unexpectedness and the degree of unexpectedness seem to have impact on memory performance.

Keywords: Unexpectedness, Emotional Arousal, Short Term Memory, Novelty, Long Term Memory

Received: 30.04.2024; **Revised:** 16.06.2024; **Accepted:** 18.06.2024; **Publication:** 30.06.2024

Citation: Pirpiroglu I., & Unal, G. (2024). The effects of unexpectedness and emotional arousal on long-term and short-term memory. *Current Research and Reviews in Psychology and Psychiatry*, *4*(1), 54-66.

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Beklenmediklik ve Duygusal Uyarılmanın Uzun Süreli ve Kısa Süreli Bellek Üzerindeki Etkileri

Öz

Amaç: Bellek oldukça seçicidir. Çeşitli faktörler (örneğin, yenilik, beklenmediklik, duygular) bellek performansını etkiler. Bu çalışma, beklenmediklik derecesi ve duygusal uyarılmanın uzun ve kısa süreli bellek üzerindeki etkilerine incelemektedir.

Yöntem: Bunun için 125 lisans öğrencisi rastgele olarak 4 gruba ayrılmıştır: 2 beklenmediklik (yüksek ve düşük) ve 2 duygusal uyarılma (negatif değerli ve pozitif değerli). Beklenmediklik manipülasyonu için, 9 yaygın kullanıma sahip Türk atasözü kullanıldı. Her bir atasözününün ortasından bir kelime çıkarıldı ve atasözleri katılımcılara sunuldu. Katılımcılardan boşlukları zihinsel olarak tahmin etmeleri istendi. Bir sonraki sayfada, boşluk yeni bir kelime ile doldurulduu. Düşük beklenmediklik durumu için, anlam akışını bozmayan ve atasözünden çıkarılan orijinal kelimeye benzer olan kelimeler kullanıldı. Yüksek beklenmediklik durumu içinse orijinal kelimeden anlamsal olarak uzak kelimeler kullanıldı. Duygusal uyarılma için iki tür müzik (pozitif ve negatif değerli) kullanıldı. Kısa süreli bellek performansı, deneyden sonra hatırlanan doğru kelimelerin sayısını içerirken, uzun süreli bellek ise deneyden 24 saat sonra hatırlanan doğru kelimelerin sayısını içerir.

Bulgular: Araştırma bulgularına göre, duygusal uyarılma kısa ve uzun süreli bellek performansında anlamlı bir fark yaratmamıştır. Uzun ve kısa süreli bellek performans ölçümleri sonucuna göre, düşük beklenmedik uyaranlar yüksek beklenmedik uyaranlara göre hem uzun hem de kısa süreli bellekte daha iyi hatırlanmıştır.

Sonuç: Çalışmanın sonucu, düşük beklenmedik uyarıcıların, negatif uyarılma ile birleştirildiğinde uzun süreli bellekte performansın artmasına neden olduğunu gösterdi. Dolayısıyla hem uyarıcı beklenmedikliğinin hem de beklenmedikliğin derecesinin bellek performansı üzerinde etkili olduğu görülmektedir.

Anahtar Kelimeler: Beklenmediklik, Duygusal Uyarılma, Yenilik, Kısa Süreli Bellek, Uzun Süreli Bellek

Introduction

Memory research has showed that memory is very selective. There are many factors that affect what information enters memory systems. Among these factors, novelty unquestionably stands out (Baddeley et al., 2015). For many years, in cognitive neuroscience, researchers have focused on the effects of emotional stimuli on memory (Dolcos & Cabeza, 2002). The current study aims to see the effects of both unexpectedness and emotional arousal on short- and long-term memory.

Unexpectedness

New stimuli attract more attention and are encoded into memory more effectively than familiar stimuli (Nyberg, 2005). Based on the positron emission tomography (PET) technique, Tulving and Kroll (1995) suggested that subcortical and cortical regions in the brain respond more to novel stimuli than to familiar stimuli. In addition, in the novelty/coding hypothesis, they mentioned that the novelty evaluation system in the brain directs new stimuli to further processing in the early stage of coding for later recognition. Furthermore, in repetition studies, activation during encoding in the temporal and prefrontal regions is associated with the recognition of novel stimuli (Kirchhoff et al., 2000). In functional magnetic resonance imaging (fMRI) studies, participants were presented with a repetition of a group of images before trial. The other group was presented with the stimulus for the first time during the experiment. While neural activity decreases as a result of repeatedly presented images, brain activity increases in many regions in newly presented images (Nyberg, 2005).

It is possible to define novelty in its simplest and general sense as situations or stimuli that do not exist in the individual's memory system and require the creation of new representations by the observer. (Barto et al., 2013; Berlyne, 1960). There are various categories of novelty in cognitive neuroscience: spatial novelty,

contextual novelty, associative novelty, and stimulus novelty (Reichardt et al., 2020). Associative novelty manipulation includes re-presenting previously well-known familiar stimuli in a different (novel) arrangement (Nyberg, 2005). This difference may be spatial, item-item or temporal (Kumaran & Maguire, 2007; Reichardt et al., 2020). Associative novelty is most closely related to the concept of surprise and difficult to classify (Barto et al., 2013).

The concepts of novelty, surprise, and unexpectedness are frequently mentioned together in the literature. While they are closely related, they are distinct from each other. Thus, understanding the relationship between these concepts is important. Regarding this fact, the concept of surprise is a response that occurs because of the inconsistency between expectations, the encountered reality and experience (Barto et al., 2013). Some novel stimuli trigger a surprise response, but not every novel stimulus elicits a surprise response. As the brain encounters new stimuli, it engages in appraisal. If this appraisal is powerful enough to generate a surprise signal and surpasses the threshold, a surprise response occurs. The reason is that the stimuli creating the surprise response are also inherently unexpected (Reichardt et al., 2020; Skavronskaya et al., 2021). Positive effect of novelty manipulations on memory depends on the degree of unexpectedness of the stimulus (Reichardt et al., 2020) and that associative novelty manipulation is closely related to unexpectedness.

Considering the findings and guidance of the literature we focused on the degree of unexpectedness and created our low and high unexpected stimulus conditions. Thus, it was expected that novel stimuli would be remembered better than familiar stimuli. Connectedly, the first hypothesis was as follows: “Participants in the high unexpected stimulus group demonstrate better short- and long-term memory performance than those in the low unexpected stimulus group”.

Emotional Arousal

Emotional arousal strengthens memory by activating neural mechanisms. Especially factors such as elaboration and attention are important for memory encoding (Hamann, 2001). Emotional stimuli are easily recalled compared to neutral stimuli. This is because emotional arousal, regardless of its content, is important for the survival of species (Quevedo et al., 2003).

Music is a generally used as a method of inducing emotion to observe the effect of emotional state on cognitive processes such as memory in an experimental setting (Grenee et al., 2010). Studies show that music reveals many different emotions, and these emotions are confirmed through both personal assessment methods and psychophysiological measurements (Thayer & Faith, 2001). Especially, the strong emotional reactions of the participants to music were independent of the music education and the reactions were consistent among the participants (Krumhansl, 1997).

Emotional experience has two dimensions. While valence indicates a continuum such as positive/negative, pleasant/unpleasant, arousal refers to calmness/excitement depending on the degree of activation (Nineuil et al., 2020; Thayer & Faith, 2001). Eschrich et al. (2008) showed that positive valence music led to better recognition performance, while arousal had no significant effect on recognition. Similarly, Samson et al. (2009) showed that although arousal did not affect memory significantly, valence had significant impact. In their study, participants were given a recall test 24 hours after listening to the excerpts, and the music representing happiness led to better recall performance compared to sadness. While some studies show that the effect of valence on memory is unclear, they focus on the positive

effects of high arousal on memory by increasing attention and facilitating encoding (Alonso et al., 2015).

In the literature on emotional arousal, the results of studies focusing on arousal and valence are contradictory. Thus, for the current study, solely, the effect of valence on memory is investigated. Connectedly, the second hypothesis is as follows: "Participants in the positive valence emotional arousal group demonstrate better short- and long-term memory performance than the negative valence emotional arousal group".

Finally, the third hypothesis, which were created to observe the effects of both emotional arousal and unexpectedness on short- and long-term memory, was as follows: "Participants in the high unexpected stimuli group perform better in short-term memory when exposed to positive valence emotional arousal". Since, to the authors' knowledge, there exist no studies that focus on the degree of unexpectedness and also examine the effect of emotional arousal on short- and long-term memory, the current study will hold significant importance for the literature.

Method

Participants

A total of 125 (16 male, $\bar{x}$=22.03, SD=1.55) corrected vision undergraduate psychology students (low unexpectedness/negative valence: 32, low unexpectedness/positive valence: 30, high unexpectedness/negative valence: 36, high unexpectedness/positive valence: 27) aged 18-33 in Ankara, Turkey participated in this study.

Measurement Tools

Unexpectedness manipulation

It is a task created by the researcher to see the effect of unexpectedness on short- and long-term memory. A total of 9 commonly used Turkish proverbs of 4-5 words were selected, and the word was removed from the middle of each proverb (see Appendix A). Then, these proverbs were presented to the participants in the form of a PowerPoint presentation (e.g. "İşleyen demir tutmaz"). There were two slideshows for two different conditions (i.e., high and low unexpectedness). Participants were asked to guess the word that would be a missing word. On the next page, the missing word was filled in with a red word and presented to the participants. While reading the proverbs, participants will be able to easily fill in the missing word in their minds. However, in order to ensure unexpectedness, for the high unexpected condition, an unrelated word was inserted into the gap (e.g. "İşleyen demir buz tutmaz"), while for the low unexpected condition, a new word that was similar to the original word or did not disrupt the flow of the sentence was inserted (e.g. "işleyen demir kir tutmaz"). The words in both conditions will be unexpected for the participants because they will be presented with proverbs that are frequently used in daily life and are expected to be known by everyone who knows Turkish well.

Short- and long-term memory measurements

To measure short-term memory, participants were asked to fill in the gaps in the sentences presented throughout the experiment immediately after the presentation of proverbs. In total, 9 sentences were presented during the experiment. Participants were expected to remember the gap in each sentence. The accuracy of the words written for each gap was evaluated.

To measure long-term memory, the participants were contacted 24 hours later and asked to fill in the gaps in the same sentences again. They received 1 point for each correctly remembered word on both scales. In this measurement, which they can get a maximum of 9 points in total, a high score is an indicator of high long and short-term memory performance.

Emotional arousal manipulation

We used two types of music that induce emotional arousal in our study. Participants in the positive valence group listened to 1.30-minute section of Antonio Vivaldi's "La Primavera (Spring) from The Four Seasons", while participants in the negative valence group listened to Joaquin Rodrigo's "Adagio" from the Concerto for Guitar an Orchestra.

The music used for positive stimulation was taken from Krumhansl's (1997) study. In his study, both emotional evaluations and physiological measurements such as respiratory, cardiac, vascular, and electrodermal function were taken from the participants. According to study, the excerpt "La Primavera (Spring) from The Four Seasons" by Antonio Vivaldi has been shown to represent happiness (Krumhansl, 1997).

The music used for negative stimulation was taken from Thayer and Faith's (2001) study. They listed the emotions created by 17 musical sections using facial electromyography (EMG).

Accordingly, Joaquin Rodrigo's "Adagio" from the Concerto for Guitar an Orchestra represents sadness (Thayer & Faith, 2001).

Demographic information form

It was developed to collect demographic information (such as age, gender) from participants.

Design and Procedure

It is a 2 unexpectedness (high vs. low) and 2 emotional arousal (negative valence vs. positive valence) mixed design. The experiment was conducted face to face and responses were collected online via Google Forms during the study. The implementation of the research was approved by Ankara Yıldırım Beyazıt University Health Sciences Ethics Committee (decision no. 365-08; date: 27.10.2023). Participants first completed the informed consent form. After that, they were randomly assigned to the manipulation conditions. Participants in each condition first listened to the music in the relevant arousal manipulation condition for 1.30 minutes, then regarding the unexpectedness manipulation condition, they first saw the proverb with one word missing and were asked to mentally fill in the relevant blank, and then saw the new red word version added to the blank on the second page. The same procedure was applied for each proverb. Participants were not specifically instructed to memorize the red words. In order to measure short-term memory immediately after the presentation was completed, participants were asked to write down the red words in the sentences presented throughout the experiment. For long-term memory, 24 hours later, participants were asked to write down the words presented in the experiment. Then, they were asked to answer the demographic information form after solving the manipulation control questions on the other page of the form. After the research was completed, the study was concluded by presenting the study information form to the participants and thanking them for their participation.

Results

Unexpectedness Manipulation Check

To ensure that the proverbs to be presented before the experiment would be high and low unexpected proverbs, a pilot study was conducted before the main study and participants were asked to evaluate each proverb (1) low unexpectedness to (10) high unexpectedness. According to the independent samples t-test, the low and high unexpectedness groups were significantly different from each other, $t_{(38)}=2.28$, $p=0.028$. According to this result, the proverbs presented in the high unexpectedness condition were more unexpected by the participants than the proverbs presented in the low unexpectedness condition.

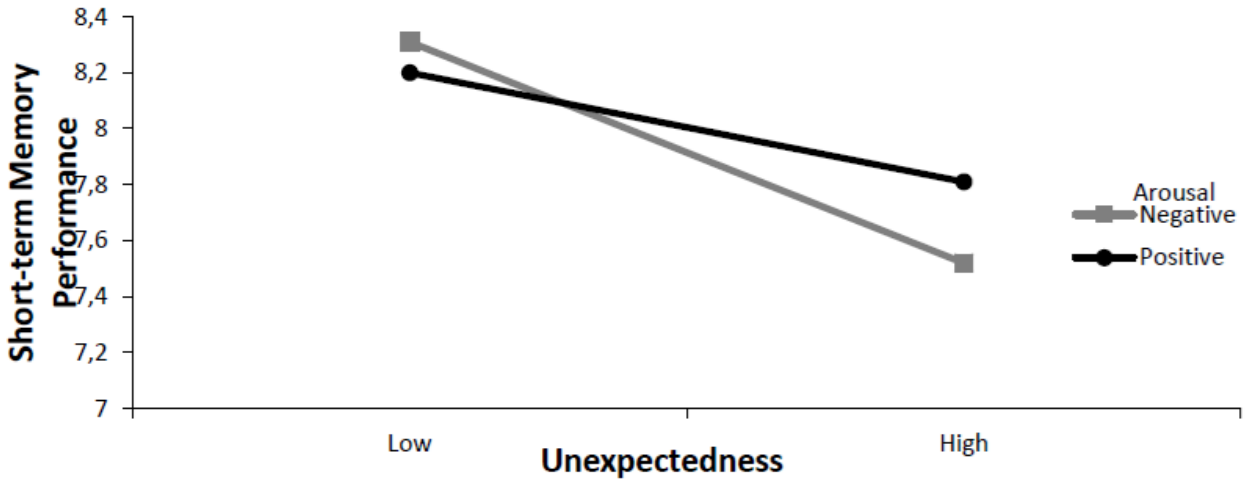

Figure 1. Interaction Effect of Unexpectedness and Emotional Arousal on Short-term Memory

Emotional Arousal Manipulation Check

Although the two types of music used in the study have negative and positive values, a pilot study was conducted before the actual experiment and participants were asked to evaluate the two types of music (e.g., "How sad did the melody of the music make you?"). According to the independent samples t-test, the negative and positive valence groups were significantly different from each other, $t_{(38)}=2.18$, $p=0.035$. According to these results, the music presented in the negative valence group was evaluated as more negative than the music presented in the positive valence group.

Main Analyses

An initial two-way ANOVA analysis was conducted to investigate the effect of unexpectedness and emotional arousal on short-term memory. According to the Levene Test, the equality of the variables was ensured $F_{(3, 121)}=2.38$, $p=0.144$. The result indicated that the main effect of unexpectedness was significant, $F_{(1, 121)}=7.08$, $p=0.009$, partial $\eta^2=0.055$. The low unexpectedness group ($\bar{x}=8.25$, $SD=0.15$) showed better short-term memory performance than the high unexpectedness group ($\bar{x}=7.67$; $SD=0.16$). However, the main effect of emotional arousal was not significant $F_{(1,121)}=0.15$, $p=0.692$, partial $\eta^2=0.001$. Additionally, as Figure 1 shows, the interaction effect of unexpectedness and emotional arousal was not significant $F_{(1,121)}=0.83$, $p=0.365$, partial $\eta^2=0.007$.

A two-way ANOVA analysis was re-conducted in order to investigate the effect of unexpectedness and emotional arousal on long-term memory. According to the Levene Test, the equality of the variables was ensured $F_{(3, 121)}=1.17$, $p=0.321$. The result showed that the main effect of unexpectedness was significant, $F_{(1, 121)}=5.31$, $p=0.023$, partial $\eta^2=0.042$. The low unexpectedness group ($\bar{x}=7.83$, $SD=0.19$) showed better long-term memory performance than the high unexpectedness group ($\bar{x}=7.19$, $SD=0.19$). The main effect of emotional arousal was not significant, $F_{(1, 121)}=0.95$, $p=0.330$, partial $\eta^2=0.008$. However, as seen in Figure 2, the interaction effect of unexpectedness and emotional arousal was significant $F_{(1, 121)}=4.71$, $p=0.032$, partial $\eta^2=0.038$.

To test nature of the interaction effect, separate independent samples t-test of unexpectedness on long term memory among negative and positive level of emotional arousal was run. Among positive level of emotional arousal group, independent sample t-test was not significant $t_{(55)}=0.08$, $p=0.934$. However, among negative level of emotional arousal group, independent t-test was significant $t_{(66)}=3.57$, $p=0.001$. The results showed that low

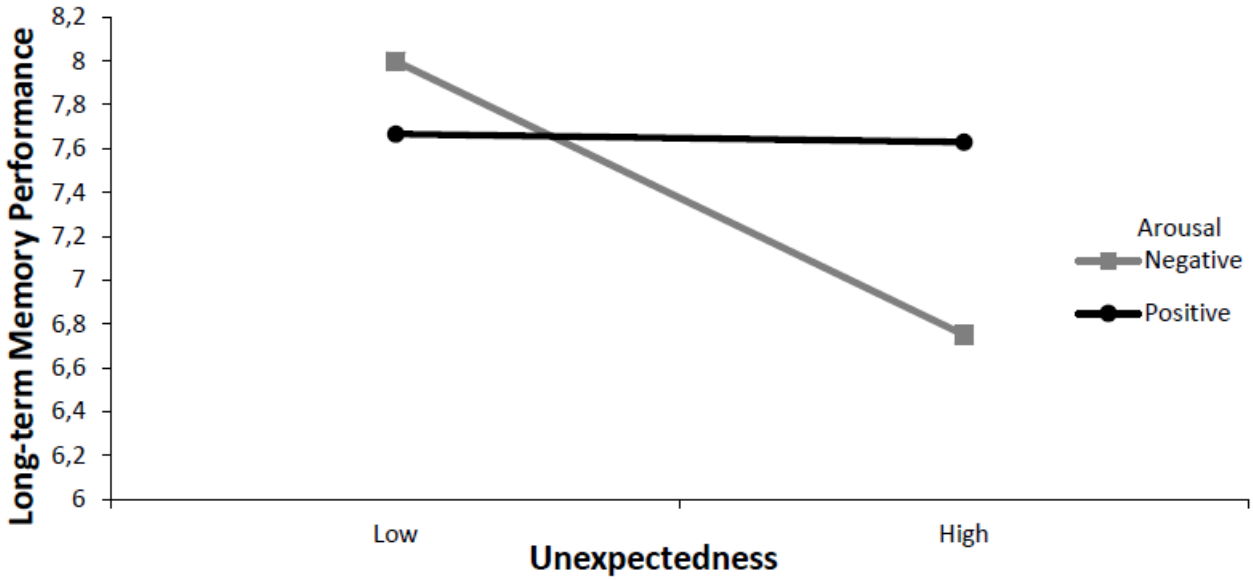

Figure 2. Interaction Effect of Unexpectedness and Emotional Arousal on Long-term Memory

unexpectedness group ($\bar{x}$=8.00, SD=1.10) had significantly greater than high unexpectedness group ($\bar{x}$=6.75, SD=1.67).

Discussion

The result of the study showed that unexpected stimuli have a significant effect on short- and long-term memory performance. Low-level unexpected stimuli were remembered better in a short-term memory test than high-level unexpected stimuli. In this case, although the first hypothesis was not supported, an opposite result was obtained. It was proposed that high unexpected stimuli would be remembered better than low unexpected stimuli in both short-term and long-term memory performance. The significant effect of unexpectedness on memory is not surprising. Many studies in the literature show the positive effect of unexpected stimuli on memory by attracting attention, leading to more advanced processing, and requiring more cognitive effort (Kirchhoff et al., 2000; Nyberg, 2005; Tulving & Kroll, 1995). Still, there exist very few studies focusing on the degree of unexpectedness, which is among the future directions of many studies (Reichardt et al., 2020). One of the aims of the present study was to focus on the degree of unexpectedness, in line with the demand of the literature, by accepting the positive effect of novel stimuli on memory compared to familiar stimuli as a prerequisite. Salient (i.e. unexpected, novel) stimuli attract attention in a bottom-up manner. Thus, memory performance is positively affected (Ravizza et al., 2016). However, how salient the stimulus is may be an important point. Contrary to what was expected, low unexpected stimuli were remembered better than high unexpected stimuli. The main reason for this could be that the stimuli presented to the participants were exposed to in daily life, since proverbs were preferred for unexpectedness manipulation in the study. In the low unexpected condition, participants' previous schemas for their stimuli were not violated much because the words used were similar to the original or words that did not disrupt the sentence structure, but in the high unexpected condition, these schemas were greatly violated. It is thought that this situation creates problems for the participants in encoding the stimuli and remembering them later on. In addition, the high unexpected condition may have made this process difficult by creating a high cognitive load at the point of processing the stimuli. Therefore, it is important to pay attention to this

issue in the selection of unexpected manipulation stimuli in future studies.

It also appeared that the hypothesis that emotional arousal would have a significant impact on long- and short-term memory was not supported. There are several studies indicate the effects of emotional stimuli on memory performance (Grenee et al., 2010; Hamann, 2001; Quevedo et al., 2003). At this point, it is quite surprising not to see a significant main effect. Although the first explanation is to question individual differences or the technique used to induce the emotion, these two possibilities can be ignored. Because before the main experiment, selected music to induce emotion was evaluated by the participants in a pilot study. In addition, the selected music has been used in previous studies on emotions in the literature. Lastly, at the end of emotional stimulation, participants were asked to evaluate their current emotional state by asking manipulation control questions. But, as a limitation of the study, mood assessment was not made before the experiment. Emotional arousal manipulation control questions were asked only at the end of the experiment. Additionally, the negative valence arousal group combined with the presentation of low unexpected stimuli produced a significant difference in long-term memory performance relative to short-term memory performance.

It was hypothesized that participants in the high-unexpected stimuli group would perform better in short-term memory when exposed to positively valanced emotional arousal. The result, as mentioned above, was exactly the opposite. We have discussed the positive effect of low unexpected stimuli rather than high unexpected stimuli. So, the important question here is that: Why did negative arousal, and not positive arousal, result in increased memory performance? Although positive mood is associated with increasing creative problem-solving ability and cognitive processes, it makes it easier to see the big picture by expanding attention. However, a negative mood causes selective attention and focused attention, making it easier to capture details (Grenee et al., 2010). In fact, this was exactly what was expected from the participants. Therefore, in the positive arousal condition, the fact that the participants generally focused on the sentences and could not pay attention to the words given in the blanks supports these results. Thus, they later performed poorly on the memory test because they could not fully focus on the words. On the other hand, low unexpected stimuli combined with negative arousal are thought to lead to deeper and more attentive processing of stimuli, resulting in increased memory performance. However, all of this is not enough to explain why it has a significant effect on long-term memory performance but not on short-term memory performance. In a study examining the effect of emotional arousal on long- and short-term memory performance, no significant effect was found on short-term memory (STM) performance, while the effect was significant on long-term memory (LTM) performance (Quevedo et al., 2003). It is suggested that the lack of emotional arousal effect in STM is due to the difference in the involvement of the amygdala in LTM and STM. In accordance with the memory consolidation hypothesis, while hippocampal activity does not affect STM, it increases LTM performance through the amygdala (Quevedo et al., 2003). At this point, it is very important to discuss the effect of neurobiological factors. Although this is not the purpose of the current study, it should be noted as a future direction. It is thought that different neural networks and brain regions are involved in the processing of high unexpected and low unexpected stimuli, (Modirshanechi et al., 2023) as well as negative and positive stimulation.

The present study examines the effects of the degree of unexpectedness and emotional arousal on short- and long-term memory

performance. The result showed that when the unexpectedness of the stimuli was lower, it would lead to a significant increase in memory performance. Low unexpected stimuli when presented with negative arousal resulted in increased long-term memory performance. It is thought that these findings will be a basis for future novelty studies.

Author Contributions: P.I. design of the study, literature review, collection, processing and interpretation of data, writing the article, creation and implementation of the experimental program, tracking of participants. **U.G.** design of the study, processing and interpretation of data, approval of the final version to be published, creation and implementation of the experimental program, critical revision of the article.

Declaration of Conflicting Interests: Authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Source(s) of Support: The authors did not receive support from any organization for the submitted work.

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Appendices

Appendix A

Unexpectedness Manipulation

High unexpectedness condition

Değerli katılımcı lütfen PowerPoint sunusunda karşınıza çıkan cümleleri dikkatle okuyunuz. Her bir cümledeki boşluğu zihninizden tahmin etmeye çalışınız. Ardından sonraki sayfada aynı cümlenin kırmızı renkli bir kelime ile tamamlanmış şeklini göreceksiniz. O cümleyi ve kelimeyi de dikkatli okuyunuz.

(1. sayfa) Ak akçe …… gün içindir.

(2. sayfa) Ak akçe yağmurlu gün içindir.

(3. sayfa) Damlaya damlaya …… olur.

(4. sayfa) Damlaya damlaya okyanus olur.

(5. sayfa) Denize düşen …… sarılır.

(6. sayfa) Denize düşen martıya sarılır.

(7. sayfa) Görünen köy …… istemez.

(8. sayfa) Görünen köy dürbün istemez.

(9. sayfa) Yalancının …… yatsıya kadar yanar.

(10. sayfa) Yalancının çakmağı yatsıya kadar yanar.

(11. sayfa) İşleyen demir …… tutmaz.

(12. sayfa) İşleyen demir buz tutmaz.

(13. sayfa) Gülü seven …… katlanır.

(14. sayfa) Gülü seven fiyatına katlanır.

(15. sayfa) Sakla …… gelir zamanı.

(16. sayfa) Sakla parayı gelir zamanı.

(17. sayfa) Doğru söyleyeni dokuz …… kovarlar.

(18. sayfa) Doğru söyleyeni dokuz ülkeden kovarlar.

Low unexpectedness condition

Değerli katılımcı lütfen PowerPoint sunusunda karşınıza çıkan cümleleri dikkatle okuyunuz Her bir cümledeki boşluğu zihninizden tahmin etmeye çalışınız. Ardından somaki sayfada aynı cümlenin kırmızı renkli bir kelime ile tamamlanmış şeklini göreceksiniz. O cümleyi ve kelimeyi de dikkatli okuyunuz.

(1. sayfa) Ak akçe …… gün içindir.

(2. sayfa) Ak akçe zor gün içindir.

(3. sayfa) Damlaya damlaya …… olur.

(4. sayfa) Damlaya damlaya deniz olur.

(5. sayfa) Denize düşen ……sarılır.

(6. sayfa) Denize düşen düşmana sarılır.

(7. sayfa) Görünen köy …… istemez.

(8. sayfa) Görünen köy harita istemez.

(9. sayfa) Yalancının …… yatsıya kadar yanar.

(10. sayfa) Yalancının feneri yatsıya kadar yanar.

(11. sayfa) İşleyen demir …… tutmaz.

(12. sayfa) İşleyen demir kir tutmaz.

(13. sayfa) Gülü seven …… katlanır.

(14. sayfa) Gülü seven hasrete katlanır.

(15. sayfa) Sakla ……gelir zamanı.

(16. sayfa) Sakla tohumu gelir zamanı.

(17. sayfa) Doğru söyleyeni dokuz …… kovarlar.

(18. sayfa) Doğru söyleyeni dokuz kasabadan kovarlar.

Appendix B

Unexpectedness and Emotional Arousal Manipulation Check

Değerli katılımcı lütfen aşağıdaki soruları 1-10 arası puanlandırarak cevaplayınız.

1. Cümlelerdeki boşluklar sizin için ne kadar beklenmedikti? (1=çok beklendik 10=çok beklenmedik)
2. Sunulan cümleler sizin için ne kadar neşeli/komikti? (1=hiç neşeli değil 10=çok neşeli)
3. Müziği dinlerken kendinizi ne kadar enerjik hissettiniz? (1=çok düşük enerji 10=çok yüksek enerji)
4. Müziği dinlerken kalp atış hızınızın hızlandığını hissettiniz mi? (1=hiç hızlanmadı 10=çok hızlandı)
5. Müziğin ritmi ve temposu sizi ne kadar heyecanlandırdı? (1=hiç heyecanlandırmadı 10=çok heyecanlandırdı)
6. Müziği dinlerken kendinizi ne kadar mutlu hissettiniz? (1=hiç mutlu hissetmedim 10=çok mutlu hissettim)
7. Müziğin melodisi sizi ne kadar hüzünlendirdi? (1=hiç hüzünlendirmedi 10=çok hüzünlendirdi)