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Memory Effects During Gradual Background Change

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Abstract

Life is experienced continuously, but our memories are separated into distinct events. The segmentation of our memories is thought to result from spatial and temporal changes within our environment, experienced as *event boundaries.* Prior research on event segmentation has shown increased errors in temporal order memory (memory of the sequence of objects over time) and perceived distance in subjective distance ratings (an individual's mental representation of how far apart objects are from each other) for items experienced across context changes, but how contextual changes affect associative memory (memory of the context an object was bound to) has received less attention. Little research has focused on how temporal and associative memory are impacted by gradual transitions in context. Through three behavioral studies, I have examined how gradual background transitions impact temporal order memory, subjective distance ratings, and associative memory. In all three experiments, participants watched a video of a person encountering items while passing through several background environments that transitioned gradually. Across experiments, we found no boundary effect on temporal order memory or subjective distance. Unexpectedly, we consistently found impaired associative memory for items adjacent to the boundary. Together, these results suggest that the causes of these boundaries may be more nuanced than previously expected. These insights deepen our understanding of how our minds organize our continuous experiences into the distinct events we remember.

1. Introduction

Human experiences are continuous from the moment we wake up to the moment we fall asleep. So why do we recall discrete memories? The leading theory describing this phenomenon is the Event Segmentation Theory, which hypothesizes that ongoing experiences are segmented into discrete events due to changes in spatial or temporal context, also known as *event boundaries* (Zacks et al., 2007). For example, if you get dressed in your bedroom and then enter the bathroom to brush your teeth, the change in location would indicate the end of one event and the start of a new one. The Event Segmentation Theory is fundamental in understanding the structure of episodic memory, or our conscious memory of everyday events, in humans. Because people frequently experience contextual shifts in everyday life, like moving from one room to another, studying memory at event boundaries helps explain how we organize our continuous experiences into memorable episodes. This organization is crucial for the retrieval of distinct events while maintaining a continuous sense of self.

Several studies have demonstrated that event boundaries affect temporal memory. Temporal memory is primarily assessed by looking at the order memory of paired items. Specifically, temporal order memory assesses the accuracy of recalling a sequence of items within and across events (DuBrow & Davachi, 2013). Previous work supports that temporal order memory is negatively impacted by event segmentation due to event boundaries

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interrupting item-item integration processing, or the pairing of two items together in memory, leading to incorrect recollection (Heusser et al., 2018). This is commonly tested in a laboratory setting by asking participants to identify the order in which items were displayed on a computer screen (Clewett et al., 2020; DuBrow & Davachi, 2013). These previous studies have consistently shown decreased accuracy in order recall with items across a boundary compared to within, showing that the integration of item-item processing is being interrupted, thus supporting the event segmentation theory.

Beyond recalling the order of items, temporal memory can also be examined by having participants rate the perceived distance between item pairs, either within or across an event boundary, typically on a scale from "very close" to "very far". Here, "distance" refers to the subjective temporal distance between two items, or how far apart item pairs are remembered to be in time. Critically, item pairs are presented at a fixed temporal distance across all trials, making it easier to see a distance effect when pairs are rated as further apart. Previous studies have shown that items separated by an event boundary tend to be perceived as farther apart than those within the same event, even when the distance between them is equated (Clewett et al., 2020; Wang & Egner, 2022). This reflects the idea that distinct events are stored as separate episodes in memory, making moments across boundaries feel more distant than those within a single event (Heusser et al., 2018). These results demonstrate a perceived separation of events, showing how event boundaries influence the objective and relative components of temporal memory.

Episodic memory requires the ability to recall the timing and sequence of specific events. Measures of temporal memory, such as order accuracy and perceived distance, allow us to assess these important components of episodic memory. Temporal order memory offers an objective assessment of event segmentation, whereas distance ratings provide insight into the subjective component (Clewett et al., 2019). Together, these measures provide a deeper understanding of how different aspects of event segmentation shape episodic memory.

Though there has been a primary focus on how event boundaries impact temporal memory, less research has investigated how event boundaries impact associative memory. While the order of events is crucial for establishing episodic memory, changes between events are often distinguished by associations between items and context, making associative memory equally important to study. Though limited, previous studies have assessed associative memory by presenting participants with an item and asking them to place it in the context (such as a colored background) it was paired with during the study (Heusser et al., 2018; Riegel et al., 2023). There has been preliminary evidence for a decrease in errors in item-context binding when items are adjacent (presented immediately before or after a context change) to the boundary compared to nonadjacent items. For example, if a sequence of items has a purple border background and then switches to an orange border background, the items that come before and after the color change would have enhanced memory for the color they were associated with. This is believed to be due to participants focusing their attention on novel boundary shifts, therefore paying closer attention to item-context pairings adjacent to boundaries (Heusser et al., 2018).

Most studies assessing temporal and associative memory rely on distinct changes in context, such as presenting participants with a series of images one at a time (Clewett et al., 2020; Heusser et al., 2018; Van De Ven et al., 2022). While this model's simplicity allows for more control in a laboratory setting, it fails to capture the nuances of our day-to-day environments. Using film clips better encapsulates the dynamic and continuous nature of people's lives, but the camera cuts still lead to distinct boundaries. As a result, there has been little focus on assessing temporal and associative memory with gradual transitions in context. Addressing this gap is important for understanding how events are structured under more naturalistic settings.

To address these gaps in the literature, this study assesses temporal and associative memory using a novel task design that incorporates a continuous video format of presenting items one by one. Importantly, the transitions in context are gradual, meaning they change in a continuous, slow manner similar to those in real life. For example, rather than the environment abruptly changing, a person walking from a park to a city would notice fewer trees start and buildings become more frequent, as the environment gradually transitions. I incorporated temporal order memory and subjective distance ratings as benchmarks to compare with associative memory, given that the effects of these measures are robust in previous literature. I hypothesized that temporal order memory would be more difficult to remember, and subjective distance ratings of item pairs would be perceived as farther apart when across the boundary compared to within the boundary. I also hypothesized that associative memory of item-scene pairs adjacent to the boundary will differ from item-scene pairs nonadjacent to the boundary. As this hypothesis was exploratory due to a lack of research on associative memory with gradual context changes, I did not predict the directionality of this hypothesis. Previous literature has primarily assessed associative memory with distinct, abrupt context changes, and it is unclear if the same memory outcomes will occur for gradual context changes. Therefore, I made no directional predictions.

Three separate experiments were conducted to best answer my hypotheses. Experiment 1 assessed temporal order memory, subjective distance ratings, and associative memory across gradual background transitions versus within gradual background transitions. Experiment 2 replicated Experiment 1 while increasing the number of backgrounds to further investigate the null temporal order memory and subjective distance ratings results in the prior experiment. Experiment 3 focused on associative memory, as there was consistently a significant impairment in associative memory for items adjacent to the gradual background transitions across all experiments. This sequence of experiments allowed for a strong comprehension of how associative memory is impacted during gradual changes in background.

2. Methods

2.1 Rationale

All three experiments were approved by the University of Oregon's Institutional Review Board.

In Experiment 1, I aimed to investigate the effects of gradual background transitions on temporal memory and associative memory. I found no significant effects on temporal memory when item pairs were within or across background transitions. Additionally, memory was impaired in item-scene associative memory when items were adjacent to the boundary, which contradicts previous findings (Heusser et al., 2018; Riegel et al., 2023). The purpose of Experiment 2 was to increase statistical power by increasing the sample size and adding more boundaries.

Associative memory results were consistent across Experiments 1 and 2. A third iteration was important to ensure its robustness as these unexpected results contradict those in previous literature (e.g., Heusser et al., 2018; Riegel et al., 2023). This third experiment aimed to assess associative memory on all 28 items to see if the results can be replicated with an increased number of trials.

2.2 Participants

Participants in all three experiments were undergraduate students from the University of Oregon and were recruited using Sona, the University of Oregon's human subjects pool, in exchange for course credit. In Experiment 1, I recruited fifty-two participants, ages 18-20 (45 female, 3 male, 1 nonbinary; *M*age = 18.57, *SD* = 0.61). Demographics were not collected from three participants because of computer issues. Thirteen participants were excluded due to failure to complete all the tasks. After exclusions, a total of thirty-nine participants were included in data analysis (36 female and 3 male; *M*age = 18.56, *SD* = 0.60). In Experiment 2, I recruited ninety-six participants, ages 18-30 (71 female, 21 male, 2 nonbinary; *M*age = 19.40, *SD* = 1.93). Demographics were not collected from two participants because of computer issues. Twelve participants were excluded for not completing all the tasks. One participant was excluded for performing worse than two standard deviations from the mean on the temporal order memory assessment. This left a total of eighty-three participants for data analysis (65 female, 15 male; *M*age = 19.25, *SD* = 1.74). Seventy participants were recruited for Experiment 3, ages 18-22 (46 female, 20 male; *M*age = 19.02, *SD* = 1.09). Demographics were not collected from five participants due to computer issues. The goal was to collect an equivalent sample size as in Experiment 2; however, the sample size was limited by resource and time constraints. Three participants were excluded for performing below chance on the associative memory assessment. This left a total of sixty-seven participants for data analysis (44 female and 19 male; *M*age = 18.98, *SD* = 1.11).

2.3 Materials

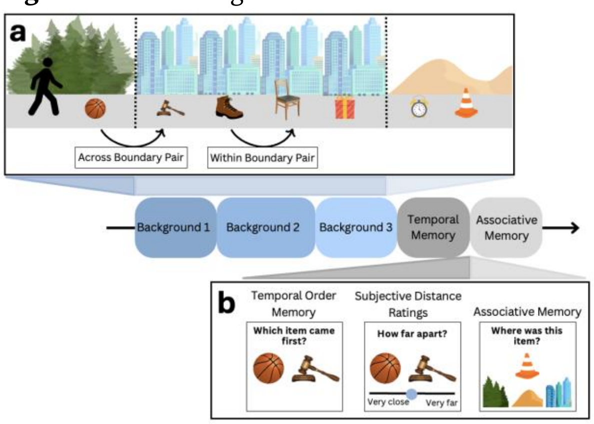
2.3.a Experiment 1: Temporal and Associative Memory

Participants watched a video where a character encountered 28 items one at a time. The background changed intermittently throughout. After the video, participants completed three memory tests in two separate blocks of trials. For temporal memory, participants were shown pairs of items (a distance of 0 or 2 apart) and asked which one came first. The same pair of items was then shown, and participants had to indicate how far apart the items were on a scale of "very close" to "very far." For the second block, participants were shown an item and asked to pair it with the background in which it was located. Importantly, items in the associative memory block were never seen in the temporal memory block.

This study was conducted in a laboratory setting. Prior to starting this in-person study, participants gave informed consent and completed an electronic demographic questionnaire. Participants then watched a two-minute and forty-five-second video in which a character encountered 28 items one at a time. The background changed three times (city, mountains, and plains) and transitioned gradually (Figure 1a). Participants were assigned one of eight videos according to their participant ID number. All videos contained the same backgrounds and items and were counterbalanced so that item and background locations were not the same across participants. Additionally, the videos were designed specifically for this experiment and made using the platform Unity. The items in the videos appeared on the ground as the character reached set points in the scene and would disappear once the character encountered them. After watching the video, temporal memory was assessed for eight item pairs (Figure 1b). Four item pairs were either right next to each other in the video the participant just watched (distance = 0), and four item pairs were separated by two items (distance = 2).

To assess if temporal memory was impaired or improved at the background transitions, tested item pairs were selected such that two pairs spanned the background change (one at a distance of 0 and one at a distance of 2) while six item pairs did not. Temporal order memory was probed by presenting an item pair and asking which appeared first. Since items were previously viewed from left to right in the video, item location was randomized across participants during this assessment so that items weren't consistently shown on the left or right side of the screen. This was done to prevent potential location bias, or the tendency to select items on the right, since, in the video, items on the right would come before those on the left. Participants responded by pressing buttons on the top of the keyboard (either '1' for the item on the left or '0' for the one on the right). Immediately after, subjective temporal distance ratings were assessed for the same pair by asking how far apart participants believed the items were from each other. Participants used a slider to indicate the distance on a scale ranging from "very close," "close," "far," and "very far." For analysis, four discrete labels denoted different parts of a continuous slider ranging from 0 (very close) to 1 (very far). The first and last items were excluded from the pairings since people remember the first and last items in a list better, which inflates the memory effects. These assessments and analyses of temporal memory align with those used by previous literature (Clewett et al., 2020; Wang & Egner, 2022).

Figure 1. Task Design



Note. Schematic of the task design for Experiment 1.

In addition to these traditionally used measures, an associative memory test was administered (Figure 1b). Participants were shown an item and asked to pair it with the background they recalled the item being displayed in front of, similar to prior research (Heusser et al., 2018; Riegel et al., 2023). All three backgrounds shown in the video were presented. Participants were asked to use the keyboard to indicate their responses ('j' for the background on the left side of the screen, 'k' for the background in the middle, and 'l' for the background on the right). The remaining ten items that had not been previously used to assess temporal memory were shown for the associative memory assessment. Of those assessed, two of the items were adjacent to a background change (one before and one after the change). Participants were debriefed upon completion of the experiment.

2.3.b Experiment 2: Temporal and Associative Memory with Increased Power

Experiment 2 used the same 28 items as Experiment 1 but contained four backgrounds (city, plains, forest, and mountains) to increase the number of boundaries. Temporal memory was assessed for nine item pairs after watching the video. Four item pairs were at a distance of 0, and four were at a distance of 2. One item pair was the first and last items as an attention check, which was used as exclusion criteria for analyses. For associative memory, all four backgrounds were shown on the screen. Participants used the keyboard to indicate which background in which the item was shown ('a' for the background on the top left of the screen, 's' for the bottom left, 'k' for the top right, and 'l' for the bottom right). Ten items were assessed for associative memory, with four items being adjacent to the background change (two before and two after the change).

2.3.c Experiment 3: Associative Memory

Experiment 3 used a different set of 28 items that were normalized using ResMem, a machine-learning model that assesses the memorability of images (Needell & Bainbridge, 2022). Normalization involves evaluating images of items to ensure that they are neither too memorable nor too forgettable. Because a novel paradigm was used, normalization ensured that potential item effects in Experiment 1 or 2 were minimized. Participants watched a two minute and forty-five second video in which a character encounters the 28 items one at a time across four backgrounds (woods, plains, city, and mountains). After completing the video, participants were probed on associative memory only. All 28 items were assessed.

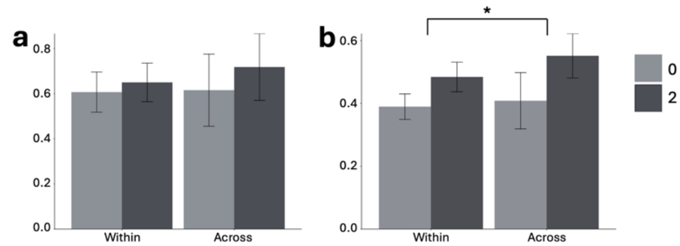
3. Results

3.1 Temporal Memory

3.1.a Experiment 1: Temporal and Associative Memory

The purpose of this study was to investigate the differences in temporal and associative memory caused by gradual background transitions. To examine temporal order memory, I used a 2x2 ANOVA on the proportion of correct responses, with boundary type (across vs. within) being the first within-subject factor and distance (0, 2) being the second. The results showed no main effect for boundary ($F(1, 114) = .010$, $p = .922$), distance ($F(1, 114) = .240$, $p = .625$), or boundary x distance interaction ($F(1, 114) = .236$, $p = .628$; Figure 2a). This means that temporal order memory was not significantly different for items across versus within a gradual background change. For subjective distance ratings, I used a 2x2 ANOVA to compare the perceived distances using the same factors. There was no main effect for boundary ($F(1, 152) = .173$, $p = .678$) or distance x boundary interaction ($F(1, 152) = .570$, $p = .452$), but there was a significant distance effect ($F(1,152) = 4.352$, $p = .039$; Figure 2b). These results indicate, contrary to the hypothesis, that no boundary effects on temporal memory were found, whether measured by temporal order memory or subjective distance ratings.

Figure 2. *Experiment 1 Temporal Memory Results*

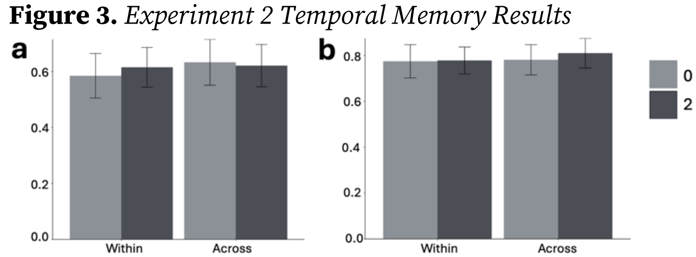


Note. Temporal memory results of Experiment 1. **a)** Proportion correct for temporal order memory split by across vs. within boundary by distance (0, 2). **b)** The average subjective distance ratings for item pairs within vs. across the boundary by distant (0, 2). Brackets indicate significant difference between the distances within the within and across boundary groups. Asterisk (*) indicates significance at $p < .05$.

3.1.b Experiment 2: Temporal and Associative Memory with Increased Power

The purpose of this study was to increase the number of boundaries increase statistical power. A 2x2 within-subject ANOVA with boundary (within, across) and distance (0, 2) as predictors and temporal order memory as the dependent variable showed no main effect for boundary ($F(1,328) = .489$, $p = .485$), distance ($F(1,328) = .054$, $p = .816$), or boundary x distance interaction ($F(1,328) = .296$, $p = .587$; Figure 3a). A 2x2 within-subject ANOVA with boundary and distance as predictors and subjective distance ratings as the dependent variable did not show a main effect for boundary ($F(1, 246) = .363$, $p = .548$), distance ($F(1, 246) = .264$, $p = .608$), or distance x boundary interaction ($F(1, 246) = .157$, $p = .692$; Figure 3b).

Figure 3. *Experiment 2 Temporal Memory Results*



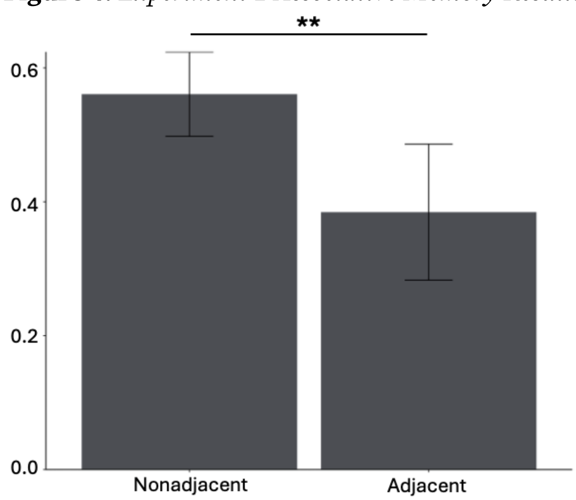
Note. Temporal memory results of Experiment 2. **a)** Proportion correct for temporal order memory split by item pairs across vs. within boundary by distance (0, 2). **b)** The average subjective distance ratings for item pairs within vs. across boundary by distance (0,2).

3.2 Associative Memory

3.2.a Experiment 1: Temporal and Associative Memory

A pre-registered exploratory analysis was conducted to examine the effects of boundaries on associative memory. This was assessed by looking at the proportion of correct responses for item-scene pairs adjacent vs. non-adjacent to the background transitions. The paired t-test showed that participants' memory for the item-scene associations was greater for items nonadjacent to the boundary (M = 0.56, SD = 0.19) compared to items adjacent to the boundary (M = 0.38, SD = 0.31, $t(38) = 3.00$, $p = .005$; Figure 4). These results support the hypothesis that associative memory is impacted by gradual background transitions.

Figure 4. *Experiment 1 Associative Memory Results*

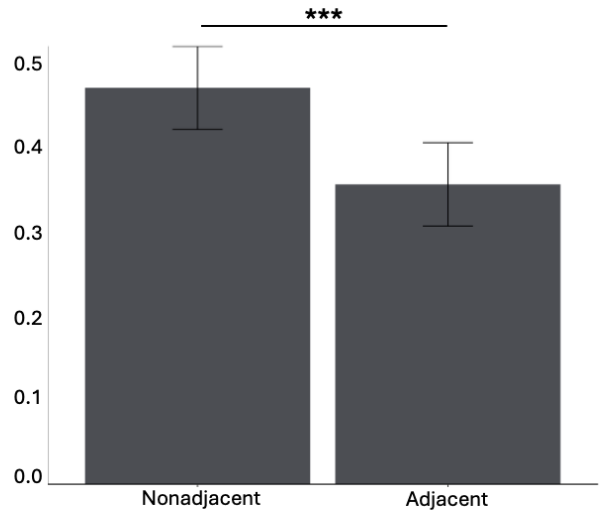


Note: Associative memory accuracy for items split by items adjacent and nonadjacent to the boundary. Asterisk (**) indicates $p < .01$.

3.2.b Experiment 2: Temporal and Associative Memory with Increased Power

As in Experiment 1, item-scene associative memory was analyzed using a paired t-test comparing boundary adjacent and boundary nonadjacent items. The paired t-test showed a greater increase in errors for items adjacent to the boundary (M = 0.36, SD = 0.23) compared to items nonadjacent (M = 0.47, SD = 0.23, $t(82) = 3.87$, $p < .001$; Figure 5). These results suggest that associative memory was impacted by background transitions.

Figure 5. *Experiment 2 Associative Memory Results*

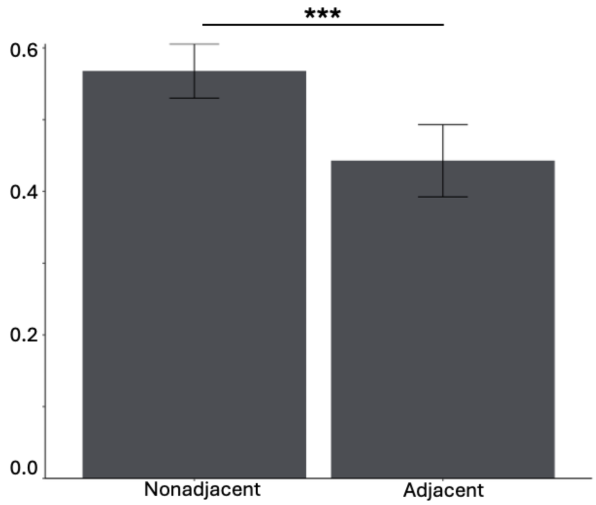


Note. Associative memory accuracy by boundary (adjacent vs. nonadjacent). Asterisks (***) indicates $p < .001$.

3.2.c Experiment 3: Associative Memory

The purpose of this study was to focus on the effects of gradual background transitions on associative memory. I used a paired t-test to look at the proportion of correct responses for item-scene pairs within vs. across the boundary and found an increase in errors for items adjacent to the boundary (M = 0.44, SD = 0.21) compared to nonadjacent (M = 0.57, SD = 0.16, $t(66) = 3.97$, $p < .001$; Figure 6). These findings suggest that associative memory was influenced by the transition in the background.

Figure 6. *Experiment 3 Associative Memory Results*



Note: Associative memory performance split by items adjacent vs. nonadjacent to boundary. Asterisks (***) indicates $p < .001$.

4. Discussion

4.1 Experiment 1: Temporal and Associative Memory

Experiment 1 revealed no effect on temporal memory but increased errors in associative memory at boundaries. These findings were unexpected as they are contradictory to those established in previous literature. Past results have consistently shown impaired temporal order memory (Clewett et al., 2020; DuBrow & Davachi, 2013) and that items are perceived as further apart (Clewett et al., 2020; Wang & Egner, 2022) across a boundary compared to within. Our results showed no significant difference in temporal memory across or within a boundary, suggesting that the transition in background did not disrupt item-item integration processing. Additionally, associative memory has consistently been shown to increase when items are adjacent to the boundary compared to nonadjacent items (Heusser et al., 2018; Riegel et al., 2023). Interestingly, these results demonstrate a reversed effect.

Combined, our results raise questions about whether segmentation occurred across these gradual background transitions. It is important to note that much of the literature has assessed temporal and associative memory by presenting context changes distinctly. The gradual background transitions used in this novel paradigm may not be abrupt enough to demonstrate previously found event boundary effects. Alternatively, this study includes a limited number of trials for each participant, so the lack of effect may be due to low statistical power. Due to these discrepancies, Experiment 2 was conducted to increase the statistical power of our results.

4.2 Experiment 2: Temporal and Associative Memory with Increased Power

The purpose of Experiment 2 was to increase statistical power, which was done by increasing the sample size and number of potential boundaries. The goal of this study was to verify the findings from Experiment 1 and evaluate the robustness of previously observed findings. Results were consistent with those of Experiment 1, showing no boundary effect for temporal memory and an impairment of associative memory at the boundary. Given the increased errors in associative memory across Experiments 1 and 2, we decided to maximize the number of trials assessing this effect to further establish its significance.

4.3 Experiment 3: Associative Memory

Experiment 3 focused on associative memory to see if the previously observed effects would replicate with increased trials. Results revealed that increased errors were present at the boundaries when participants were probed on associative memory for all items. This finding is consistent with Experiments 1 and 2, suggesting it is a robust effect.

5. General Discussion

This set of experiments investigated the effect of gradual background changes on temporal and associative memory. Experiment 1 examined the temporal memory effects for items across versus within three backgrounds that gradually transitioned between each other. There was an increase in errors in associative memory for items adjacent to the boundary compared to nonadjacent, but no boundary effect was shown for temporal memory. In Experiment 2, the number of backgrounds was increased to four and a larger sample size was tested to determine whether the null effects from Experiment 1 were due to low statistical power. Consistent findings were shown, with a significant boundary effect for associative memory but not temporal memory. Experiment 3 examined associative memory to check the robustness of the results found in Experiments 1 and 2. I found that participants exhibited an increase in errors for items adjacent to the boundary, replicating the previous findings.

Based on prior literature, it was predicted that there would be increased errors for temporal order memory and that subjective distance ratings would be perceived as further apart for items across the spatial changes. Additionally, I predicted that there would be a difference in associative memory for items adjacent to the boundary compared to nonadjacent items. The hypothesis that temporal memory would be impacted by boundary change was not supported by the results, conflicting with prior literature. Importantly, the hypothesis that associative memory would be impacted by a gradual boundary change was supported across all experiments. The associative memory results showed the opposite trend from that in previous literature (Heusser et al., 2018; Riegel et al., 2023).

A possible explanation for this difference in temporal memory findings from previous work may be due to the present work's original method of manipulating context. Previous studies have assessed temporal memory by presenting images one by one, rather than a continuous presentation as implemented here. In prior literature, context is changed through alterations in image border color (Heusser et al., 2018; Riegel et al., 2023), audio (Clewett, 2020), or task type (DuBrow & Davachi, 2013; Wang & Egner, 2022). All context changes occur suddenly to disrupt item-item integration processing (DuBrow & Davachi, 2013). In this study, the context changes were introduced as a gradual change in background to better mirror the way context changes occur in everyday life. This approach is equivalent to studies that use movie clips as stimuli to reflect the gradual, continuous nature of everyday experiences, while still maintaining control over what participants encode. As an example, Schwan & Garsoffky (2004) found that participants were able to segment moments into events when watching continuous videos of step-by-step tasks. This indicates that continuous stimuli can be used to demonstrate event segmentation while maintaining ecological validity. Similarly, the present task design, rather than using unnatural context changes, may better reflect how experiences, such as moving through spaces, are remembered in real-life contexts.

The slow, continuous transitions may not have been distinct enough to elicit a boundary effect. One possibility is that this more naturalistic approach mirrors real-world contexts where individuals perceive fewer boundaries, implying that gradual changes alone may not be enough to elicit event segmentation. Conversely, the way the boundaries were manipulated may not have captured the salience of real-world boundaries, which, though often gradual and continuous, are still relatively distinct enough to induce event segmentation. More research is needed to pinpoint whether the lack of a boundary effect demonstrates more of our real-life experiences or a limitation in how gradual changes were used in this study.

Research examining continuity editing, a film technique used to maintain a continuous flow within a scene, shows that following a character at a consistent pace on a 180° plane helps audiences perceive a smooth flow of the film, regardless of how the background changes (Magliano & Zacks, 2011). In this study, the incorporation of a walking character was simply so the video camera could follow an object separate from the items participants were encoding. The character was not added for flow, though it may have unintentionally triggered perceptual flow. In line with continuity editing principles, this perceptual flow may have subtracted attention from the changing backgrounds, reducing the probability of participants segmenting each background into separate events. Future research should investigate how perceptual flow and context distinctiveness interact to trigger event boundaries.

The reduced salience of background changes may also explain the unexpected impairment in associative memory for items adjacent to boundaries. Prior research has found decreased errors at boundaries, likely due to increased attention during moments of context changes (Heusser et al., 2018). In the present study, perceptual flow and visual competition (where multiple on-screen elements compete for attention) may have contributed to the impairment in associative memory observed here. Supporting this, Mazza et al. (2004) found that participants more accurately identified changes in the foreground than in the background. In fact, having salient information present in the foreground seemed to further reduce the attention given to background changes. The results of the present experiments may be due to participants' inability to identify transition points, likely caused by visual competition between the foreground (character and items) versus background (scenes) components present on screen. Unlike in previous research, where images are shown in the center of the screen, here, items were placed on a path on the bottom of the screen, with the background filling the rest to mimic more naturalistic item encounters. This manipulation may have prevented participants from attending to both the item sequence and background change as they happened in different areas of the screen. If participants were unable to properly attend to item order, the sequence could not be used to generate pairs to be used as anchor points for associative memory. This task design better resembles that of everyday life, where multiple streams of information from the background and foreground fight for attention. Future studies should consider how visual competition interacts with event segmentation, especially in more real-world relevant contexts.

In conclusion, these experiments challenge the generalizability of the Event Segmentation Theory to gradual, naturalistic context changes. Here, the results contradict previous findings that demonstrate differences in temporal and associative memory with distinct context changes, suggesting that event segmentation may be more nuanced than previously anticipated. This work emphasizes the need for further investigation into the degree of distinctiveness and salience a context change needs to elicit an event boundary. Additionally, these studies showcase the importance of further studying how attention influences the creation of event boundaries and item-scene associations. Future research should continue to explore more naturalistic paradigms to assess the Event Segmentation Theory, since context changes are often continuous and subtle. This collection of studies provides important insight into how we can establish a better, real-world understanding of how our memories are fragmented in our everyday lives.

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