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# Memory for Metaphors: Verbatim memory held for literal sentences vs. metaphors

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# Memory for Metaphors: Verbatim memory held for literal sentences vs. metaphors

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**Abstract**

Certain literary features of text (metaphor, idiom, etc.) are said to be foregrounded, or stand out from the surrounding text. Prior research (Miall & Kuiken, 1994) demonstrates that foregrounded text slows readers down, which is consistent with attention being grabbed. Do features of literary text, more specifically metaphors, improve memory as a result of being foregrounded? The present study investigated the effect of reading metaphoric phrases on reading time, memory accuracy, and decision times. We predicted that when a textual phrase was read as metaphor, verbatim memory would be better retained than when that same phrase was read as a literal sentence. Fifty-four undergraduate students completed a measure of print exposure and read target phrases that were presented as either a metaphor or a literal sentence, depending on the prior context. Afterward, participants completed a memory recall task. The results of our analyses generally did not support our hypothesis. Additional research investigating these effects is suggested.

*Keywords:* memory, metaphor, foregrounding, language comprehension

**Memory for Metaphors: Verbatim memory held for literal sentences vs. metaphors**

The primary purpose of language as we usually use it is for delivering messages and communicating information. Typically, the form that the message is delivered via is less important—whether that may be through a conventional sentence or a stylistic feature such as a metaphor/idiom. Although stylistic features may not be as common in everyday speech (but see Glucksberg, 1989), they are characteristic of literary text. In language processing, *foregrounding* refers to certain words or stylistic features in a text that are highlighted or made more noticeable because they deviate from the typical style or structure of the rest of the text. These deviations may include unique word choices, uncommon expressions, or distinctive sentence structures that make the foregrounded text stand out from the rest of the content. Pieces of foregrounded texts include metaphors, alliteration, ellipsis, and the like.

Some theorists (e.g., Miall & Kuiken, 1994) have claimed that foregrounded stylistic features that are used in literary fiction stand out and disrupt the usual communicative purpose of language. Research has shown that foregrounded passages are read more slowly (e.g., Miall & Kuiken, 1994; van den Hoven et al., 2016), presumably because they de-automatize the otherwise usually mostly-automatic act of reading. This decrease in speed aligns with the notion that attention has been captured. Logically, it follows that if a foregrounded text element slows readers down and grabs attention, memory for the precise wording of the foregrounded phrase should be improved. Despite this straightforward prediction, little to none of the current research literature examines these effects, particularly how memory might be affected by metaphors.

Metaphors are a form of stylistic feature that compare an abstract concept to a more concrete idea, allowing readers to visualize and comprehend the concept more easily. The predicate form of a metaphor follows *A is a B*. For example, *Traffic was a nightmare*, adheres to

this format. Metaphors typically possess a topic and a vehicle. The topic (e.g., traffic) is that which is being compared to an abstract concept. The vehicle (e.g., nightmare) serves as the abstract concept that assigns a new or unusual set of features to the topic (Stewart & Heredia, 2002). Some metaphors are referential, or anaphoric, in nature. In reference or anaphoric form, the metaphor usually only possesses the vehicle, which refers back to a previously introduced concept. For example, *The nightmare lasted the whole way home,* refers back to the previously mentioned traffic.

To further understand memory for the precise wording of literary devices, we tested to see if readers exhibited improved verbatim recall for anaphoric metaphoric phrases. The current research aimed to investigate whether sentences that are read through a metaphorical context are capable of being recalled with better precision than when the same sentences are read in a literal context. Participants were instructed to read short texts that ended with a final target sentence (e.g., *The sponge soaked it up*) that was either metaphorical or literal in meaning. The manipulation of metaphorical vs. literal meaning was implemented by changing the context of the preceding sentences in the passage. After finishing reading the texts, participants' verbatim memory of the sentences was tested.

**Foregrounded Text**

The current research literature has well established that we tend to retain poor memory for the verbatim wording of phrases that we have either read or heard (e.g., Sachs, 1974). Sachs investigated whether memory retention of verbatim wording is the same for phrases that are read versus listened to. Participants either read or listened to short passages that included intervening material and then were given a memory test. They were told to report whether a sentence they had read/heard was identical or it had been changed. The results indicated that participants could

not distinguish between paraphrases and original sentences. Despite this overall poor memory for the verbatim wording of conventional text or speech, further research from Miall and Kuiken (1994) has shown that when phrases or utterances are foregrounded, individuals tend to slow down while reading them.

Foregrounded phrases are in reference to the stylistic variations in text and speech that push it toward literariness, whether they be phonetic (e.g., rhyme and alliteration), grammatical (e.g., ellipsis), semantic (e.g., simile, idiom, metaphor), or otherwise. In Miall and Kuiken's (1994) research, participants were given literary short stories featuring foregrounded texts and their reading times were measured. They were also asked to rate the stories according to how striking they perceived them to be. Participants were found to spend longer times reading foregrounded passages, suggesting that foregrounded text provides readers with an opportunity to pause and reflect on the context. This act of slowing down while reading is consistent with attention being grabbed, which can often be an antecedent of improved memory (Diachek & Brown-Schmidt, 2022).

The function of everyday speech/language is to communicate messages and thus becomes an automatized, unconscious task. Miall and Kuiken (1994) argued that in literature, however, stylistic features are first priority and communication is secondary. Foregrounded pieces of text disrupt the unconscious act of reading because they are different from the surrounding text in the passage. This de-automatization is indicative of attention being grabbed and forces readers to analyze the phrase consciously. The results showed that not only did participants spend longer reading foregrounded passages, but they also reported that they found those passages to be more striking.

*Defamiliarization* refers to the process that occurs as a result of de-automatization; when

prior understandings of meaning are dissolved in order to produce new ones. Miall and Kuiken (1994) argued that foregrounded features such as alliteration or metaphor produce defamiliarization. In other words, the foregrounded text allows readers to overcome previous conceptions in an effort to produce novel ideas or see things in a different light. The pause that is produced during the process of defamiliarization evokes feelings in the reader. *Refamiliarization*, in turn, is the process by which a reader might reconsider the surrounding context to provide meaning to the foregrounded text. According to Miall and Kuiken, the feelings evoked by defamiliarization guide this process of refamiliarization. Readers produce and interpret meanings about the foregrounded phrases based on the feelings that were evoked during the process of defamiliarization. The attention-grabbing processes that occur when reading foregrounded texts are comparable to those that occur when listeners hear disfluencies in speech.

Disfluencies are any sort of interruption in the fluent speech stream, such as ‘uh’, ‘um’, pauses, and repetitions. The effect of disfluencies in speech are similar to those of foregrounded phrases in text. A key distinction, however, lies in that foregrounded text is deliberately chosen as a stylistic feature, whereas disfluencies in speech occur irregularly and usually unintentionally. Disfluencies produce a similar pause in readers that foregrounded text does in the process of defamiliarization. Disfluencies function as ‘cognitive roadblocks’, orienting listener’s attention and signaling the necessity for deeper processing (Kuijpers & Hakemulder 2018). Research executed by Diachek and Brown-Schmidt (2022) supported the disfluency-memory boost effect which showed that memory was improved for information that followed disfluencies.

Participants in Diachek and Brown-Schmidt's (2022) study were instructed to listen to phrases that did or did not contain a disfluency and then completed a memory recognition test.

For example, they listened to sentences such as *My sister had a skiing accident and she broke her um leg*, which contains the disfluency *um* right before the word *leg*. Participants held significantly greater memory for the words that immediately followed a disfluency. For example, memory would have been retained highly for the word *leg* in the previous sentence. This effect was found in multiple types of disfluencies, more specifically those found toward the end of a sentence. As a result, disfluencies capture attention and compel listeners to reevaluate the significance of what they have just heard, much like foregrounded text. Thus, it should be considered that disfluencies and foregrounded text, such as metaphors, work in similar ways to produce an effect that allows for better memory retention of utterances.

**Highly-Interactive Text**

The memorability of phrases is also impacted by how interactive they are. Sentences that are highly interactive are those that focus on information about the speaker's intentions, beliefs, and relation to the listener and typically convey wit, sarcasm, humor, or personal criticism (Keenan et al., 1982). Keenan, MacWhinney, and Mayhew (1977) investigated the effects of high-interaction vs. low-interaction sentences on memory. Participants engaged in a group discussion and then were given a memory-recognition test after a delay. One third of items on the memory test were either low or high-interactional sentences that had been previously uttered in the discussion. For example, in a low interactional context, one might have said: *Do you always use CRT displays?*, a question that does not possess any sort of personal sentiment. Whereas in a high interactional context, one may have said: *Do you always put your foot in your mouth?*, a question that is accompanied by a tone of passive aggression. The results showed that participants could remember the exact wording for the highly-interactive sentences, but could not recall verbatim sentences containing dull or factual information. Keenan et al. (1977) argued that

this could be because highly-interactive sentences elicit an emotional or affective reaction in listener, similar to the affect that is produced during defamiliarization (Miall & Kuiken 1994). Foregrounded text elicits an emotional effect from readers during defamiliarization which is similar to the emotions that are evoked by highly-interactive sentences. This provides reason to believe that foregrounded text is more interactive, which supports increased memory recall.

The assertion that readers hold better memory for foregrounded texts is further supported by Murphy and Shapiro's (1994) research. Their goal was to examine the causes behind participants forgetting verbatim information during discourse. In their research, participants were presented with a personal letter that contained various sentences that could either be interpreted in a bland context or a sarcastic context. For example, *Is the flower shop too far for you?* was a sincere question in the bland condition but a caustic jab in the sarcastic condition. Participants demonstrated verbatim memory recall much more often for sentences that were presented in a highly-interactive context (sarcastic) as opposed to a low-interactive context (bland), providing a conceptual replication of Keenan et al.'s (1977) findings. Murphy and Shapiro offered a pragmatic explanation. The pragmatic view proposes that listeners devote the most attention to the text that is most relevant, important, or salient, given their current goals. The pragmatic view supports the notion that readers and listeners orient more attention to highly-interactive content (such as foregrounded texts), in turn increasing verbatim memory.

**Verbatim Memory for Idioms**

An idiom is a type of expression that conveys a meaning that is different from the literal definition of the individual words used, similarly to metaphors. Different from metaphors, however, idioms are conventional and non-compositional — that is, an idiom's meaning typically cannot be derived solely from the words inside of it. Instead, idioms rely on cultural

context and common usage (Cailles & Declerq, 2010). For example, the phrase *kick the bucket* would not hold the same meaning for someone unfamiliar with the term. On the other hand, metaphors are considered to be compositional because their meaning *can* be derived from the conventional meanings of their words. The research surrounding verbatim memory recall for foregrounded text is lacking when it comes to metaphors.

However, precise memory for idioms has been studied. Gibbs's (1980) research investigated memory for idiomatic phrases that were either read as idioms (i.e., the conventional usage of the phrase) or as literal sentences (i.e., unconventional usage of the phrase). Participants were instructed to read stories featuring idiomatic phrases as the last sentence that were either preceded by a literal context or an idiomatic one. An example target sentence is, *He's singing a different tune*, in which he has either changed his mind, which is the conventional idiomatic usage, or is not singing the same song, which is an unconventional literal usage. A day later, participants were provided with the same stories, but missing the final sentence, and asked to fill it in. The results showed that memory recall for unconventional utterances (i.e., phrases read in a context where they lose their idiomatic meaning) was better than that for the conventional uses of the same utterances. By default, idiomatic phrases are interpreted as idioms; whenever they are placed in the context of literal usage, it takes individuals more time to interpret them (Gibbs, 1980). The findings also showed that readers took significantly longer to process the unconventional utterances, implying that when individuals hear an unconventional use of an idiom, it produces a double-take reaction. This in turn slows down reading time and requires deeper processing on behalf of the reader, increasing the accuracy of memory recall. This double-take reaction is comparable to the process of defamiliarization that occurs in response to foregrounded text, as described by Miall and Kuiken. Therefore, using idiomatic phrases outside

of their conventional context might slow down readers and grab attention, similarly to foregrounded text. Metaphor usage typically employs unconventional language to refer to more common things. The effects of this unconventional language usage can be compared to the those of interpreting unconventional usage of idiomatic phrases, assuming that they both require extra interpretative work from the reader. Therefore, it should be expected that reading metaphoric phrases will take longer than the literal-context version of those phrases.

**The Current Study**

Idioms do not hold the same compositional quality as metaphors. Meaning, the interpretation of a metaphor can be derived directly and solely from the words inside of it, whereas this cannot be done with an idiom. Due to this, the processes observed in Gibbs' (1980) research are worth studying in the context of metaphors. It is understood that verbatim memory for written and spoken phrases is usually poor (Sachs, 1974), but this memory is typically retained better if these phrases are foregrounded (Miall & Kuiken, 1994). Disfluencies such as *uhs* and *ums* are foregrounded and memory for words following them is retained better (Diacheck & Brown-Schmidt, 2022). This could be because foregrounded phrases are highly-interactive, making them more likely to grab a reader's attention (Keenan et al., 1977), which can in turn improve verbatim memory (Murphy & Shapiro, 1994). Taken together, it appears that highly-interactive language is foregrounded and thus grabs readers' attention and slows down reading times because the language is utilized in less-familiar ways. This attention-grabbing should then lead to improved memory. This occurrence has yet to be investigated in metaphors. We predict that anaphoric metaphor phrases will affect readers in the same way as other highly-interactive linguistic devices, yielding a more accurate memory recall for such phrases. The purpose of our present research design is to examine this effect.

In our study design, target metaphor phrases that could be interpreted in either a literal context or a metaphorical context were selected. Two brief texts were written for each metaphor, framing it in either a literal context or a figurative context. In Table 1 below is an example of how two different contexts were presented for the same sentence, *The sponge soaked it up*.

**Table 1**

*Example passages*

| ***Metaphoric Context:*** | ***Literal Context:*** |
|---|---|
| When I began teaching, I didn't know what I was getting myself into. Middle school students can hold either ambivalence or wonder in their eyes. I began to tutor Daniel and rediscovered my passion for teaching. I taught for hours on end about the history of our world and different cultures. *The sponge soaked it up*. | When I began cooking, I didn't know what I was getting myself into. Complicated dishes can either taste disgusting or delightful. I began to cook special desserts and rediscovered my passion for baking. I cooked for hours on end, spilling flour and olive oil along the way. *The sponge soaked it up.* |

Participants were instructed to read short passages that ended in a target sentence. The final target sentence could either be read as a metaphor or a literal sentence, depending on the preceding context provided by the passage. Afterward, participants' memory was tested. During the memory test, a sentence was presented, and they were then asked to determine (yes or no) whether they had previously read it or not.

## Method

### Participants

The participants were 54 undergraduate college students taking a general psychology class at the University of Arkansas. They volunteered to participate in the study by using Sona Systems, which is software for managing participant pools that provides undergraduate students access to psychology research studies available on campus. At their own convenience, students

have the ability to access and enroll in research studies. In exchange for their participation, participants were given credit toward a course requirement.

**Materials**

The Author Recognition Test (ART; Stanovich & West, 1989) was used to measure print exposure in participants to measure individual differences on this variable. In this task, participants are given an inventory consisting of 100 names. Fifty names are those of well-known authors while the other 50 are names of researchers unlikely to be familiar to participants. Participants were instructed to place a checkmark next to each name that they recognized. Participants earned one point for each correct author name they identified and lost one point for each unfamiliar one they identified. The ART specifies that half of the names in the list are of fairly well-known authors, and half of them are not. This offers an estimate of participants' exposure to literary works.

Additionally, about 30 target metaphor sentences were written for the experiment. For each target sentence, two accompanying stories were written. The experimental stories provided context that was necessary to interpret target sentences as either literal or metaphorical. Both passages written for each target sentence were made to be similar in length and structure. All but one of the stories were five lines in length, with the final line being the target sentence (see Table 1 for a full example). The metaphoric quality of the target sentences was determined through a norming study, allowing the selection of the 20 stories that were most clearly interpreted as intended (i.e., as ending in a metaphor). In addition to the stories written for the target sentences, 10 filler stories were presented to the participants. The inclusion of the filler stories served to obscure the manipulation in the critical stories.

**Procedure**

Participants voluntarily scheduled themselves for half-hour study sessions through Sona Systems. They were told that they were completing a study about language comprehension. After signing a consent form, they completed the ART on paper to measure their exposure to print. Upon finishing the ART, an experimenter informed the participants that they would be reading some short stories and then answering questions about them. All further instructions were presented on the computer that administered the experiment. DirectRT software (Jarvis, 2008) was used to conduct the experiment.

The computer presented participants with 30 different stories. Twenty of these stories included one of the 20 target sentences (metaphorical/literal) while the remaining 10 served as filler stories. Of the 20 experimental stories each participant read, half provided a literal context, and the other half provided a metaphorical context. Two stimulus lists were created so that if a target sentence appeared in one list, it would appear in a metaphorical context in the other list, and vice versa. Therefore, each story was seen in each condition across participants half the time in its metaphoric version and half the time in its literal version. The thirty stories were presented in partially random order. The first story and every third story were always a filler. The experimental stories were randomly mixed in, in a different order for each participant. This way no more than two experimental stories were even seen in a row.

Sentences were read one at a time on the computer screen. Participants could advance to the next sentence by pressing the spacebar. After each filler story, participants were presented with a comprehension question that required either a *yes* or *no* answer. Answers were indicated by pressing the left and right arrow keys, labeled Y or N, respectively.

After reading all 30 stories, the computer provided participants with instructions for the memory test. A sentence (either a target sentence or a lure) appeared on the screen and the

participant decided whether they had previously read the sentence or not. The instructions asked participants to be both fast and accurate in their decision-making.

The memory test consisted of 60 sentences. Half of the sentences had been read by participants: 10 were from fillers and were not the last sentence of the story, 10 were the critical last sentence from metaphorical-context stories, and 10 were the critical last sentence from literal-context stories. The remaining 30 sentences were lures that participants had not previously read and were expected to answer 'no' to. The lure sentences were a mix of stand-alone metaphors and literal sentences. The first memory trial was always a filler, but the rest were presented in a different random order for each participant. Following completion of the memory test, participants were debriefed, thanked for their time, and given course credit for participation.

## Results

We hypothesized that participants would slow down while reading and retain better verbatim memory for phrases that had been placed in a metaphoric context than when those same phrases were placed in a literal context. We collected data from 54 participants. Participant ART scores were low, but not unusually so for a participant-pool study. The mean ART score was 4.0 (*SD* = 3.3), with a range from -2 to 15.

Each participant completed 60 memory trials in which they either answered *yes* or *no*. Half of these (*n* = 30) were *yes* responses: 10 metaphor-context sentences, 10 literal-context sentences, and 10 filler sentences. The other half (*n* = 30) were *no* responses. Per participant, there were 20 critical memory trials. These trials include the 10 metaphor-context sentences and 10 literal-context sentences. Across all 60 memory trials, participants answered correctly a mean of 94.4% (*SD* = 4.5%) of the time, with a range of 79.1% to 100%.

### Reading Time Analyses

While stories were being read, reading time was measured. For the reading times on critical sentences, a linear mixed effects model was fit with condition (metaphor vs. literal) as a fixed-effect variable and participants as a random-effects variable to try to predict reading times of metaphors. Reading times for metaphors ($M$ = 1507 ms, 95% CI = [1385, 1628]) were significantly longer than on literal sentences ($M$ = 1365 ms, 95% CI = [1243, 1487]), $t(998) = 4.33$, $p < .001$). Consistent with our hypothesis, the results of this analysis indicate that participants spent a significantly longer amount of time reading the phrases when they were placed in the metaphoric-context as opposed to the literal-context. A second model was fit with condition, ART scores, and their interaction as predictors, but the results were the same as the first model. That is, participants slowed down while reading target phrases presented in a metaphoric condition, regardless of ART score.

**Memory Accuracy Analyses**

To assess whether metaphoric phrases led to greater verbatim memory recall than literal phrases, a logistic mixed effects model was fit with condition (metaphor vs. literal) as a fixed-effect variable and participants as a random-effects variable to try to predict accuracy. Contrary to our hypothesis, there was no significant difference observed between the metaphor condition (memory = 92.4%; 95% CI = [90.0%, 94.2%]) and the literal condition (memory = 92.7%; 95% CI = 90.5%, 94.5%]), $z = 0.32$, $p = .75$. In other words, participants displayed accurate memory for phrases in both the metaphoric-context and literal-context condition roughly 92% of the time, which did not support our hypothesis.

Another logistic mixed effects model was fit with condition (metaphor vs. literal), ART scores, and their interaction as fixed-effects variables and participants as a random-effects variable. There were no significant effects of condition ($p = .37$), the ART ($p = .74$), or their

interaction ($p$ = .79). Our results show that although there was a small, positive relationship observed between ART scores and memory, $z$ = 0.33, $p$ = .74, the relationship was not significant. This indicates that the ability of the participants to recall verbatim memory for both metaphorical and literal sentences was not significantly related to print exposure.

**Decision Time Analyses**

To assess whether decision times got longer, which is consistent with reading slowing down, a linear mixed effects model was fit with condition (metaphor vs. literal) as a fixed-effect variable and participants as a random-effects variable to try to predict decision time to respond, but only for the correct memory trials. In contrast to our hypothesis, we found that there was no significant difference in decision time between the metaphor condition (RT = 745 ms, 95% CI = [660, 830]) and the literal condition (RT = 740 ms, 95% CI = 655, 825]), $t(1915) = 0.12$, $p$ =.91. Our analysis revealed that participants took, on average, about the same amount of time to correctly identify both metaphoric and literal sentences that they had read.

Another linear mixed effects model was fit with the condition, ART scores, and their interaction as fixed-effects variables and participants as a random-effects variable. Again, our analysis did not support our hypothesis. There were no significant effects of condition ($p$ = .60), the ART ($p$ = .65), or their interaction ($p$ = .36). The correlation between ART scores and decision time was observed to be very weak, and this weak relationship did not vary significantly between the metaphorical and literal conditions. This indicates that print exposure had little to no effect on participant decision times in either condition.

## Discussion

The purpose of our study was to gain a better understanding of the attention-grabbing processes that occur while reading metaphors that potentially improve memory. We predicted

that readers would possess better verbatim memory for phrases when they were read as a metaphor versus when the same phrase is read as a literal statement. The sentences preceding each target phrase were manipulated to create the context in which each phrase took place (metaphoric context vs. literal context). The results of the present study were not completely in support of our hypothesis. Whereas past researchers have found that foregrounded text is attention-grabbing (Miall and Kuiken, 1994) and can improve memory (Murphy & Shapiro, 1994; Keenan et al., 1977), the present study showed that participants remembered phrases approximately 92% of the time, regardless of which condition the phrase was presented in.

There are three key findings of the present research. Most interestingly, an analysis of reading times showed that participants did slow down when reading the phrases through the metaphoric context. These results align with those of Gibbs (1980) and suggest that participants possibly found the phrases to be more striking, supporting previous research from Miall and Kuiken (1994). Secondly, the results strongly imply that individuals possess a generally good memory for written phrases, despite which condition they were presented in. Whether the target phrase had been read in the metaphoric context or the literal context, memory for the phrase was accurate approximately 92% of the time. Lastly, decision time was analyzed to measure how long participants took to decide whether they had seen a phrase or not. The results of this analysis showed that participants typically took the same amount of time to determine whether they had read a target phrase or not. Taken together, our findings suggest that, regardless of the condition that a phrase was presented in, participants could readily identify the phrases that they had previously seen with above-average accuracy.

Participants took significantly longer to read target phrases when they were presented in the metaphoric condition than when they had been presented in the literal condition. The pattern

of results for reading times is consistent with previous research by Miall and Kuiken (1994) and van den Hoven et al. (2016) that demonstrated the effects of foregrounded text on reading processes. These findings showed that individuals tend to slow down while reading foregrounded text. Under the assumption that metaphors utilize unconventional language, this finding was also consistent with that of Gibbs (1980), where the results demonstrated that participants took longer to read unconventional utterances (i.e., literally-intended idioms). Another study by Westbury and Harati (2022) showed that individuals typically processed literally true sentences faster than metaphors because they have more closely related words in them, unlike the unconventional language that is used in metaphors. These conclusions were further supported by the results of our reading-time analysis. These results could be an indication that metaphors were more difficult to comprehend than literal sentences. However, based on the findings of similar studies (Miall & Kuiken, 1994), another possible explanation could be metaphors are found to be striking and grab readers' attention, which in turn slows them down.

The present study represented a first attempt to address the memory-improving processes that occur when reading identical phrases as either metaphors or literal sentences. Because our findings are not consistent with our hypothesis and the previously established research literature, potential limitations of our study design and methods should be considered. One potential limitation concerns the metaphors that we chose for our target phrases. We examined memory accuracy for anaphoric metaphors, which require more work from readers as the target refers back to a previously mentioned subject. It is possible that an improved memory accuracy would be more likely to be observed for predicate metaphors, which include both the target and the vehicle in one phrase (e,g., Budiu & Anderson, 2002). For example, the predicate metaphor

*Traffic was a nightmare* may require less interpretative work out of the reader than *The nightmare lasted the whole way home.*

Another possibility is that our metaphors were not accurate representations of metaphors found in typical literary texts. The metaphoric phrases constructed for our study might have been too complex, weird, vague, simple, subtle, etc. Findings that are based on one type of metaphor may not be generalized to every type of metaphor (Katz et al., 1988). Thus, it is worth considering whether a different set of metaphoric phrases would yield different results. Another final potential limitation could be that the literal contexts that were written to precede target phrases might not have been literal enough. For example, creating a context where *The sharks gathered together* (where sharks are in reference to cutthroat lawyers) can be read metaphorically is easier than constructing a context where sharks literally gathered together. Thus, the context provided might be too unrealistic given the nature of our metaphors.

Although the present results support the idea that metaphoric phrases are read slower than literal phrases, memory for both types of these phrases was generally good despite which condition they were placed in. This suggests another potential limitation of our study — the memory retrieval task provided to participants was possibly too simple. Overall performance on the metaphoric and literal sentences was about 92% correct. There are multiple ways in which the simplicity of this task may manifest. Firstly, participants might have recognized the pattern of the story presentation because there were not enough fillers or randomization. Another limitation that might have made the memory retrieval task too easier is easily recognizable foils. That is, the foil sentences presented in the memory retrieval task might have been too obviously not previously read. The foil sentences consisted of metaphoric phrases, similar in style to the target phrases, that had not been seen by participants prior. Memory accuracy scores improved for each

foil that participants correctly identified as not having seen before. Thus, memory accuracy scores may have been exceptionally good because participants could easily identify the foil sentences—which may be another reason why the results did not support our hypothesis. Finally, the delay between reading short stories and performing the memory retrieval task may have possibly been too short. Therefore, target phrases might have been still readily available in participants' minds to be recalled because the delay between tasks was not long enough.

Much work remains to be done before a full understanding of the mechanism through which metaphors grab attention and potentially improve memory can be established. Despite our results not supporting our hypothesis, the findings raise a variety of intriguing questions for future study. In terms of future research, it would be useful to extend the current design by addressing some of the aforementioned potential limitations. Future variations of this research might manipulate the type of metaphors used, i.e., testing verbatim memory for predicate metaphors as opposed to anaphoric/reference metaphors. Subsequent studies should also place emphasis on complicating the memory retrieval task so that it is not so easy for participants to complete. This could be done by using more fillers or utilizing more complex randomization of the stories. A final recommendation for replications of this study would be to implement a longer delay between reading stories and the memory retrieval task, perhaps asking participants to return the following day to complete the memory task.

**Conclusion**

Despite the results being nonsignificant and unsupportive of our hypothesis, this research can be seen as a first step towards integrating two lines of research, memory and metaphor comprehension, that, to our knowledge, have not been directly linked. Understanding the processes that contribute to memory encoding and retrieval have important implications for the

real world, such as applications in learning environments or for individuals who struggle with memory impairment. Researching metaphor comprehension provides insight into the ways that metaphor can assist individuals in creating a novel schema for pre-conceived notions. In other words, metaphors allow individuals to see things in a new way. We hope that future research will stimulate further investigation into verbatim memory for metaphoric phrases.

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# Appendix A

## Author Recognition Test

**Among the following list of names, place a checkmark next to any author's name that you recognize. Half of the names in the list are of fairly well-known authors, half of them are not.**

___ Agnes Weiyun He
___ Albert Camus
___ Allen Grimshaw
___ Amy Tan
___ Anne McCaffrey
___ Bertram Bruce
___ Boaz Keysar
___ Bonnie J.F. Meyer
___ Carol Lee
___ Catherine Anderson
___ Catherine Snow
___ Charles Goodwin
___ Charles Perfetti
___ Clive Cussler
___ Danielle Steele
___ David Miall
___ David Rapp
___ Dean Koontz
___ Debra Long
___ Diana Palmer
___ Douglas Adams
___ Douglas Biber
___ Edward O'Brien
___ Emmanuel Schegloff
___ F. Scott Fitzgerald
___ Franz Schmalhofer
___ Gabriel Garcia Marquez
___ George Orwell
___ Heather Bortfeld
___ Helga Noice
___ Herbert Clark
___ Ian Fleming
___ Isaac Asimov
___ Italo Calvino
___ J.R.R. Tolkien
___ Jackie Collins
___ James Paul Gee
___ Jeff Hancock
___ Jeffrey Eugenides
___ Jennifer Wiley
___ Joe Magliano
___ Johanna D. Moore
___ John Grisham
___ John LeCarré
___ John Updike
___ José Saramago
___ Joy Fielding
___ Judith Green
___ Judith Krantz
___ Judith Langer
___ Justine Cassell
___ Keith Millis
___ Ken Follett
___ Louis L'Amour
___ Maeve Binchy
___ Marion Zimmer Bradley
___ Matthew McGlone
___ Michael Bamberg
___ Michael Schober
___ Milan Kundera
___ Morton Gernsbacher
___ Natalie Person
___ Neal Norrick
___ Neil Gaiman
___ Nicholas Sparks
___ Nora Roberts
___ Patricia Cornwell
___ Peter Dixon
___ Piers Anthony
___ Ray Bradbury
___ Raymond Chandler
___ Raymond Gibbs, Jr.
___ Richard Gerrig
___ Richard Ely
___ Richard Mayer
___ Robert Ludlum
___ Roger Shuy
___ Rolf Zwaan
___ Roy Freedle
___ Sidney Sheldon
___ Stanton Wortham
___ Stephen King
___ Steve Whittaker
___ Susan Goldman
___ Susan Brennan
___ Susan Fussell
___ Taffy Raphael
___ Terry Pratchett
___ Thomas Mann
___ Tim Koschmann
___ Toni Morrison
___ Umberto Eco
___ Upton Sinclair
___ Ursula K. Le Guin
___ W.G. Sebald
___ Will van Peer
___ Willa Cather
___ Yukio Mishima
___ Zora Neale Hurston

# Appendix B

## Passages

| | |
|---|---|
| When Cindy arrived at the ball, she was wearing a wonderful white dress.<br>Her fine long neck was adorned by an exquisite diamond necklace.<br>Many handsome men wanted to invite her to dance.<br>She was a little bit anxious because she had never danced before. | When Cindy arrived at the lake, she was carrying a set of binoculars.<br>Her favorite activity was spending time birdwatching.<br>Many fancy birds were in and near the water.<br>She was a little bit excited when she saw a graceful bird on the water. |
| | |
| The swan glided beautifully. | |

| | |
|---|---|
| "Okay class, you are dismissed," stated the ambivalent teacher.<br>It was finally summer break and the children emerged from their seats.<br>The bell rang throughout the halls as the double doors burst open. | Bill wiped a bead of sweat from his forehead as he set down the bucket.<br>After feeding the cattle, he was exhausted and ready to leave the farm.<br>He lifted the gate door and whistled. |
| | |
| The animals ran wild. | |

| | |
|---|---|
| P.E. class is the worst period of the day.<br>There is always the one person who forgets deodorant.<br>As the smell wafted by, I knew the culprit immediately.<br>My partner Erica inquired about the scent and I rolled my eyes. | The drive through the country is the worst part of the commute.<br>There is always some sort of cow manure or roadkill.<br>As the smell filled my nose, I knew the culprit immediately.<br>My partner Erica inquired about the scent and I rolled my eyes. |
| | |
| The skunk is the source. | |

| | |
|---|---|
| Tabby was desperately stuck on her algebra homework.<br>Thankfully, her father was an accountant.<br>She brought the homework to him and asked politely for assistance.<br>The hardworking man set aside his work and glanced at the paper. | Tabby was desperately stuck on her algebra homework.<br>Thankfully, her father had just bought her a new Dell.<br>She brought the homework to her desk and input the equations.<br>The machine took some time to boot up and began to work. |
| | |
| The computer analyzed the numbers. | |

| | |
|---|---|
| My boyfriend and I arrived at the dinner table twenty minutes late.<br>"What has taken you so long?", my best friend asked.<br>We had been shopping I explained, and she inquired how I had paid.<br>With a sly smirk, I gestured towards the man on my left with a nod. | I arrived at the dinner table twenty minutes late.<br>"What has taken you so long?," my boyfriend asked.<br>I had been shopping I explained, and he inquired how I had paid.<br>Reluctantly, I gestured towards my wallet on table. |
| | |
| The credit card paid for it. | |

| | |
|---|---|
| When I began teaching, I didn't know what I was getting myself into.<br>Middle school students can hold either ambivalence or wonder in their eyes.<br>I began to tutor Daniel and rediscovered my passion for teaching.<br>I taught for hours on end about the history of our world and different cultures. | When I began cooking, I didn't know what I was getting myself into.<br>Complicated dishes can either taste disgusting or delightful.<br>I began to cook special desserts and rediscovered my passion for baking.<br>I cooked for hours on end, spilling flour and olive oil along the way. |
| | |
| The sponge soaked it up. | |

| | |
|---|---|
| Jonathan and I decided to take a camping trip by the lake last weekend.<br>We swam, fished, and even roasted marshmallows.<br>However, we made a dire mistake when we forgot to pack bug repellant.<br>A mosquito buzzed around me for a few minutes before making its attack. | Jonathan and I decided to take a trip to Transylvania last weekend.<br>We toured the castles and even went to the museums.<br>However, we made a dire mistake when we forgot to pack garlic.<br>A pale, shadowy figure stalked us for a few minutes before making its attack. |
| | |
| The vampire bit me. | |

| | |
|---|---|
| High school was full of enough pressure, but Jennifer made it worse.<br>We had stopped being friends in elementary school, and she hated it.<br>Jennifer began a rumor that I had lice during the first week of school.<br>I tried to combat the lies, but it was too late. | High school was full of enough pressure, but flu season made it worse.<br>Schools stopped requiring the flu shot in elementary school, and I hated it.<br>Kids began getting sick during the first week of school.<br>I tried to avoid the germs, but it was too late. |
| | |
| The plague had spread. | |

| | |
|---|---|
| The competition among paralegals is stiff.<br>It is teeming with brilliant minds.<br>The interns pace up and down the halls of the courthouse with cups of coffee. | The ocean is an expansive, beautiful body of water.<br>It is teeming with wildlife.<br>The dolphins jumped above the surface and back into the water. |

| | |
|---|---|
| The law students study and take notes as they observe. | The whales floated slowly and majestically along. |
| | |
| The sharks gathered together. | |

| | |
|---|---|
| I was engrossed in my novel at the coffee shop when I was promptly disturbed.<br>A group of about six women bustled in as I flipped to chapter three.<br>They loudly chattered about what they may order.<br>I rolled my eyes and tried to focus on the book, but their volume steadily increased. | I was engrossed in my novel in the backyard when I was promptly disturbed.<br>A group of about six chickens began to strut by as I flipped to chapter three.<br>I must not have latched the gate to their house.<br>I rolled my eyes and tried to focus on the book, but their volume steadily increased. |
| | |
| The hens kept interrupting. | |

| | |
|---|---|
| My feline is my best friend but also has a hold over me.<br>If I don't do as she pleases, she will wreak havoc.<br>If her food bowl isn't filled, she will awaken you until it is.<br>Unfortunately, yesterday I bought a different brand of food than she prefers. | Princess Courtney is a fair lady but also has a hold over me.<br>If I don't do as she pleases, she will wreak havoc.<br>If she doesn't have breakfast in bed, she will scream and cry.<br>Unfortunately, yesterday I bought a different kind of bread than she prefers. |
| | |
| Now, the princess won't eat. | |

| | |
|---|---|
| When my parents dragged me to my brother's choir concert, I was not pleased.<br>I didn't care to listen to children sing out of tune.<br>However, the young performers quickly changed my attitude.<br>There was a soloist who stole the show. | When my parents dragged me to the nature trail, I was not pleased.<br>I didn't care to walk through the bug-ridden woods.<br>However, the beautiful atmosphere quickly changed my attitude.<br>There was a bird that serenaded our walk through the forest. |
| | |
| The nightingale sang beautifully. | |

| | |
|---|---|
| My aunt Julie was quite the eclectic woman.<br>Her house was full of odd and ends and the smell of incense.<br>She was also always dressed head to toe in extravagant garments.<br>Today, it was a necklace so heavy it looked like it may break her back. | My cousin Julie was quite the eclectic woman.<br>Her home was with the tightrope walkers and lion trainers.<br>She was always showing me some bizarre new trick with fire or knives.<br>Today, it was instead a massive reptile that looked like it may eat her. |
| | |
| The snake draped around her neck. | |

| | |
|---|---|
| Jack had always been afraid of taking risks.<br>He was content to blend in and go with the flow, until he met Sarah.<br>She encouraged him to chase his dreams.<br>He took a leap of faith, and to his surprise, his business succeeded. | Jack had always been afraid of taking risks.<br>He was content to care for easy plants, until he saw a Peace Lily.<br>It was hard to maintain, but it was his dream plant.<br>He took a leap of faith, and to his surprise, the lily succeeded. |
| | |
| The flower flourished. | |

| | |
|---|---|
| Mary and John had been fighting for months and the argument had reached its climax.<br>But they sat down and talked.<br>They each took the time to listen and understand the other's point of view.<br>The once-frozen relationship thawed, and they were able to reconcile. | Mary and John had been camping for months and the expedition had reached its climax.<br>They sat down and observed the icy terrain.<br>They took the time to consider how much Antarctica had changed.<br>The once-frozen continent was thawing, and they had to leave soon. |
| | |
| The ice was starting to melt. | |

| | |
|---|---|
| Samantha had always felt unfulfilled in her job like she had no purpose.<br>One day she decided to volunteer at the local community center.<br>She found that helping others brought her joy and fulfillment.<br>She began to pursue her passion for volunteering every day. | Samantha had always felt unfulfilled in her job like she had no purpose.<br>One day, she decided to volunteer at the local community garden.<br>She found that digging through the dirt brought her joy and fulfillment.<br>She began to pursue her passion for gardening and visited every day. |
| | |
| The garden grew. | |

| | |
|---|---|
| Tim had always been a procrastinator.<br>He kept finding excuses, and distractions to keep him busy; but as the deadline approached, he felt the pressure mounting.<br>As soon as he had made any progress, he was sidetracked by an email or a notification.<br>His attention span was short and he couldn't seem to stay on task for long. | Tim had always been a bad hunter.<br>He kept finding excuses and distractions to keep him busy, but he felt his father’s pressure mounting.<br>He didn’t have it in him to shoot an animal but did it to please his dad.<br>He aimed his gun at a small forest critter, shot, and missed terribly. |
| | |

| |
|---|
| The squirrel ran off. |

| | |
|---|---|
| Jenna had always been shy and she never wanted to be the center of attention.<br>When she was offered a promotion that required her to lead a team, she was afraid of being exposed as a fraud.<br>With the help of a mentor, she realized that she was facing a common case of impostor syndrome.<br>Scared to see if she could actually do it, Jenna rejected the promotion. | Jenna had always been cleanly and she never wanted a filthy home.<br>When she realized she had a mice infestation, she was afraid of being exposed as a dirty person.<br>With the help of some traps and poison, she attempted to exterminate the pests.<br>However, her home intruder was not keen to leave so soon. |
| | |
| The mouse hid. | |

| | |
|---|---|
| The suspect had been interrogated for nearly 6 hours.<br>He was getting very hungry and tired.<br>The detectives came back and told him the truth would set him free.<br>The perp considered his limited options | The chef had been cooking for nearly 6 hours.<br>The guests were getting very hungry and tired.<br>The chef came back and told them that the dish was almost ready.<br>He returned to the kitchen to finish creating his omelets. |
| | |
| The egg finally cracked. | |

| | |
|---|---|
| Jane finished reading an amazing book.<br>Her mind was buzzing with new ideas.<br>After months of writer's block, she felt ready to start.<br>She walked to her desk to develop the idea. | Jane just finished shopping at Lowe’s.<br>Her mind was buzzing with new ideas.<br>After months of cold weather, she felt ready to start.<br>She headed out to the garden with her purchase. |
| | |
| A seed was planted. | |

## Appendix C

### Memory Test Items

(Version 1); lures are NO responses, whereas all others are YES responses.

| | |
|---|---|
| literal | The flower flourished. |
| literal | A seed was planted. |
| literal | The mouse hid. |
| literal | The ice was starting to melt. |
| literal | The snake draped around her neck. |
| literal | Now, the princess won't eat. |
| literal | The garden grew. |
| literal | The egg finally cracked. |
| literal | The squirrel ran off. |
| literal | The nightingale sang beautifully. |
| metaphor | The animals ran wild. |
| metaphor | The plague had spread. |
| metaphor | The hens kept interrupting. |
| metaphor | The vampire bit me. |
| metaphor | The credit card paid for it. |
| metaphor | The skunk was the source. |
| metaphor | The computer analyzed the numbers. |
| metaphor | The sharks gathered together. |
| metaphor | The swan glided beautifully. |
| metaphor | The sponge soaked it up. |
| filler | The creampuffs didn't show up. |
| filler | The chimneys are disgusting. |
| filler | I was in charge of all of the sweet treats. |
| filler | I pulled out the vacuum and plugged it in. |
| filler | Anything seemed better than the nose she had now. |
| filler | My family's trip to the pumpkin patch went very smoothly. |
| filler | Someone said "GO" and the explosive was lit. |
| filler | The door creaked open slowly as we entered the dust-coated study. |
| filler | He squinted at the mirror and barely recognized himself. |
| lure | The twig snapped from the tree. |
| lure | The bell rang twice. |
| lure | The eyes saw everything. |
| lure | The milk soured rapidly. |
| lure | Her fire burned brightly. |
| lure | The ferrets did a top-notch job. |
| lure | Look at the barrel on that guy. |
| lure | The spice is what keeps me coming back. |
| lure | I felt like I was in a skillet. |

| | |
|---|---|
| lure | The rooster is broken, so I overslept. |
| lure | That idea is a gem. |
| lure | I have enough fuel to last all day. |
| lure | The dagger cut deeply. |
| lure | The baby cried out loud. |
| lure | The fish wriggled in the sun. |
| lure | The rain began to pour. |
| lure | A bolt struck and he started. |
| lure | The tailor's favorite poison was whiskey. |
| lure | A rainbow of people showed up. |
| lure | The phone woke her up from a nap. |
| lure | She couldn't tell if they were scaly or slimy. |
| lure | He thought about running away before the ceremony. |
| lure | He hoped that the pork was fully cooked. |
| lure | The salesman drove to work at noon. |
| lure | The song in the diner sounded familiar. |
| lure | Her boyfriend spilled the beans. |
| lure | The fire started in the closet in the bedroom. |
| lure | She used to be a vegetarian. |
| lure | The gum in her hair had to be cut out. |
| lure | The young couple lived in a kind of shoe. |