

EFFECTS OF MEMORY INDUCTION ON MEMORY
ENCODING AND RETRIEVAL

By

SEDONA FRANCHESKA COSTE

A Thesis Submitted to the Honors College
In Partial Fulfillment of the Bachelors degree
With Honors in
Psychology

THE UNIVERSITY OF ARIZONA

M A Y 2 0 1 8

Approved by:

Dr. Matthew Grilli
Department of Psychology

Abstract

This paper addresses the role of episodic memory induction on memory encoding and retrieval in younger and older adults. This study had 70 participants: 40 young and 30 older, both split into an experimental (episodic specificity induction) group and a control (gist based) group. All participants were asked to recall an event from their life in which they were personally involved and then, based on their pre-assigned condition, were asked questions about the memory either in the episodic specificity interview, or the gist based interview. Afterwards, participants participated in a visuospatial event memory test that consisted of a series of videos, then a filler task designed to distract participants, then were asked to recall as many details about the videos as they could. The number of details recalled served as the dependent variable in the study. The results were that the young adults who had the episodic specificity induction recalled more details compared to the gist based group. There was no significant difference between memory performances in the older adults. Additional probing did not eliminate the advantage for the episodic specificity group in the young adults, the idea that an episodic encoding mode was induced in this group was supported.

Literature Review

In studying memory, it is important not only to be able to distinguish between different kinds of memory, such as episodic or semantic, but also to be able to understand the processes of encoding of memories and retrieval of memories. Episodic memories are memories that involve re-experiencing single events (Grilli & Verfaellie, 2015). This could mean anything from a day spent at a family vacation, to taking an exam, to even walking your dog. Semantic memories are memories that consist of culturally shared knowledge about the world such as facts, concepts, vocabulary, and perhaps most important, concrete knowledge and facts about the self (Grilli & Verfaellie, 2014). However, knowledge about the self often comes from reactions to life experiences, and perhaps included in that knowledge, episodic memories. Episodic and semantic memories are both types of declarative memory, which are memories that can selectively receive information from perceptual or cognitive systems, retain different aspects of this information, and transmit that information to other systems. Then, the memory can be converted into behavior and conscious awareness (Tulving, 1972).

The relationship between episodic memory and detail recall has been examined, wherein processes that contribute to memory and imagination are linked to enhancement of episodic processes. It has been seen that when participants are primed with an episodic specificity task, there are increases in recall of episodic details that are related to remembering or imagining an event, but not picturing. In a 2014 study by Madore and colleagues, a picture description element was introduced and the effects on memory for both younger and older adults were recorded. The picture functioned as the main task in the study, where in the first session, the participants looked at picture and reported a memory or imagination related to each, and in the second session did the same but instead watched a video. The participants in the episodic specificity induction were

told to report about the surroundings, people, and actions depicted in the photo/video. The participants in the control induction were asked to focus on their impressions, thoughts, and feelings were about the photo/video as a whole, and then asked questions regarding their thoughts about the photo/video. The researchers found that in both sessions, the participants in the specificity induction produced more internal details provided on their memory and imagination tasks, but did not produce more external details (Madore et al., 2014). Their work suggests that the specificity induction affected episodic processes that have a similar role in memory and imagination (2014). External details are details that involve related facts and references to outside events and while important in certain circumstances, are often recalled more similarly to semantic memories.

Tulving and Thomson first defined the encoding specificity principle of memory in 1973. The principle states that human memory is best when the information available during encoding is also available during retrieval (Puglisi et. al, 1988). Retrieval can be defined as the processes that are initiated by a cue, that lead to the emergence of a conscious representation of a specific episode (Rugg, Johnson, & Uncapher, 2015). Since then, many psychological studies have attempted to utilize the concept of the encoding specificity principle. Puglisi and colleagues (1988) tested this principle, alongside the general encoding principle, in both younger and older adults. This study paired a picture with a word, and measured the frequency of verbal association when participants were asked to generate a word when presented with only a picture. The results indicated that both young and older adults were able to pair the correct words with the pictures and indeed benefitted from the effects of episodic specificity. There was limited evidence for an effect from the general encoding induction on the older adults, but in general, under full and

undivided attention, both young and older participants recalled more when the cues were presented at encoding and retrieval (1988).

Our study aims to understand how encoding memory in a specific way can allow an individual to better retrieve it. Simply put, encoding is a process that occurs in the brain that converts the stimulus into mnemonic information (Tulving & Thomson, 1973). However, memory is not just storing information, it must be accessible in order for later use, and retrieval plays a large part in the act of remembering an episodic or semantic detail. Memory can be divided up into two parts: encoding information regarding the event and its details, and retrieving the information from storage for use in the present time (1973). Although encoding and retrieval are separate processes, there is an overlap in their physical locations in the brain. The largest area of overlap in the two functions was in the middle of the longitudinal extent of the right hippocampus, as well as the outside the medial temporal lobe (Meltzer & Constable, 2004). In the Meltzer and Constable study, participants were asked to remember a list of easy or hard words, along with a cue word that would help them remember the words on the initial list. It was found that formation of the memory trace in the hippocampus, and the retrieval of the trace via cue resulted in an increase in metabolic demand and blood flow, and there were positive effects of recall when participants were shown the cue word (2004).

In the present study, we had participants recall a memory that they were personally part of, and then we conducted one of two interviews that asked for different kinds of details involving said memory. Our goal was to induce one of two encoding modes that could extend to later events, namely either episodically specific, or gist-based, in both young and cognitively healthy older adults. The episodic specificity interview involved prompts for more detail about the event such as event sequence and details about other people in the memory, whereas the

general impressions group interview involved more open-ended questions about how the person generally felt about the memory. The dependent variable was the number of details recalled in the visuospatial event memory test videos. Our research question was whether the participants in the episodic specificity induction recalled more details from the memory test videos.

The critical manipulation for this thesis was the provision of prompts after initial free recall. This enabled us to assess whether we had induced an encoding mode, as we predicted we would, or if we had simply induced a retrieval mode that extended over time. In other words, we predicted that if we had induced an encoding mode, providing additional prompts that focused on the episodic qualities of the videos would not eliminate the advantage of the episodic specificity group relative to the gist-based group. On the other hand, if all we had done was induce an extended retrieval mode, the additional prompting may eliminate the memory advantage.

Methods

Participants

There were seventy total participants in four groups: twenty younger adults in the gist-based condition, and twenty younger adults in the episodic-specificity condition and fifteen older adults in the gist-based condition, fifteen older adults in the episodic-specificity condition. These participants were recruited from within the Tucson community, and from a pool of undergraduates enrolled in the entry-level Psychology 101 course that chose to participate in the present study, respectively. The younger participants were between 18-24 years old ($M= 19.15$, $SD= 1.311$), and had an average of 13.65 years of education. In the younger participant group, the experimental condition (episodic specificity) participants were on average 19 years old with 13.4 years of education, and 19.3 years old in the control condition (gist based) with 13.9 years of education. In the older participant group, the participants were between 61-91 years old ($M=$

75.96, $SD= 7.39$) with an average of 16.81 years of education. In the older participant group, the experimental condition participants were on average 75.81 years old and had 16.8 years of education, and in the control condition, participants were 76.47 years old on average and had 16.82 years of education.

Design

When participants entered the lab, they were seated and given the consent to look over and ask any questions if needed. In the older adult condition, they were also administered the Montreal Cognitive Assessment (MoCA) in order to determine a baseline for healthy cognitive aging. Any participant who did not score above 24/30 points on the MoCA was still tested, but their results were excluded from our data pool. After consent forms and MoCA, if necessary, the participants were given a prompt, whether they are from the gist-based (control) group, or the episodic specificity induction (experimental) group. The prompt asked participants to think of an event that occurred within the last year and at least a week before the interview. The event must have involved one other person, and it must be from a specific time and place. The participant must have been personally involved in the event. Then, the participants received either the episodic specificity induction or the general impressions induction, which was counterbalanced across participants.

The episodic specificity interview participants were prompted to describe the surroundings during the event, the people that were involved in the event, and the actions that unfolded during the event. They are asked to provide as much detail as they can in the two minutes allotted for each portion. If participants spoke less than two minutes they were prompted to provide more details based on information they had mentioned already.

The general impressions interview participants were prompted to answer questions about the event they selected, in less detail than the episodic specificity group, such as how they felt about the event, and how long it lasted. These questions were written as to not require too much detail to avoid inducing the episodic specificity. Then, all participants completed the Visuospatial Event Memory test, where they received this prompt: “I’m now going to show you a series of videos. Each video will have a title, which will appear before and after the video. Please pay attention to these videos and their titles. This portion will take about 5 minutes. Then we will move on to something else.”

Participants were given a DigitSpan task for ten minutes, as to distract from immediate recall of the videos. Finally, participants completed the memory test, the results of which provided our dependent variable. Participants were asked to recall as many details as they could remember, without additional cueing. The same prompt was repeated for every video, except the first and last videos presented, to control for the primacy and/or recency effects. After the researcher completed an initial free recall, the participant was asked to recall details regarding the perceptual and spatial details of each video with additional prompting. The focused on for visual details, such as colors, or other features of objects or people, as well as details about the scenery, such as where objects and people in each video were located in relation to each other. Each participant had 1 additional minute to provide any other details generated from the recall. Details that were repeated from the initial recall were scored as a repetition.

Stimuli and Measures

Our stimuli included the prompted memory interviews and the short videos the participants were asked to watch. The experimental setting was a lab classroom. Our materials included recording devices to record the interviews, pre-made packets designed for researchers

to take notes, and the computers on which the participants watched the videos. The independent variable was the treatment that the four groups received. The gist based interview was administered to the control group, and the Episodic Specificity Interview was administered to the experimental group, both of which were be split into two groups (younger participants and older participants). The dependent variable is the number of correct details each participant recalled about the short videos.

Participants' induction interviews and memory recall sessions were recorded, transcribed, scored, and tallied using a reliable scoring protocol. Researchers were trained on the scoring protocol before attempting to score the participant data. The total interviews to be scored were divided up evenly, and researchers' scoring was found to be statistically reliable with each other in order to maintain that the interviews and memory recall sessions were scored consistently and accurately. Episodic details include details pertaining to event, time, place, emotion, or perceptual qualities of the videos recalled. Other details include details that were mentioned or recalled that had nothing to do with the videos, such as personal stories that were external to the videos' events or details, or details falsely recalled from the videos. Additionally, any semantic details recalled were placed in the 'other' category for the purpose of this study.

Results

Young and older adult groups recalled details were analyzed separately.

Pre-prompting

Young adults

In the young adults, a 2 (group) x 2 (detail) ANOVA revealed that individuals in the episodic specificity induction group generated more details than individuals in the gist-based induction group (main effect of group), $F(1, 38) = 6.76, p = .013$. Also, episodic details were generated more than other details (main effect of detail type), $F(1, 38) = 339.63, p < .001$. There

also was a significant interaction between group and detail type, $F(1, 38) = 6.33, p = .016$.

However, young adults in the episodic specificity group generated more episodic and other details relative to young adults in the gist-based induction group, $t's \geq 2.03, p's \leq .049$.

Older Adults

In contrast to young adults, a 2 (group) x 2 (detail) ANOVA revealed that older adults in the episodic specificity induction group did not generate more details than older adults in the gist based induction group (no main effect of group), $F < 1$. There was a main effect of detail type, $F(1, 28) = 278, p < .001$, but not a detail type by group interaction, $F < 1$. In sum, the episodic specificity induction did not modify memory performance in the older adults.

Post-prompting Findings

Given that older adults did not benefit from the episodic specificity induction, only the young adult data were further analyzed to determine whether prompting closed the gap between the episodic specificity and gist induction groups.

Young Adults

Similar to the pre-prompting findings, a 2 (group) x 2 (detail) ANOVA revealed that young adults in the episodic specificity induction group generated more details than young adults in the gist-based induction group (main effect of group), $F(1, 38) = 5.15, p = .029$. Also, as before, episodic details were generated more than other details (main effect of detail type), $F(1, 38) = 211.62, p < .001$. There was not a significant interaction between group and detail type, $F(1, 38) = 2.83, p = .101$, indicating that young adults in the episodic specificity induction group continued to generate more episodic and other details in comparison to young adults in the gist-based induction group.

Discussion

In this study, the younger adults in the episodic specificity induction benefitted relative to their counterparts in the gist-based induction, as they recalled more episodic details. The older

adults in the episodic specificity induction did not benefit from their induction, as both groups performed similarly in the number of details recalled.

These results are important because they suggest that in young adult, a simple change in the way participants are encouraged to retrieve real world content can alter subsequent memory for seemingly unrelated content that also contains rich, episodic details. Indeed, if we had simply induced an extended retrieval mode from the autobiographical interview, the additional prompting should have closed the gap between the two groups. However, this was not the case. These findings suggest that engaging an episodically specific retrieval mode can carry over to another task close in temporal proximity, and become an episodic specificity encoding mode.

Additionally, there was no statistical significance in the average number of details recalled between the participants in the gist based induction and participants in the episodic specificity induction in the older adult group. Research regarding cognitive aging indicates that while there are deficits in temporally specific memory in older adults, memory of semantic information and general knowledge is preserved and even facilitated (Levine et. al., 2002). This was also seen in the initial interview, when both groups of older adults struggled with keeping the details they generated specific to that episodic event, and instead often provided semantic details about their friends or family, as well as emotional details regarding their personal feelings about the events of the videos.

Differences in motivation could have influenced the performance of the older adults as well. While the younger participants received course credit for participating in the present study, older adults came in voluntarily. They were most likely curious about their memory performance in their advanced age, and eager to see how their memory has changed, relative to the younger adults, who were not as invested in gauging their health and memory. Older adults often view

participating in memory related studies as an opportunity to look back on their lives and see themselves in different roles, as well as what they contributed (Levine et. al., 2002). These types of memories are more semantic in nature than episodic and therefore it is possible that in order to produce an encoding effect in the older adults, a longer induction period was necessary. Because older adults tend to think about and remember events in terms of semantic details, it is possible that our induction was not strong enough, and could have benefitted from more time spent in the specificity interview. Finally, older adults were given monetary compensation for their time and efforts, while the younger participants were not, which could have altered the level at which participants actively participated in the study.

Younger participants recalled more perceptual details than other detail types $t(38) = 2.347, p = .024$ which could be a result of the specific wording in the encoding task, as well as the prompting in the recall task. In the encoding task, participants in the episodic specificity induction were asked to provide visual details regarding the surroundings, which are generally perceptual features, as well as the people that were involved in the event, which provided more perceptual features. In the prompting task, participants were asked if they recalled any more visual details and other perceptual details regarding people, colors, surrounding objects, and spatial positioning. These are all examples of perceptual features of each video that the participant was asked to recall, and while the participants in the episodic specificity group were induced to encode more perceptual details in the videos, it is no surprise that they recalled more perceptual details than any other type of episodic detail.

A future study could include a condition in which participants would not get an induction at all, in order to establish a baseline level of detail recall without any induction. This way, it would be easier to determine how strong the effect of the episodic induction has on the

participants' encoding. Moreover, the older and younger adults differed in their average years of education, which could have made a difference in detail recall. Future studies may benefit by recruiting recent college graduates or even graduate students in an attempt to match up the years of education each participant in each group had, without compromising the age component of the study.

References

- Grilli, M. D., & Verfaellie, M. (2014, June 17). Personal semantic memory: Insights from neuropsychological research on amnesia. *Neuropsychologia*, *61*, 56-64.
doi:10.1016/j.neuropsychologia.2014.06.012
- Grilli, M. D., & Verfaellie, M. (2015, December 22). Experience-near but not experience-far autobiographical facts depend on the medial temporal lobe for retrieval: Evidence from amnesia. *Neuropsychologia*, *81*, 180-185. doi:10.1016/j.neuropsychologia.2015.12.023
- Levine, B., Svoboda, E., Hay, J. F., Winocur, G., & Moscovitch, M. (2002). Aging and autobiographical memory: Dissociating episodic from semantic retrieval. *Psychology and Aging*, *17*(4), 677-689. doi:10.1037//0882-7974.17.4.677
- Madore, K. P., Gaesser, B., & Schacter, D. L. (2014, May 1). Constructive episodic simulation: Dissociable effects of a specificity induction on remembering, imagining, and describing in young and older adults. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *40*(3), 609-622. doi:10.1037/a0034885
- Meltzer, J. A., & Constable, R. T. (2004). Activation of human hippocampal formation reflects success in both encoding and cued recall of paired associates. *NeuroImage*, *24*(2), 384-397.
doi:10.1016/j.neuroimage.2004.09.001
- Puglisi, T., Park, D. C., Smith, A. D., & Dudley, W. N. (1988). Age Differences in Encoding Specificity. *Journal of Gerontology: Psychological Sciences*, *42*(6), 145-150.
doi:10.1016/j.conb.2006.10.012
- Rugg, M. D., Johnson, J. D., & Uncapher, M. R. (2015). Encoding and Retrieval in Episodic Memory. *The Wiley Handbook on the Cognitive Neuroscience of Memory*, 84-107.
doi:10.1002/9781118332634.ch5

Tulving, E. (1972). Episodic and semantic memory. *Organization of memory, 1*, 381-403.

Tulving, E., & Thomson, D. M. (1973). Encoding specificity and retrieval processes in episodic memory. *Psychological Review, 80*(5), 352-373. doi:10.1037/h0020071

Figures

Figure 1: Details recalled per memory by younger adults pre and post prompting

Figure 2: Details recalled per memory by older adults with no significant interactions pre and post prompting

Figures

Figure 1

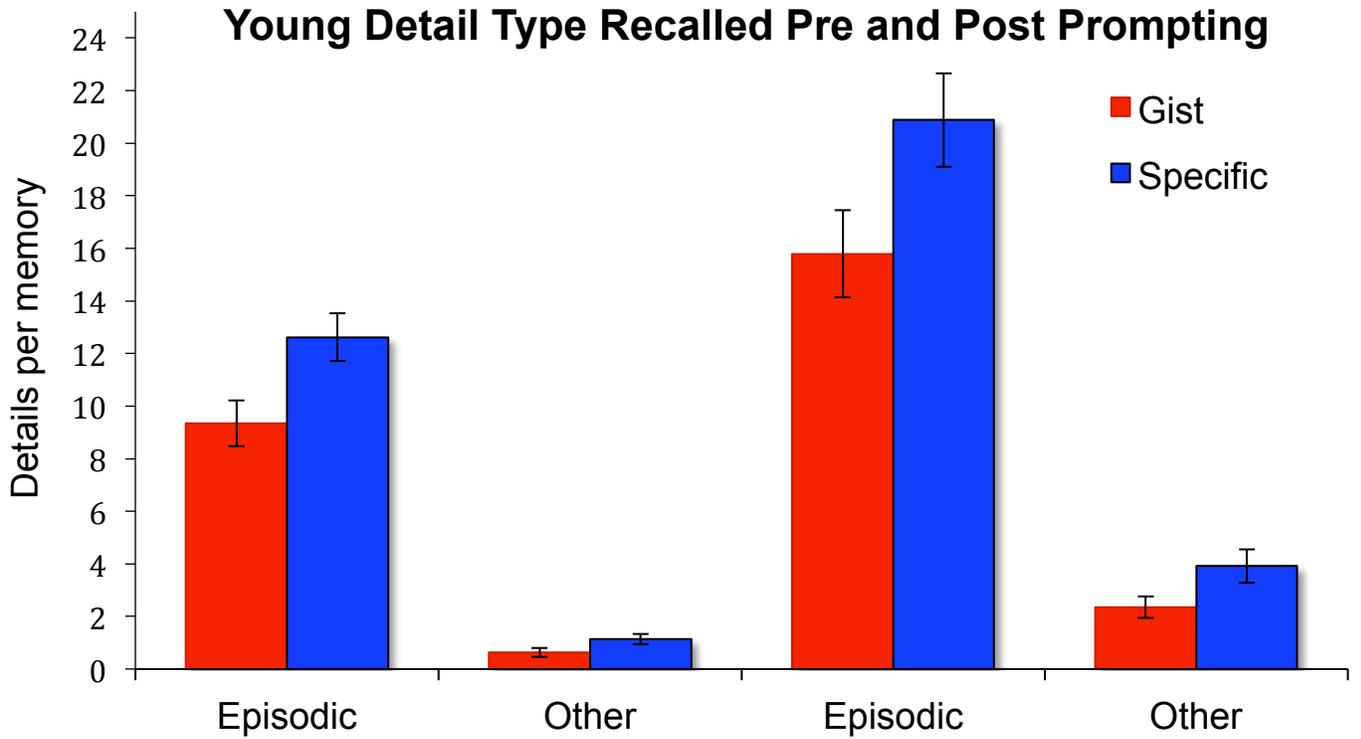
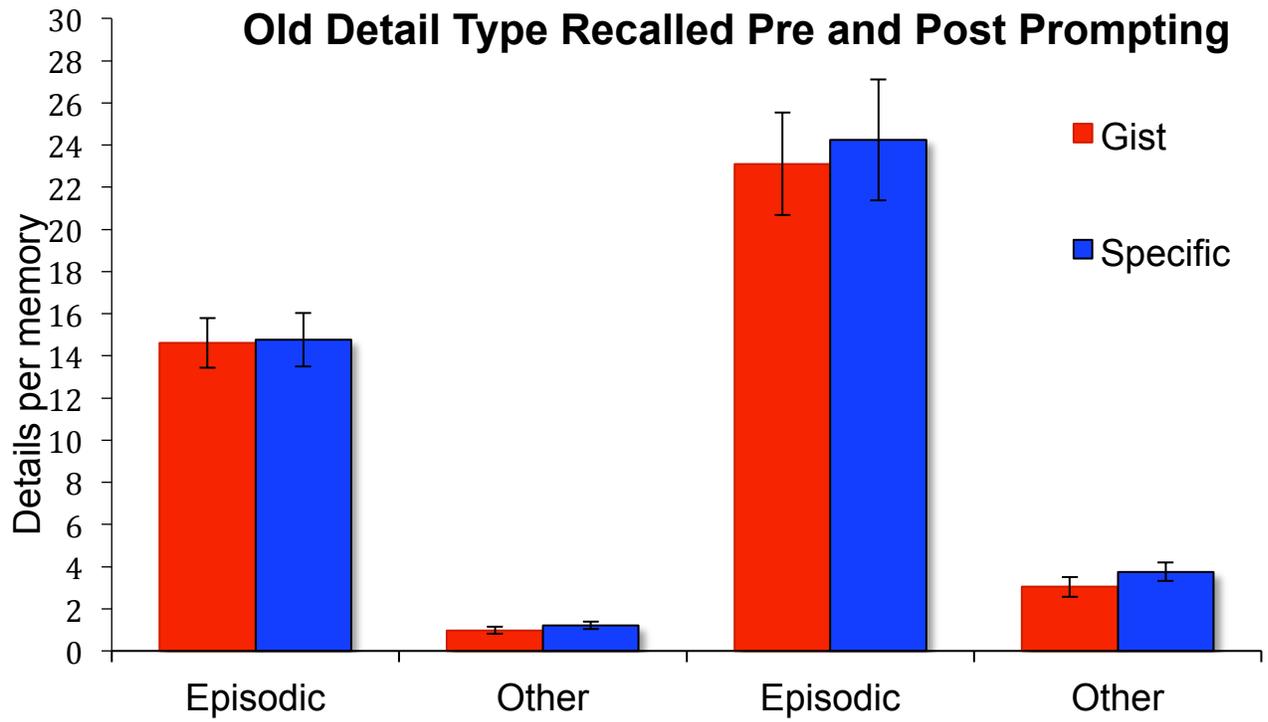


Figure 2



This study was performed by myself (Sedona Coste), Kathryn Mangen, and Janet Landry. All three of us recruited and tested participants equally. We also transcribed, scored, and double-scored their interviews equally, and once the data was collected and recorded, we each took the data we needed and performed the analyses necessary, as per our individual theses.