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Abstract

Schemas are the framework of an event or place that help individuals organize previously learned information and process new information. The purpose of this study was to better identify the role schemas have in memory recall when looking at accuracy. Using a subset of data collection focused on outsourcing conditions, the present study focused on memory errors for schema-consistent and schema-inconsistent memory tasks. Participants were given the same maps, locations, and memory tasks after signing a consent form. Participants had to navigate the map and remember the tasks concurrently. After completing the memory tasks and navigating both maps, participants were asked to draw the map and recall the tasks at each schema from memory. The independent variable was the schema-consistent and schema-inconsistent memory tasks, and the dependent variables were the participants' memory of the tasks while navigating the map. A paired samples t-test revealed that schema-consistent tasks were recalled with significantly more accuracy than schema-inconsistent tasks. These findings suggest schema-consistency influences the accuracy of memory recall. Further research is needed to generalize the findings of this study.

Keywords: schemas, consistent, inconsistent, memory

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Memory errors refer to mistakes in an individual's memory that can be identified by incorrect recall, mistaking details, or complete loss of memories altogether. Many factors play into the creation of memory errors. Mehta, Hoegg, and Chakravarti (2011) suggest individuals have greater accuracy when recalling items considered inconsistent with their schema. Specifically, this study aims to examine memory errors created when recalling memory tasks that are consistent and inconsistent with the item's schema.

A schema is the framework of a scene or event. Specifically, when looking at memory, schemas are useful in organizing a person's existing knowledge or retrieving previously learned information (Mehta et al., 2011). For example, when a person walks into a bank, asking to withdraw money is a schema-consistent task because it is common to cash a check, withdraw money, or apply for a loan at a bank. Likewise, telling a coach your child will miss practice at a park is a schema-inconsistent task because it is uncommon to talk to a baseball coach at the park. Prior research suggests that the consistency and bizarreness effect can influence the accuracy of information recall for schema-consistent or schema-inconsistent information (Mehta et al., 2011).

The consistency effect is the idea that items that differ from an individual's expectations will be better remembered than those that are consistent with their expectations (Pezdek et al., 1989). Charlton and Leov (2021) conducted a study examining the accuracy of memories for schema-consistent actions and objects while driving. The researchers instructed the participants to drive a route that was chosen by researchers and was entered on a phone that was mounted to the dashboard of the participant's car (Charlton & Leov, 2021). Participants were asked to complete questionnaires before, during, and after completing the route chosen by researchers to

test the memory accuracy of the participants while driving. Charlton and Leov (2021) found that the participants' memory for schema-inconsistent actions and objects was more accurate than schema-consistent actions and objects. Additionally, the results suggested a higher number of false memories were recalled for schema-consistent objects while driving. The results of this study support the consistency effect and acknowledge that a higher number of memory errors are present for schema-consistent objects.

Pezdek et al. (1989) conducted a study that examined the generalizability of the consistency effect in real-world situations. In their study, participants were asked to examine two different rooms. One room was a graduate students' office, and the other room was a preschool classroom. Participants were instructed to study the schema for a minute, as they were going to be asked questions afterward. The participants were asked either immediately after, or a day later, to recall as many items that were in the different schemas. The results of their study supported the consistency effect in real-world situations, showing better memory performance for items that deviated from the expectations, thus extending the generalizability of the consistency effect.

Similarly, the bizarreness effect refers to the idea that people tend to remember inconsistent or bizarre information better than common information (Geraci et al., 2013). For example, an individual may remember being tasked with telling a baseball coach that their child is going to miss practice at a part because it is inconsistent with a park schema. Geraci et al. (2013) conducted a study examining the bizarreness effect in memory recall. The researchers used three different conditions: a combined list of common and bizarre sentences, a list of common sentences, or a list of bizarre sentences. Each condition had nouns capitalized in each sentence. Participants were asked to recall as many of the capitalized nouns following the

presentation of the sentences. The results of the researchers' study supported the bizarreness effect in the combined list of common and bizarre words, but there was no effect in both of the separate categories. Given the results of this study, it suggests participants will remember bizarre memory tasks with greater accuracy but may have no main effect for schema-consistent or schema-inconsistent memory tasks.

This current study focuses on examining whether participants create more memory errors of tasks consistent with schemas as compared to when tasks are inconsistent with the schema. Specifically, we hypothesize that there will be more memory errors for tasks consistent with the schema than tasks inconsistent with the schema. Prior research supports this hypothesis, also suggesting that schema-inconsistent tasks will be better remembered when they are inconsistent with an individuals' expectations. This study will look to fill in the gaps of prior research by examining what influence schemas have in the accuracy on memory recall.

Method

This current study was part of a larger experiment that was designed as a 2 x 3 mixed model design. There were three different conditions which included a counter-outsourcing group, an outsourcing group, and an incidental learning group. Half of the participants self-generated the first map and half of the participants followed GPS directions given by researchers. The counter-outsourcing groups were encouraged to keep the information in mind but were discouraged from outsourcing information. The outsourcing groups were encouraged to outsource information, to knowingly assist them in the memory test following the experiment. The incidental learning groups were neither discouraged nor encouraged to outsource information. The memory test measured incidental information learned while navigating the maps.

The data used in the current study is a subset from the data collection that focused on the three outsourcing conditions. The current study focuses on memory errors for schema-consistent and schema-inconsistent memory tasks.

To identify which tasks were consistent or inconsistent with the schema, participants were asked to norm the tasks used in the larger experiment and asked to rate the likelihood of them carrying out the memory tasks at the specific schemas. Participants were asked to rate on a scale of zero to four, with zero being not likely to carry out and four being likely to carry out. This process was repeated for each of the memory tasks. Researchers then took the averages of the ratings for each memory task. If the averages were above two, the memory tasks were considered schema-consistent memory tasks. Likewise, if the averages were below two, the memory tasks were considered schema-inconsistent memory tasks.

Participants

All of the participants were students from the University of Nebraska at Omaha enrolled in a psychology course. Participants were between the ages of 18 and 45. Any participants that were 18 and under has to have a signed parental permission slip to participate in the study. No participants were excluded from our experiment based on their race, religion, or gender. There was a total of 109 participants. Data from eleven participants were removed for not following directions given by researchers, or not completing all parts of the experiment.

Participants age, gender, and education were collected in order to better understand the participant pool. Of the participants that completed the study, 64 self-reported as Caucasian/White, six self-reported as African American/Black, seven self-reported as Asian, 17 self-reported as Hispanic, 12 self-reported as Biracial/more than one race, one self-reported as Indian, one self-reported as Egyptian, and one self-reported as other/prefer not to say.

Additionally, 13 reported having a high school diploma/GED, 75 reported having some college, 17 reported having an associate's degree, and four reported having a bachelor's degree. Ninety-one participants self-identified as female, seventeen participants self-reported as male, and one participant self-reported as other (M = 21.70, SD = 4.45). Descriptive statistics are shown in *Table 1*.

Design

The independent variables were the schema-consistent and schema-inconsistent memory tasks, and the three conditions (i.e., counter-outsourcing condition, outsourcing condition, and incidental learning condition). The dependent variable was the participants' memory of the schema-consistent and schema-inconsistent memory tasks while navigating the map.

Each of the ten locations had two memory tasks. Two of the locations had two-inconsistent memory tasks, two of the locations had one-inconsistent memory task and one-consistent memory task, and six of the locations had two-consistent memory tasks.

Materials

All participants were given a portion of a map of Phoenix, Arizona, and used a pen to trace the route they took, whether it was self-generated or if they followed GPS directions given by the researchers. Participants following the GPS route given by researchers were told which streets to take and which direction to turn. Those who self-generated the route were not given names of streets to take or told which direction to turn. Participants' memory was measured by asking them to trace the exact route they took on a new map of the same area. While tracing the map, participants were asked to identify all locations they stopped and the memory tasks for each of the locations.

For map 1, participants had to navigate to multiple locations. The first location participants had to navigate to was from their house to Wells Fargo bank. The memory tasks for the bank were to withdrawal fifty dollars from their bank and to deposit a paycheck. From the bank, participants had to navigate to NAPA Auto Parts store. The memory tasks for the auto shop were to pick up a new headlight for their car and to buy coolant. From the auto shop, participants had to navigate to the Arizona Supplies Store. The memory tasks for the supplies store were to buy an umbrella and a bleacher seat cushion. From the supplies store, participants had to navigate to Lowell Elementary School. The memory tasks for the elementary school were to drop off a signed permission slip for a field trip and to pick up their child. From the elementary school, participants had to navigate to Central Park. The memory tasks for the park were to tell the baseball coach that their child would miss practice tomorrow and to talk to Ms. Ruby about what they could bring for the team bake sale. Each of these tasks were either schema-consistent or schema-inconsistent (see Appendix 1).

For map 2, participants had to navigate to multiple locations that were different from map 1. The first location participants had to navigate to was Harbor Freight, a hardware store. The memory tasks for the hardware store were to pick up a new battery for a power drill and to buy a light bulb for their back porch. From the hardware store, participants had to navigate to the Kori y Ana Flower shop. The memory tasks for the flower shop were to pick up flowers to bring to a funeral and to buy a new watering can. From the flower shop, participants had to navigate to Taco Feliz Mexican, a restaurant. The memory tasks for the restaurant were to pick up a new work schedule and to give their boss a request form for time off next month. From the restaurant, participants had to navigate to the Preston Funeral Home. The memory tasks for the funeral home were to give their late neighbor Fred’s spouse, Linda, flowers and to tell Linda that they

would water her garden for her next week. From the funeral home, participants had to navigate to Gordon's Feed and Seed Shop. The memory tasks for the feed and seed store were to pick up a new chew toy for their dog and to buy a new laser pointer for their cat. Each of these tasks were either schema-consistent or schema-inconsistent (see Appendix 2).

Procedure

Each participant was given a consent form to sign before continuing in the experiment. All participants who returned a signed consent form to the researchers were given the first map. The map was the same for all participants. None of the participants were familiar with the map, which consisted of a section from Phoenix, Arizona. The participants were given the same instructions for the location and memory tasks for each location. Each location had two memory tasks that were either consistent or inconsistent with the schema. The participants had to navigate the map and remember the memory tasks concurrently. For example, a consistent memory task would be withdrawing money from a bank, and an inconsistent memory task would be telling a coach your child will miss practice at a park. After completing the memory tasks and navigating both maps, participants were asked to draw the map and recall the tasks at each schema from memory. Once finished with these tasks, all participants were debriefed on the study and completed a demographic form.

Results

The independent variable was the task status as either schema-consistent or schema-inconsistent as determined by the norming process. The dependent variable was the participants' memory of the tasks while navigating the map. We measured this by identifying whether the participant accurately recalled the memory task and identified the details of each task.

A paired-samples t-test was conducted to compare the accuracy of schema-consistent and schema-inconsistent memory tasks, and to determine if there was a significant difference between the two. We expected to find a significant difference between schema-consistent and schema-inconsistent memory tasks, with schema-inconsistent memory tasks having significantly more accuracy. The results from the paired samples t-test showed a significant difference between schema-consistent and schema inconsistent memory tasks, $t(108) = 8.38$, $p < .001$, $d = .802$. Participants recalled schema-consistent memory tasks ($M = .571$, $SD = .175$) with significantly more accuracy than schema inconsistent memory tasks (($M = .390$, $SD = .247$).

We hypothesized that were inconsistent with the item's schema would be remembered with more accuracy than items that were consistent with their schema. However, the thesis was not supported. Schema-consistent memory tasks were recalled with significantly more accuracy than schema-inconsistent memory tasks.

Discussion

The results did not support the hypothesis that schema-inconsistent memory tasks would be remembered with more accuracy than schema-consistent memory tasks. There was a significant difference between schema-consistent and schema-inconsistent tasks with schema-consistent tasks being remembered with greater accuracy. The findings suggest that memory for items consistent with their schema would be remembered better than items that differ from their schema.

A possible explanation for the results may be attributed to cognitive biases. Cognitive biases refer to different errors in memory when learning and processing information (Stangor & McMillian, 1992). Specifically, confirmation bias, a type of cognitive bias that refers to the tendency to confirm information from existing knowledge and memories, plays a role in memory

recall when schemas are present. Schemas help organize new and previously learned information. Participants may have relied on previously learned information to confirm the schema-consistent memory tasks. Another possible explanation for the findings in the study may be that the schema-inconsistent memory tasks may not have been bizarre enough to stand out in the participants' memory.

One of the limitations of this study is the uneven number of schema-consistent and schema-inconsistent memory tasks. There were fourteen schema-consistent memory tasks and only six schema-inconsistent memory tasks. The uneven number of schema-consistent and schema-inconsistent memory tasks may have contributed to the significant difference in the accuracy between the two. It is impossible to know whether the uneven number of schema-consistent and schema-inconsistent memory tasks had an impact on the results of the data analysis.

Another limitation is the lack of generalizability. All of the participants were college students, and the majority of the participants self-identified as female and as Caucasian/White. As Dotson and Duarte's (2020) study discusses, having a diverse pool of participants in any study is important because different cultures can have different effects on an individual's memory. The lack of diversity in our pool of participants makes it impossible to identify how diversity would have impacted memory performance in this study.

For future direction, researching whether an even number of schema-consistent and schema-inconsistent tasks influence the accuracy of memory recall may be beneficial. Geraci and coworkers (2013) suggested that the bizarreness effect is typically found in mixed-list designs. Using one schema-consistent memory task and one schema-inconsistent memory task for each schema may produce stronger support for greater accuracy of schema-inconsistent memories. It

may also be helpful to research how age plays a role in the accuracy of memory recall for items consistent and inconsistent with the item's schema. The results of Prull's (2015) study suggest that there is a difference in the accuracy of memory recall schema-inconsistent items in younger and older adults. This could be beneficial to understanding the influence age has on the recall of schema-consistent and schema-inconsistent memory tasks.

Understanding how schemas influence memory for schema-consistent and schema-inconsistent is beneficial when looking at the formation of memories and accuracy in memory recall. This study looked at memory errors for schema-consistent and schema-inconsistent memory tasks and the influence of schemas on memory recall. While the hypothesis was not supported, there was a significant difference in the accuracy of recall between schema-consistent and schema-inconsistent memory tasks. This suggests that schemas do play a role in the accuracy of memory recall. By understanding the effect of schema-consistent and schema-inconsistent memory accuracy, researchers can complete further research in explaining how schemas influence the formation of memories and memory recall accuracy.

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Appendix 1.

Map 1:
Bank
____Task 1: withdrawing $50.00 from your bank
____Task 2: depositing your paycheck

Auto Shop
____Task 1: pick up a new headlight for your car
____Task 2: get more coolant

Arizona Supplies store
____Task 1: buy an umbrella.
____Task 2: buy a bleacher seat cushion

Child's elementary school
____Task 1: drop off a signed permission slip for a field trip
____Task 2: pick up your child.

Park
____Task 1: tell the baseball coach that your child will be missing practice tomorrow
____Task 2: talk with Mrs. Ruby about what you can bring for the team bake sale next week

Note. Memory tasks for each location for Map 1. Green = schema-consistent, Red = schema-inconsistent.

Appendix 2.

Map 2:
Hardware store
____Task 1: pick up a new battery for a power drill
____Task 2: buy a light bulb for your back porch

Flower shop
____Task 1. pick up flowers to bring to the funeral
____Task 2. purchase a new watering can

Taco Feliz
____Task 1. pick up the new work schedule
____Task 2. give your boss a request form for time off next month

Funeral home
____Task 1. give your late neighbor Fred's spouse, Linda, flowers.
____Task 2. tell Linda that you will water their garden for them next week

Feed and seed store
____Task 1. pick up a new chew toy for your dog
____Task 2. buy a new laser pointer for your cat

Note. Memory tasks for each location for Map 2. Green = schema-consistent, Red = schema-inconsistent.

Table 1

Demographic Information

Characteristic			
Age		*M* (*SD*)	
Outsourcing		21.3 (3.60)	
Incidental Learning		22.3 (5.79)	
Counter-Outsourcing		21.6 (3.54)	
Gender	Female	Male	Other
Outsourcing	28	6	0
Incidental Learning	31	7	0
Counter-Outsourcing	32	4	1

Notes. N = 109, M = mean, SD = standard deviation. Gender and age were self-identified by the participants.