# Understanding Figurative Language:

# Studies on the Comprehension of Metaphors and Similes

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## Abstract

**Understanding Figurative Language:**

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At least since Aristotle, scholars have contrasted the more “literal” simile (e.g., *lawyers are like sharks*) with the more "figurative" metaphor (e.g., *lawyers are sharks*) to better understand how people deduce non-literal interpretations when comprehending figurative language such as metaphor. This thesis presents four manuscripts that investigated the comprehension of metaphors and similes to better understand this literal-figurative divide. The study reported in the first manuscript, employing off-line ratings and property-listing tasks, examined how metaphors and similes are interpreted, and how such statements are used on the Internet. Property lists generated for metaphors and similes were equivalent, although connotative properties seemed more salient for metaphors. The same study also found that similes on the Internet were used more often before an explanation. The study reported in the second manuscript examined the comprehension of metaphors and similes using self-paced reading, while the study reported in the third manuscript used eye-tracking. Results of the two studies were inconsistent: the self-paced reading study suggested similes were more difficult to process (longer reading times), while the reverse was suggested by the eye-tracking study (shorter saccade lengths for metaphors). Because first-pass reading measures such as saccade length are most immune to extra-linguistic variables, taken together results from both studies favor viewing metaphors as more difficult to comprehend than similes. Finally, the fourth manuscript presents a study that examined how people living with Alzheimer's disease interpret metaphors and similes using paraphrase and interpretation tasks. Interpretations for metaphors and similes were equivalent, but more apt statements (*music is (like) medicine*) were easier to interpret than less apt ones (e.g., *life is (like) a bottle*) highlighting the role of aptness in metaphor and simile interpretation. The final chapter presents a theoretical discussion in light of the results obtained in the four studies. In summary, the results suggest metaphors and similes activate a similar set of properties, but that connotative properties might receive increased activation when a metaphor is presented. This additional activation for connotative properties could make metaphors require more processing than similes.

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Dr. Roberto G. De Almeida has relentlessly supported me throughout my time as a graduate student at Concordia University. While there have been epic theoretical debates, and some theoretical disagreements remain, they have pushed me to better understand the literature and results presented to me. This thesis represents an example of this process. Certain chapters underwent several rounds of revision before being accepted, but these chapters are now better for it, and my understanding of the literature presented was similarly improved.

Dr. Jane Ashby was integral for the completion of the eye-tracking study. One of the key results in this thesis was the shorter saccade lengths found for metaphors, which would not have been noted otherwise. Indeed, the conclusions reached in this thesis could have been quite different had no eye tracking study been included. Therefore, I thank Dr. Jane Ashby for making these resources available and showing me the importance of using online techniques that minimize extra-linguistic variables.

Several undergraduate students also greatly assisted with the completion of the studies presented. Effie Andreakis was responsible for compiling the property lists for Chapter 2, and it was an enormous undertaking as the data set produced by participants was quite large. Deborah Martin assisted with the collection of data from Google and sorted the different explanations found into the different idea categories. Finally, Marco De Caro was my primary research assistant for all studies except the eye-tracking study. The psycope code for Chapter 3, for example, was completed by Marco, and he also assisted with the collection of Google data. Numerous individuals also served as proof-readers at different points in time. I thank Levi Revin for reading several early drafts of the presented manuscripts, and Victor Whitehead for his assistance on the introduction and discussion chapters. Finally, a special thanks goes to the daughter-mother team of Leah and Marnie McQuire. These two individuals proof-read the final drafts of the manuscript chapters and collected the norming data from normal elderly controls for chapter 5.

Indeed, I wish to especially thank those individuals and institutions in addition to Leah and Marnie that assisted with the study of metaphor in people living with Alzheimer's Disease. Melissa Hindley and Vanesso Manco assisted with the collection of data, and Melissa in particular helped establish connections with the Sunrise Senior Living community of Beaconsfield. Similarly, I thank the staff at the Alzheimer's Society of Montreal (Raffaela Cavaliere, Pascal Godbout, Linda Banks) for allowing me to participate in the society's activities (art therapy group, support center) and facilitating the collection of data from participants. Similarly, I thank the Alzheimer's Society of Canada for their financial support.

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## Contribution of the Authors

For all presented manuscripts, Carlos Roncero was lead author, and was closely supervised by Dr. Roberto de Almeida through the progression of the studies. Dr. de Almeida was greatly involved in the writing of the manuscripts presented, and is second author on all papers presented except chapter 4: *Metaphors are not (like) similes: Eye-Tracking Evidence*, where Dr. Jane Ashby is second author. Dr. Ashby ran the study at the University of Massachusetts (Amherst). She also analyzed the data, and wrote the first drafts of the method and results section. Dr. Roberto G. de Almeida and I were principally responsible for the remaining sections.

Deborah Martin and Marco de Caro appear as third and fourth author respectively for Chapter 2: *Ratings, Internet Frequency Counts, and Interpretation Norms for 84 Metaphors and Similes*. They were largely involved in study 2 of chapter 2, the collection of statements for metaphors and similes. They worked collaboratively with Roberto de Almeida and I for this aspect of the project in terms of procedure (collection of materials from the Internet, decision to group explanations into ideas), but were not involved in the analysis of the results nor the writing of the manuscript.

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# Chapter 1: Introduction

Discussions regarding metaphor date back to at least Aristotle (trans. 1926) and have generated debate across a wide range of disciplines (e.g., linguistics, philosophy, psychology, and neuroscience). The puzzle posed to scholars of metaphor is unraveling how the intended meaning of a statement can be deduced when that particular meaning is different from the lexical meaning of the sentence. For example, the meaning of the sentence *Hammerheads are sharks* carries the propositional content that hammerheads are fish based on the content of the individual lexical items—or their entailments—and how they are put together. In contrast, the sentence *Lawyers are sharks* would not imply that lawyers are fish. Most people stating this sentence would be expressing the sentiment that lawyers can be ruthless and egocentric. How individuals are able to determine this intended meaning, despite the fact it does not match the lexical meaning, has been a central topic in theories of metaphor.

Several metaphor researchers (e.g., Glucksberg, 2003; Miller, 1993; Morgan, 1993; Ortony, 1993; Rumelhart, 1993; Searle, 1993) have noted that metaphors violate maxims of conversation (Grice, 1975; Sadock, 1993). More specifically, a metaphor violates the principle of *quality*, that people should be truthful in their statements, and the principle of *quantity*, that people should be informative in their statements (Grice, 1975). For example, the metaphor *Lawyers are sharks* violates the principle of quality because lawyers are *not* sharks. Meanwhile, statements such as *Boys will be boys* violates the maximim of quantity because the statement seems to provide the redundant information that boys are boys, like saying a tautology such as *books are books* or *couches are couches*. Similarly, sentences such as *My dog is an animal* and *No man is an island*, while literally true, often have an associated connotative meaning that extends beyond the literal meaning (i.e., that the dog is somewhat dangerous, and that man can not live in isolation).These sentences, like *Boys will be boys*, violate the maxim of quantity because the information they provide, while valid, seems non-informative. Consequently, people interpret these sentences as carrying a meaning beyond what is explicitly said.

People also have the expectation that others will try to communicate with them in an effective manner (Miller, 1979 Searle, 1993). Consequently, when people hear metaphors that seem to violate maxims of conversation, they will try to deduce the intended meaning that is being asserted by the metaphor. Searle (1979) defined this intended meaning as *speaker's meaning* in contrast to the meaning asserted only by the words in the sentence (i.e., lexical meaning). Thus, although a person states *S is P*, the listener is aware that the speaker is actually asserting that *S is R* (Searle, 1993). For example, hearing the sentence *lawyers are sharks*, most native speakers of English would readily interpret this sentence as meaning that lawyers are aggressive rather than meaning that lawyers are fish.  The subsequent theoretical question is how individuals are able to deduce the speaker's intended meaning from the sentence actually articulated.

Searle (1979) put forward a three-stage model of metaphor interpretation that is commonly referred to as the standard pragmatic model or Searle's Three-Stage model. In this model, interpretation begins with a literal interpretation of the sentence that is actually articulated, but quickly rejected when seen as violating maxims of conversation such as quality or quantity. Whether a particular statement violates these maxims, however, will depend on context. For example, hearing *Bill is a snake* would not violate maxims of conversation if Bill is in fact the name of a lizard at the zoo, whereas knowledge that Bill is a human being, and not a lizard, would force the listener to reject the literal interpretation of the sentence and interpret the sentence as a metaphor. Similarly, the statement *It's hot in here* is ironic only when the room is actually cold. Therefore, when the literal meaning obtained is a good fit within the sentential context or a person's knowledge of the world, then interpretation is predicted to proceed fluidly. However, when this lexical meaning doesn't fit the context—as can occur for metaphors—then extra processing will be required to determine the speaker's intended meaning. As stated by Searle (1993): "where the utterance is defective if taken literally, look for an utterance meaning that differs from sentence meaning" (p.103).

To my knowledge, the first empirical test of Searle's three-stage model was Clark and Lucy (1975), who set out theoretical predictions that would become highly influential in later studies of metaphor. Relevant to the present thesis was their prediction that: "The listener should take longer whenever the intended meaning is different from the literal meaning" (p.58). This prediction is based on the assumption that deducing the conveyed meaning from a literal meaning takes time. Therefore, interpreting the sentence *Bill is a lizard* will be faster when Bill is in fact a lizard as opposed to a human being.[1] This prediction would later be central to many studies of metaphor. In the study by Clark and Lucy, they found support for Searle's three-stage model because indirect requests (*can you pass the salt*) took longer to read and verify than direct statements (*you can pass the salt*).

[1] Note that Searle and Grice never asserted this empirical prediction themselves, and the prediction can only be true if one assumes that the stages suggested by Searle occur serially, in real time, during sentence interpretation. However, many researchers make these assumptions when they examine Searle's three-stage model and predict that metaphors will take longer to process and interpret than comparable literal sentences (e.g., Blasko & Connine, 1993). Lepore and Stone (2010) also note that Searle offers no argument for his assumptions other than his arguments that the few other accounts he considers are flawed.

Ortony, Shallert, Reynolds, and Antos (1978) criticized Clark and Lucy's (1975) results because the sentences had been read in isolation. Rather than adopting the three-stage model of metaphor processing, and the associated argument that figurative meaning is obtained only after the rejection of a literal interpretation, Ortony et al. argued that metaphor processing involves elaboration processes that are refined by the context. To test this hypothesis, Ortony et al. (and later, Inhoof, Lima, & Carroll (1984) using eye-tracking) compared reading times for comparable figurative and literal sentences. In both studies, participants took longer to interpret a sentence figuratively when the supporting context was short, but there were no time differences when the supporting context was long. For example, in sentences (1a) and (1b), the preceding context is short and it took participants longer to interpret the sentence *the hens clicked noisily* in (1a) where a figurative interpretation is required.

1.a. At a meeting of the women's club, *the hens clucked noisily*

1.b. In the back of the barn, *the hens clucked noisily*

When the preceding context was longer, however, as seen below in (1c) and (1d), then the reading times for *the hens clucked noisily* were comparable.

1.c. At a meeting of the women's club the youngest member requested the floor and brought up the issue of supporting the equal rights amendment. The importance of the issue outweighed her discomfort in speaking before the group. They reacted as she expected. *The hens clucked noisily.*

1.d. In the back of the barn, the farmer's youngest child gathered pebbles and skipped them deftly across a puddle by the chicken coop. He knew that he was supposed to be feeding the animals but he kept on flicking at the birds. *The hens clucked noisily.*

Both Ortony et al. and Inhoff et al. viewed their results as inconsistent with the prediction that literal meaning should always be activated faster than a figurative meaning because the acquisition of a figurative meaning first requires obtaining a literal meaning. Instead, Ortony et al. argued that contextual support rather than the "literalness" of a sentence would determine comprehension time. More specifically, comprehension involves using

> …an already constructed representation of what has gone before (the context) as a conceptual framework for interpreting a target sentence, or any other linguistic unit . . . whether or not a target sentence requires a relatively large amount of processing time is a function of how easily it can be interpreted in light of contextually determined expectations rather than a function of its non literalness (p. 467).

This view of metaphor processing is sometimes called the *interactionist view*, as comprehension is viewed as an interaction between the sentence being read and the accompanying linguistic context (Giora, 2008).

The study by Clark and Lucy (1975) had presented sentences in isolation. In light of the results found by Ortony et al. (1978), some researchers argued that the three-stage model of metaphor processing is true only when sentences are presented in isolation (e.g., Rumelhart, 1979). To test this hypothesis, Janus and Bever (1985) compared reading times for literal sentences and metaphors presented in context, using the same paragraphs and sentences employed by Ortony et al. Consistent with other studies, there were no significant differences in reading times for the literal and figurative conditions. However, Janus and Bever (1985) also measured reading times for the initial phrases of target sentences (e.g., *the hens* in *the hens clucked noisily*) and found the initial phrases had significantly longer reading times when read after contexts that primed for a figurative interpretation. Janus and Bever interpreted this result as reflecting an initial "recognition problem" (Miller, 1979) in that participants required extra reading time upon realizing a literal interpretation wasn't appropriate and needed to be rejected in favor of a metaphorical representation; an interpretation of the results which is consistent with the Standard Pragmatic theory. It is possible, however, that the preceding contexts were not equivalent for producing a literal or figurative representation. Participants rated the literal phrases as more predictable after context than their figurative counterparts. The lower predictability of figurative sentences after context could have contributed to the initial phrases in the figurative condition having longer reading times. In other words, the result could reflect a predictability effect rather than a literality effect. Viewed in this manner, the results are consistent with Ortony's argument that processing time is more related to the amount of contextual support than the literality of the sentence.

These initial studies of metaphor cast doubt on the hypothesis that obtaining the figurative meaning for a given sentence is *always* slower and subsequent to obtaining its literal meaning. Even in the study by Janus and Bever, reading times differences disappeared when the reading times were measured for the entire sentence. Therefore, if a figurative meaning is acquired only once a literal meaning is obtained, the process itself appears to be completed very rapidly (Blasko & Connine, 1993). Some researchers have extended this argument to propose that literal and figurative meanings are accessed simultaneously, and the acquisition of a sentence's "figurative meaning" is as automatic a process as obtaining a literal meaning, and does not depend on first rejecting a sentence's literal meaning once it is viewed as nonsensical for the current context. As Glucksberg, Gildea, and Bookin (1982) have argued:

> Intuitively, it seems quite difficult, if not impossible, to inhibit our understanding of simple and transparent statements such as *some salesmen are bulldozers* or *some hearts are closets*, even though such statements are literally false. Furthermore, it seems to matter not at all whether such statements are plausible in context or not. Both the literal and nonliteral meanings seem to be apprehended without conscious effort or explicit inference (p. 87).

In other words, Glucksberg et al. argue that obtaining a figurative meaning is not an optional process nor that it occurs only once the literal meaning is considered defective.

Regardless of whether a sentence has a literal meaning that conforms to maxims of conversation, according to Glucksberg et al., people will automatically attempt to derive a non-literal meaning for a sentence.

To test their hypothesis, Glucksberg et al. (1982) asked participants to read sentences and judge them as being literally true or false. Four sentence types were presented: (1) literally true statements (e.g., *some fish are trout*); ( 2) literally false statements (e.g., *some fish are eagles*); (3) metaphors ("sentences were literally false category-membership statements, but they were readily interpretable if taken nonliterally" (p.88); e.g., *some birds are flutes*); (4) scrambled metaphors ("sentences were also literally false, but were not readily interpretable" (p.88); e.g., *some jobs are birds*). Glucksberg et al. predicted that people would be unable to inhibit an available metaphorical meaning even when instructed to judge sentences only as being literally true or false, causing metaphors to have longer response times than scrambled metaphors:

> If people can ignore metaphorical meanings, then literally false class-inclusion sentences such as *some jobs are jails* should pose no particular difficulties . . . On the other hand, if metaphorical meanings leap out-- i.e., cannot be inhibited or ignored-- then it should take longer to judge such sentences as false. The "true" metaphorical interpretation, if it is made at all, should conflict with the "false" literal interpretation and so should slow up response latencies (p.87).

In support of their predictions, Glucksberg et al. found a metaphor interference effect: although literally true sentences had faster response times than all other sentence types, metaphors had slower response times than both scrambled metaphors and literally false statements (which were not significantly different from each other).

Glucksberg et al. (1982) interpreted these results as participants being unable to inhibit a possible metaphorical meaning when it was readily perceived: "When these nonliteral meanings were apprehended, they produced a conflict in truth value: the literal meanings were false, the nonliteral true. This conflict, in turn, delayed or slowed down the final response." (p.90).In other words, participants could not avoid obtaining a figurative meaning for these statements despite being told to verify the literal truth of the statements. If figurative meanings are obtained only once a literal meaning is perceived as nonsensical within a given context, then only the sentence's literal meaning should be activated when there is no conflict. The results from Glucksberg et al., suggest that incongruence between context and literal meaning is not the only condition that triggers the activation of a non-literal meaning.

An alternate interpretation of Glucksberg et al. (1982)'s results is possible if figurative interpretations were activated as a result of task demands rather than the automatic activation of additional figurative meanings. More specifically, when participants were asked to verify the literal truth of the statements, this procedure may have invoked participants to consider figurative meanings that would have otherwise not been activated. Sentences with only a literal interpretation would have less interpretations to consider than a sentence with both a literal and figurative interpretation, leading to these sentences having shorter verification times. However, further studies have suggested that the activation of a figurative meaning can be automatic and not the consequence of task demands.

People may also readily activate the non-literal meaning of a metaphor if they are already familiar with that metaphor's non-literal meaning. Blasko and Connine (1993), for example, found comparable activation times for figurative and literal meanings. They used a cross-modal priming lexical decision task where participants heard metaphors (e.g., *Loneliness is a desert)* and then made a lexical decision for a property presented on the screen that was related to either the figurative meaning of *desert* in the metaphor (e.g., *isolate*), a literal property of *desert* (e.g., *sand*), or a control property not related to *desert* (e.g., *moustache*). They found that lexical decision times—deciding if the string of letters was an English word or not—were comparable for both figurative and literal properties, and faster than the response times found for control properties. Therefore, both the literal and metaphorical meanings appear to be activated equally fast, rather than faster activation occurring for the literal meanings. Interestingly, Blasko and Connine (1993) found this result not only for metaphors that were familiar, but also unfamiliar metaphors that had been rated as highly apt. Aptness being operationalized as how well a metaphor "expresses its specific non-literal meaning" (p.297). Therefore, these results suggest that the aptness level of a metaphor, in addition to familiarity, can affect how quickly a metaphor's non-literal meaning is activated. For highly apt metaphors, it is possible that the associated literal and figurative meanings can be activated equally fast.

In a follow-up study, Blasko and Briihl (1997) used eye-tracking to compare participants reading low- and high-familiar metaphors. Similar to earlier studies by Oronty et al. (1978) and Inhoff et al. (1984), metaphors were sometimes read after a context that "primes" (p.262) the metaphor's figurative meaning. For example, for the metaphor *to the sailor*, *the stars are a map to his destination*, the metaphor-related context was *Billboards are the yellow pages of the highway*, whereas the metaphor-unrelated context was *all good scientific research is mountain climbing*. Consistent with Blasko and Connine (1993), high-familiar metaphors were read faster than low-familiar metaphors, and the context results were consistent with Ortony et al.'s (1978) results because metaphors were read faster after the metaphor-related contexts.

These results have often been taken by some researchers to represent the demise of Searle's three-stage model (Blasko, 1999; Glucksberg, 2003). More specifically, the assumption that a figurative meaning is obtained only after an obtained literal meaning is deemed defective given the present context.[2] The results from Glucksberg et al. (1982), as well as Blasko and Connine (1993), suggest that a sentence's metaphorical meaning might be activated as quickly as a statement's literal meaning when the metaphors are either highly apt or familiar. Furthermore, processing speed can be increased when the metaphor is read after a supportive context (Blasko & Briihl, 1997; Inhoff et al., 1984; Janus & Bever, 1985; Ortony et al., 1978). Consequently, there is an increasing number of researchers who now predict that "the figurative meaning of a highly apt and familiar metaphor is rapidly available in parallel with the literal meaning of the vehicle" (Blasko, 1999, p.1677).

Some researchers even argue that the difference between processing a metaphor or a literal statement is perhaps *quantitatively* different, in that metaphors are more difficult to process, but not *qualitatively* different, in that they used the same underlying cognitive processes. Coulson and Van Petten (2002), for example, have argued that metaphors and literal statements are not distinguished by the cognitive processes involved. They argue that metaphors and literal statements are both understood through a process called *mapping*[3]: a selection and alignment of shared attributes and relations. The

[2] Searle (1979) does allow for the direct processing of metaphors (i.e., without the rejection of a literal meaning) in the case of "dead metaphors", where the original literal meaning has been lost and replaced with a new meaning: "the original sentence meaning is bypassed and the sentence acquires a new literal meaning identical with the former metaphorical utterance meaning" (p.110). Such sentences do not require first rejecting a literal interpretation to obtain a metaphorical interpretation because the literal meaning first accessed *is* the correct metaphorical interpretation.

[3] Coulson and Van Petten's theory of mapping is based on conceptual integration theory (Fauconnier & Turner, 1998).

mapping process is considered more difficult for metaphors because the topic and vehicle terms within a metaphor often come from distantly related domains. Consequently, Coulson and Van Petten argue that metaphors typically require more comprehension effort than comparable literal statements because of the increased semantic distance rather than a notion of literalness. To support this prediction, Coulson and Van Petten used ERP to compare participants' processing of three item types: literal statements (*he knows whisky is a strong intoxicant*), literal mapping statements (*he has used cough syrup as an intoxicant*), and metaphors (*he knows that power is an intoxicant*). Larger N400 amplitudes were predicted to correlate with the amount of mapping required (metaphors requiring the most, literal statements the least). Coulson and Van Petten found that the waveforms for the three expression types were similar, but that metaphors elicited larger N400s magnitudes than did the literal sentences, while the literal mappings were in-between. This N400 effect supports the argument that metaphors and comparable literal statements are understood using one general cognitive process (i.e., mapping), but the ability to select and align the correct relevant properties is more difficult for metaphors.

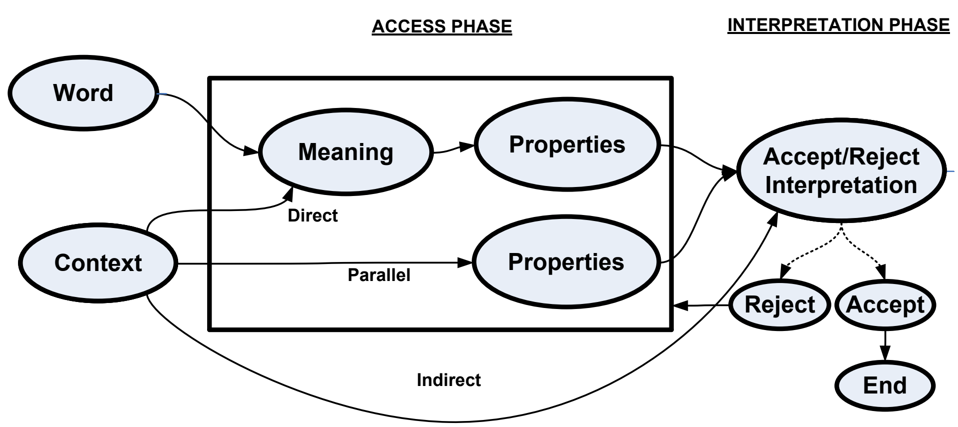
Pynte, Besson, Robichon, and Poli (1996) reached a similar conclusion in their ERP study on the time comprehension of metaphors. Pynte et al. assumed that if a literal meaning is activated prior to activating a figurative meaning, then the waveforms for literal and comparable figurative sentences (e.g., *those animals are lions* vs. *those fighters are lions*) should be different. More specifically, "if the literal meaning does not need to be rejected before the metaphorical meaning is accessed . . . one can expect the processes responsible for accessing both the literal and metaphorical meanings to be reflected by ERP modulations in the same latency band" (p.297). In other words, if literal and figurative language processing used similar cognitive processes then their individual ERP waveforms should be similar. If a literal meaning is activated prior to activating a figurative meaning, however, then the N400 effect should begin later in time than the N400 for literal sentences. Pynte et al., however, did not find support for this prediction because the two sentence types had similar wavelengths. A larger N400 effect for metaphors, however, was found; suggesting metaphors required more cognitive "effort" to be processed. Because the wavelengths were similar, however, Pynte et al. concluded the difference was quantitative rather than qualitative: similar processes for both sentence types, but more demanding of metaphors:

> "All attempts to isolate two distinct processing stages were totally unsuccessful. The manipulation of context led to late effects on the LPC, as expected, thus suggesting that the search for the metaphorical meaning indeed lasted for at least 1000 ms. However, whenever such a late effect was observed, an effect was also observed on N400. This suggests that the search for a metaphorical meaning actually began early in the comprehension process, apparently while the literal meaning was being accessed. This pattern of results seems to argue against the hierarchical hypothesis of metaphor comprehension" (p.312).

While such results do suggest metaphors and literal statements use the same cognitive processes, note that the interpretations of the ERP results presented in this chapter are the conclusions put forward by the researchers (i.e., Coulson & Van Petten, 2002; Pynte et al., 1996), and there is currently debate regarding whether the N400 effect reflects anomaly, inhibition processes, mapping, or different interpretation processes (for a review, see Kutas & Federmeir, 2011). Similarly, some researchers have questioned whether comparable reading times or reaction times are inconsistent with Searle's original postulate that a figurative meaning is obtained subsequent to determining the literal interpretation is defective. De Almeida, Manouilidou, Roncero, and Riven (2012), for example, note that comparable reading times could reflect a speed-up effect in the metaphor condition. In both conditions, a literal meaning is activated first, but the longer context produced a facilitative effect such that the search for a figurative interpretation was as fast as activating a literal interpretation, leading to comparable reading times. Therefore, while there may be consensus that certain studies have found similar results for metaphors and comparable literal statement, there is still debate surrounding how these results should be interpreted.

Broadly speaking, different theories of metaphor can be placed in 3 categories: indirect, parallel, and direct theories of metaphor processing. While the terms direct and indirect are common when describing theories of metaphor (e.g., Glucksberg, 2003), I have chosen to use the term "parallel" in this thesis to refer to theories where the given word and the context are predicted to activate their own related meanings, which are then both used in a subsequent interpretation stage. As can be expected, theories within these broad categories also have their own theoretical disagreements, and the theories presented in this chapter are only a sample of the numerous theories of metaphor currently in existence. Nevertheless, most theories can be generally classified in terms of how they view lexical access and the role of context. Indirect theories of metaphor generally take the position that lexical access is always initially literal and not impacted by context, whereas direct theories of metaphor predict lexical access can be affected by context, such that context can select the correct figurative meaning without first accessing a literal meaning. Parallel theories present a compromise position where context does not affect lexical access, but can activate meanings that are perhaps not activated by the word just read. In addition to disagreements regarding what semantic information is initially activated, these theories also disagree on whether a literal interpretation will need to be rejected prior to obtaining a figurative interpretation of the given sentence. For example, indirect theories of metaphor often predict that an obtained literal meaning will be replaced with a meaning that allows for a figurative interpretation, whereas direct theories predict a figurative meaning can already be available for a subsequent interpretation stage because it was selected by the context during lexical access. Finally, parallel theories of metaphor would predict that the meaning activated by the word, and any additional meanings activated by context, will both be available in a subsequent interpretation stage. A diagram displaying these three general theoretical predictions is presented in Figure 1A. In this thesis, the stage where lexical access occurs will be referred to as the "access stage", while the subsequent stage where this accessed material is used to derive an interpretation will be referred to as the "interpretation stage." Also note that this figure assumes meaning is decompositional. More specifically, activating a particular meaning is predicted to activate properties related to the word read.

Figure 1A: Diagram Summary of Theories of Metaphor



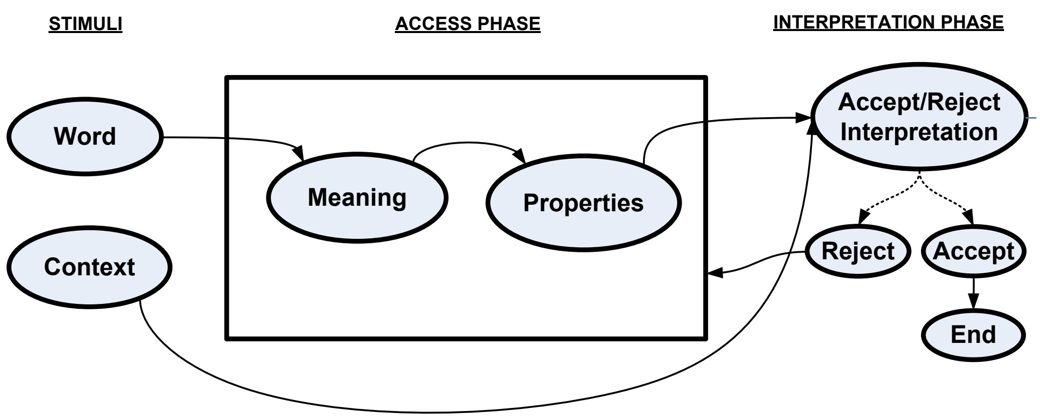

Special attention will be given to two theories of metaphor because they will be repeatedly discussed in the subsequent chapters: Career of Metaphor Theory (Bowdle &

Gentner, 2005; Gentner & Bowdle, 2008), and Categorization Theory (Glucksberg, 2003, 2008). Career of Metaphor theory and Categorization theory are especially relevant to the current thesis because they disagree on whether metaphor processing is ever indirect, and make predictions regarding the processing of metaphors (e.g., *time is money*) and comparable simile expressions (e.g., *time is like money*). For metaphors and similes, one object, hereafter called the topic (e.g., *lawyers*), is compared to or predicated by a second object, hereafter called the vehicle (e.g., *sharks*). While metaphors express this relationship using a categorical structure (*e.g., lawyers are sharks)*, similes create comparisons by adding a word such as *like (lawyers are like sharks*). These types of expressions are the ones examined in the subsequent chapters because they can test predictions regarding the nature of figurative language processing, while also controlling for lexical effects because the words in each expression are the same. Furthermore, some researchers have argued that understanding a metaphor involves mentally converting that metaphor into a simile prior to interpretation (a position often referred to as the *comparison view* (Black, 1955)). Whereas Categorization theory predicts both types metaphors and similes can be processed directly, Career of Metaphor theory predicts unfamiliar metaphors can be processed only indirectly. Furthermore, whereas Categorization theory predicts metaphors will elicit a figurative meaning, but similes a literal meaning, Career of Metaphor theory predicts metaphors and similes will have the same meaning. Finally, Career of Metaphor theory predicts that vehicle conventionality is related to faster processing times, whereas Categorization Theory predicts that more apt metaphors will be read faster.

During the discussion of parallel theories of metaphor, special attention will be given to the Graded Saliency hypothesis (Giora, 2003). Although this theory will be discussed less in the subsequent chapters, we will return to this theory when discussing the experimental results, in the final chapter. The theoretical predictions laid out by this theory could be beneficial if results are not consistent with either Career of Metaphor theory (Bowdle & Genter, 2005) or Categorization theory (Glucksberg, 2008).

Indirect Theories of Metaphor and Career of Metaphor Theory

Figure 1B: Indirect Theories of Metaphor




Indirect theories, as can be observed in Figure 1B, generally take the position that lexical access is unaffected by context and activates a literal meaning. For example, previously we discussed Searle's claim that a literal meaning would first have to be activated before deducing the correct figurative interpretation. Certain theorists have further argued that this initially activated literal meaning is also the only meaning ever activated. Davidson (1979), for example, rejects the idea of 'metaphorical meaning' in that interpreting a metaphor should require replacing a literal meaning with a figurative meaning. Instead, Davidson argues that metaphorical statements such as *love is a snowmobile* are no different from other thought-provoking incidents like a bump on the head, taking a drug, or bird song; where hearing a bird in the woods will provoke people to interpret the source of that sound. In this manner, metaphor interpretation is open-ended because it reflects the inferential processes of the person interpreting the sentence: "We imagine there is a content to be captured when all the while we are in fact focusing on what the metaphor makes us notice . . . in fact there is no limit to what a metaphor calls to our attention" (p.44). In case of similes (e.g., *love is like a snowmobile*), Davidson argues such statements overtly instruct a person to consider the similarities between two objects to correctly interpret the sentence (see Lepore and Stone (2010) for similar arguments).

My main difficulty with theorists who argue against metaphorical meaning is two-fold. First, theorists leave vague what processes take place once a literal meaning is activated beyond general inferential processes. Thus, it remains unclear in these models how the entire interpretation process from activation to interpretation takes place. Second, metaphor does not seem as open-ended as Davidson (1979) would predict. As noted by Black (1955), it would be quite surprising if anyone with some knowledge of men and wolves would interpret the sentence *men are wolves* to mean *men are vegetarians*. Instead, the ultimate interpretation of a sentence does appear to reflect properties related to the lexical items in the given metaphor. Similar to Searle (1979), Black argues that a speaker stating the metaphor *M* means in fact *L,* where *L* is semantically equivalent to *M.* Thus, when someone states *Lawyers are sharks*, they actually mean *lawyers are vicious*, and the word *shark* is being used to express *viciousness.* In contrast, Davidson would argue that *viciousness* in one of many potential interpretations that could come to mind because words carry no meaning beyond their literal interpretation (i.e., there is no clear path from the literal meaning of the word to its alternate figurative meaning other then general inferential processes). I disagree with Davidson's conclusion and agree with Camp's (2006) argument that: "We regularly use metaphors to make assertions and other speech acts with more or less determinate contents, but the non-cognitivist is committed to denying this" (p.155). In other words, when people state a metaphor such as *lawyers are sharks,* they intend for their audience to interpret the sentence as meaning lawyers are vicious (and similar negative connotations) rather than simply have the audience consider an array of possible interpretations. Also, while Davidson may see no clear path from a literal meaning to a different figurative meaning, people nevertheless show incredible consistency in their interpretations of metaphors; as will be observed in the subsequent chapters. Rarely, if ever, would an English speaker in North America interpret the sentence *lawyers are sharks* to mean lawyers are good swimmers.

Black (1955) discusses what processes might take place when someone deduces the meaning of a figurative statement. He argues that understanding a metaphor such as *men are wolves* involves a consideration of what properties are true of both men and wolves to determine in what manner men could be considered wolves. Clearly, not all aspects of wolves are also true of men, thus properties such as living in caves or having fur would be quickly dismissed. As Black notes:

> a speaker who says 'wolf' is normally taken to be implying in some sense of that word that he is referring to something fierce, carnivorous, treacherous, and so on . . . the effect, then, of (metaphorically) calling a man a 'wolf' is to evoke a wolf-system of related commonplaces. If the

> man is a wolf, he preys upon other animals, is fierce, hungry, engaged in constant struggle . . . any human traits that can without undue strain be talked about in 'wolf-language' will be rendered prominent, and any that cannot will be pushed into the background. The wolf-metaphor suppresses some details, emphasises others-- in short, *organizes* our view of man (p.288).

Therefore, in contrast with Davidon, Black assumes that speakers intend to convey a particular meaning about a subject when they express a metaphor. When someone states *men are wolves*, they intend to express the sentiment that men are fierce, whereas stating *men are butterflies* would convey a sentiment of men based on properties shared by both men and butterflies.

While Black (1955) laid out certain principles for how metaphors could be processed, the exact cognitive processes involved were not outlined. In contrast, Career of Metaphor theory (Bowdle & Gentner, 2006; Gentner & Bowdle, 2008) is an indirect theory of metaphor processing which agrees with Black's principles regarding metaphor processing, while also outlining the exact processes involved. Similar to Black (1955), Bowdle and Gentner assume that interpreting a metaphor involves a comparison of the two objects within a sentence (e.g., *men* and *wolves* in the metaphor *men are wolves*). Bowdle and Gentner also predict, however, that understanding a metaphor will involve interpreting the metaphor as a simile; a theoretical position commonly referred to as the *comparison* view.

In comparisons theories (e.g., Miller, 1979), metaphors are understood as comparisons (i.e., similes) to derive the correct interpretation. In other words, to understand the metaphor *men are wolves*, a person would understand the statement as a simile (i.e., *men are like wolves*) to derive the speaker's intended meaning. While earlier comparison theories were less explicit about the cognitive processes involved in obtaining the intended meaning from a simile, Career of Metaphor theory fills this gap by assuming that novel metaphors are understood as similes through a process called *structure mapping* (Gentner & Wolf, 1997, Bowdle & Gentner, 2005). In structure mapping, understanding a metaphor such as *men are wolves* involves comparing and contrasting the properties associated with the topic (*men*) and the vehicle (*wolves*). For example, to understand the metaphor *men are wolves*, people would convert the statement to *men are like wolves* and compare the salient properties for *men* and *wolves*. Those properties common to both words would then be aligned with associated properties. For example, the property *prey on* could be seen as true for both wolves and men, in that *wolves* prey on *animals* while *men* prey on *women*. In this manner, the metaphor can be understood as an analogy: *men are wolves* is understood to mean that men prey on women like wolves prey on animals (Bowdle & Gentner, 2005). Thus, by comparing and contrasting the properties of the two words, people can deduce the correct interpretation for an unfamiliar metaphor.

Because Career of Metaphor theory predicts that vehicles will first have a literal meaning only, and no associated figurative meaning, Career of Metaphor theory is similar to literal-first theories (e.g., Searle, 1979), which assume all words initially have only a literal meaning and extra cognitive processes are needed to then derive the figurative interpretation from this activated literal meaning. Unlike Searle, however, Career of Metaphor theory predicts that if a vehicle term is frequently used over time in a non-literal manner, then it can gain an associated figurative meaning that is directly retrievable from semantic memory. Once a vehicle has gained an associated figurative meaning, it is considered *conventional*. This progression towards conventionality is what Bowdle and Gentner (2005) call the vehicle's "career." For example, people today often refer to movies as being *blockbusters*, while the actual term *blockbuster* originally referred to a bomb that was capable of exploding a city block, and had no figurative representation. The scenario put forward by Career of Metaphor theory is that individuals began using the term *blockbuster* in comparative form, as a simile, to express a particular meaning (i.e., *that movie is like a blockbuster*). Because the literal meaning of *blockbuster* was not correct in this context, however, people needed to engage in comparative processes to derive the correct figurative meaning (i.e., structure-mapping). Over time, from people constantly deriving the same figurative meaning from hearing and using *blockbuster* to predicate this figurative meaning (e.g. *that show is like a blockbuster, that toy is like a blockbuster, that event is like a blockbuster)*, the vehicle acquires a conventional figurative meaning that is stored in semantic memory. Later, this conventional meaning can be retrieved from semantic memory whenever *blockbuster* is read and heard.

When metaphors contain conventional vehicles (e.g., *love is a drug*), Career of Metaphor predicts structure mapping will no longer be initiated. Instead, people can retrieve the conventional figurative meaning directly from semantic memory, and project this meaning from the vehicle to the topic.  For example, *drug* is related to the conventional figurative meaning of *addiction*. When someone reads a metaphor such as *love is a drug*, they project *addiction* onto *love* to understand the metaphor as meaning *love is addictive*. Gentner and Bowdle (2008) call this form of processing “categorical” to contrast it with the “comparative processing” used for metaphors with non-conventional vehicles (i.e., structure-mapping). For this reason, some people have called Career of Metaphor theory as a hybrid theory rather than an indirect or direct theory of metaphor processing (e.g., Camp, 2006) because Career of Metaphor theory assumes indirect processing for most metaphors, but direct processing (i.e., direct retrieval of the associated figurative meaning from semantic memory) when the vehicle has a conventional figurative meaning. I have chosen to classify Career of Metaphor theory as an indirect theory of metaphor processing because it assumes all words begin with only a literal meaning, and predicts the meaning initially activated will be determined more by the word itself than the associated context. In contrast, parallel and direct theories of metaphor often predict that context itself will activate a particular meaning.

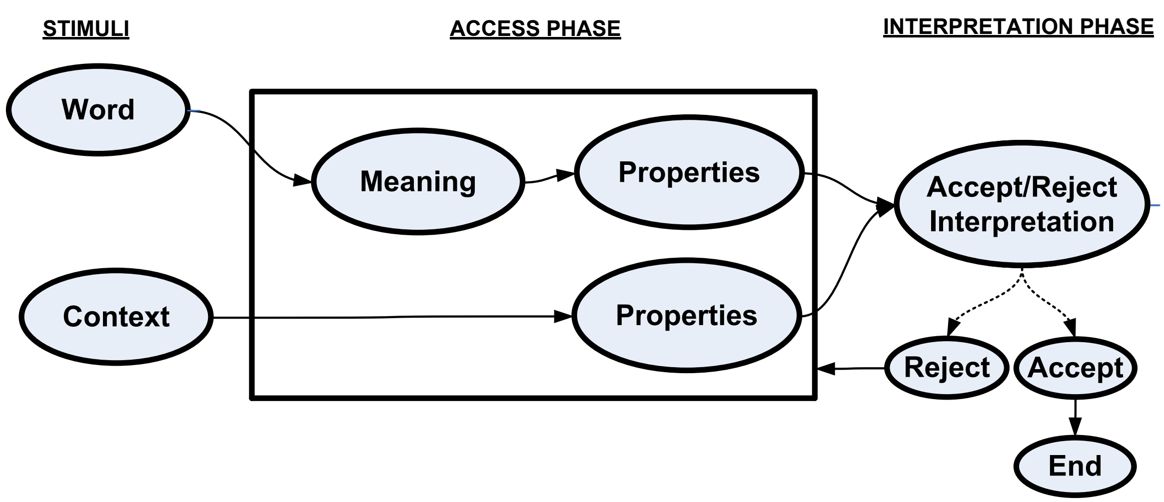
The role of conventionality, and the metaphor-simile conversion stage predicted by Career of Metaphor theory for unfamiliar metaphors, leads the theory to predict that metaphors and similes will have the same interpretation. To better understand this prediction, consider the following analogy. When a child first learns the basic multiplication tables, the process can be laborious, but over time, the process quickens to the point where answers can simply be retrieved from memory. However, the obtained answer does not change, rather the process shifts from a more difficult process to a simpler one. Career of Metaphor theory predicts a similar transition for vehicles. The shift from no figurative meaning to a conventional one is predicted to change the type of processing initiated (categorical rather than comparative), but the meaning obtained is predicted to remain the same. For this reason, if metaphors and similes are not found to have similar interpretations, then it places into question Career of Metaphor theory's prediction that unfamiliar metaphors are understood as similes to produce an interpretation, as well as the more general prediction that vehicles historically begin their "careers" within simile expressions and progress to being used within metaphors.

Career of Metaphor theory also predicts that metaphors that initiate categorical processing will be read faster than metaphors that require comparative processing because they no longer undergo a conversion stage to understand the metaphor as a simile. Bowdle and Gentner (2005) found results supporting this prediction. They compared reading times for metaphors with different levels of conventionality and found that metaphors whose vehicles had higher conventionality levels were read faster than those with less conventional vehicles. Similarly, Career of Metaphor theory predicts metaphors with conventional vehicles can be read as fast as comparable literal statements (e.g., similes) because they use categorical processing. To support this prediction, Bowdle and Gentner (2005) compared the reading times for metaphors and similes at different levels of conventionality. At low levels of conventionality, the sentence reading times were slower for the metaphor statements—reflecting the need to convert the metaphor into a simile to initiate structure-mapping. In contrast, at high levels of conventionality, the sentence reading times for metaphors and similes were comparable.

Lastly, Career of Metaphor theory predicts that the shift from comparative to categorical processing will be reflected in people's preferences for reading a topic-vehicle pair (e.g., *life-journey*) as a metaphor (*life is a journey*) or as a simile (*life is like a journey*). More specifically, topic-vehicle pairs with more conventional vehicles are predicted to be preferred as metaphors, while those pairs with less conventional vehicles will be preferred as similes. These preference predictions are assumed to reflect the type of processing used at different conventionality levels. Because metaphors whose vehicles have low conventionality are predicted to be understood using comparative processing, then the simile forms are predicted to be preferred for these topic-vehicle pairs because the comparative form of the simile (*X is like Y*) better reflects the type of processing that is initiated and used for comprehending these statements. In contrast, because metaphors with conventional vehicles can be understood using categorical processing, where the figurative meaning is retrieved from semantic memory and projected onto the topic, the metaphor form (*X is Y*) is predicted to be preferred because its form better reflects the type of processing used for expressions with conventional vehicle terms. Supporting these predictions, Bowdle and Gentner (2005) found that conventionality ratings were positively correlated with participants' metaphor preference ratings. More specifically, participants reported preference for reading a topic-vehicle pair as a metaphor when the vehicle had a high conventionality level, but as a simile when the conventionality level was low.

Parallel Theories of Metaphor Processing: Graded Saliency Hypothesis

Figure 1C: Parallel Theories of Metaphor




Giora's (1997, 2003) graded-saliency hypothesis differs from indirect theories in two key manners. First, the literality continuum, which predicts literal meanings will be activated faster than figurative meanings, is replaced with a saliency continuum, such that reading a given word will activate salient properties. Crucially, these salient properties are not necessarily "literal". The saliency of a specific property for a given word is predicted to develop over time and be related to variables such as frequency, conventionality, familiarity, and prototypicality. [4] In this manner, the graded-saliency hypothesis is like direct theories because it does not make the assumption the initially activated meaning will activate related literal properties. Unlike direct theories of metaphor, however, the graded saliency hypothesis does not predict context will impact lexical access. Instead, as demonstrated in Figure 1C, lexical access is predicted to be modular (Fodor, 1983). Contexual information, however, is predicted to activate meanings (i.e., salient properties) that are not necessarily the same ones activated by a given word in one of two possible manners. For example, context could activate a salient property through priming within the lexical module (i.e., intralexical priming between words in the lexicon). Thus, when someone reads the sentence *lawyers are sharks*, the word *lawyer* would activate the salient property *viciousness*, and this property would be available when the person reads the word *shark* and forms an interpretation of the sentence. Context can also activate certain properties through cloze probability. For example, when reading a sentence such as *Mary went outside to water the* __________, it is possible the word *flowers* or *lawn* would be activated prior to reading the final word, and salient properties related to possibly *flower* or *lawn* would be active while the final

[4] The variables affecting saliency, such as familiarity and conventionality, can be different for two individuals, due to factors including age and culture; thus, it is also possible for two individuals to have distinct salient meanings stored in the lexicon for a particular word. For example, for one individual the salient sense related to *sharks* could be *dangerous*, but *sharp teeth* for another individual.

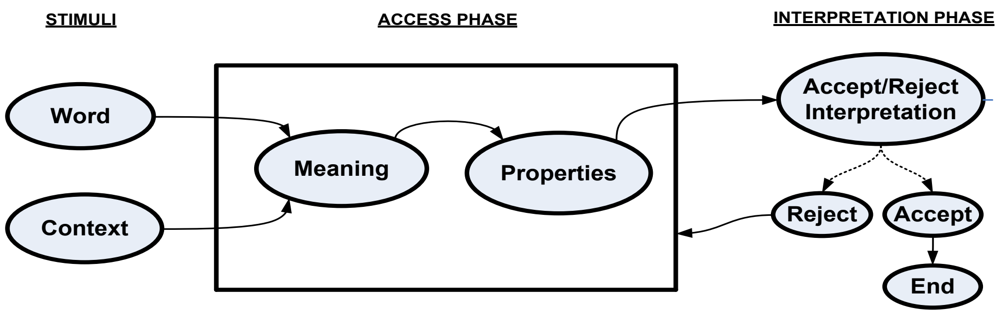
word is read, and all of these activated salient properties would be considered during the interpretation stage. Therefore, the graded saliency hypothesis assumes that both sources of information (lexical and contexual) are predicted to be used in parallel to generate the correct interpretation:

> Following Fodor's modular assumptions (1983), the Graded Salience Hypothesis (...) assumes that comprehension involves two distinct mechanisms that run in parallel, without interacting initially. One is bottom-up, sensitive only to (domain specific) linguistic stimuli; another is top-down involving inferential and integrative processes, susceptible to both linguistic and nonlinguisitc information. (Giora, Kotler, Shuval, & Fein, accepted, p.2).

Words stored within the lexicon are predicted to activate salient properties faster than less salient meanings, while a rich context can also activate a particular property which makes that interpretation itself salient within that context. Processing is expected to be fast whenever the correct interpretation matches either the salient properties that were activated by either the given words or the context. For example, in the results found by Ortony et al. (1978), the salient interpretation for *the hens clucked noisily* was presumably interpreting *hens* as referring to actual birds; thus, needing to interpret *hens* as people might be confusing and require longer processing time. When contextual support is rich, however, such that it readily primes a salient interpretation that would normally not be derived out of context, then that interpretation can be as fast as that activated by a given sentence alone.

Direct Theories of Metaphor Processing and Categorization Theory

Figure 1D: Direct Theories of Metaphor




Some researchers have argued that the context itself is what determines how lexical access will occur, as demonstrated in Figure 1D. Similar to the arguments made by Ortony et al. (1978), contextual support rather than literality itself is what determines ease of comprehension. Furthermore, rather than assuming extra processes are required for obtaining a metaphorical meaning, a single comprehensive mechanism is assumed to be sensitive to both linguistic and non-linguistic information for determining the correct meaning of any given sentence. Context is able to "selectively access appropriate meanings while blocking incompatible albeit salient ones" (p.145, Giora, 2008). When the context is rich and supportive, comprehension is expected to be fast and easy, whereas an unsupportive context would cause comprehension to be slower and more difficult.

The Underspecification Model (Frisson & Pickering, 2001), for example, assumes that reading a word activates an underspecified representation that is connected to all of the word's associated established senses.[5] For example, the verb *to paint* has one sense where it refers to applying paint to surface, and another sense where painting is being done artistically. When the word "paint" is read within a sentence, both of these senses would be activated simultaneously. Similarly, different literal and metaphorical interpretations (e.g., Vietnam the country in the sentence *I went on vacation last summer to Vietnam* versus the war movement in *I protested last summer about Vietnam* are assumed to also reflect different senses that are activated when a given word (e.g., *Vietnam*) is read. When a particular word is read, it is assumed to activate an unspecified meaning that subsequently activates all related senses (both literal and figurative).[6] Context is subsequently able to determine which sense is appropriate for the given context. Therefore, similar to Ortony's interactionst approach, the underspecification model assumes that context indicates which sense is most valid for interpretation: "the processor is subsequently able to refine this meaning on the basis of contextual information so that it can ultimately correspond to a particular sense" (p.159).

The Underspecification model leaves vague how context *does* determine the correct sense, and how the lexicon is able to hold a large number of related senses for each word. The main piece of evidence is the finding that words with a single salient sense (e.g., Finland) take longer to read in non-supportive contexts (*A lot of Americans protested during Finland, but in the end this did not alter the president's decision)* than contexts that prime a salient related sense (e.g., *During my trip, I hitchhiked around*

[5] The Underspecification Model deals only with "established senses" rather than novel interpretations of a word. Established senses have been conventionalized and are part of a person's lexical knowledge (Frisson & Pickering, 2001).

[6] Words with multiple meanings are different from words with multiple senses. Words with multiple meanings are homonyms, such as *bank*, where it can refer to either the lakeside or a financial institution. In contrast, words with multiple senses are words such "to paint" which can refer to painting for the enjoyment it provides versus utilitarian reasons (i.e., words that are not homonyms).

*Finland, but in the end I decided to rent a car for a couple of days*.), whereas words with multiple salient senses (e.g., *Vietnam)* have similar reading times when the context support either of these salient senses (e.g., *During my trip, I hitchhiked around Vietnam, but in the end I decided to rent a car for a couple of days vs. A lot of Americans protested during Vietnam, but in the end this did not alter the president's decision*). While such results do suggest that words are read faster when the context primes a salient sense related to a given word, they do not demonstrate evidence for the presence of underspecified meanings in the lexicon, nor, as mentioned, explain how the process itself selects the correct sense for a given context, nor how the process handles multiple words have a larger number of senses. Instead, the results are simply consistent with the idea that processing a word with multiple senses is easier when the context is supportive, or when the related sense for the correct interpretation of a given sentence is salient.

Relevance theories (c.f. Carston, 2002; Sperber and Wilson, 1995, 2008) also assume that how a particular word or sentence is interpreted largely depends on the context (e.g., relevance) and knowledge of the speaker and hearer. For example, the sentence *The soup is boiling* could be an indication to someone that the soup is too hot to try (assuming the person was just asked to try some); or, if someone was busy and not watching their soup, then the sentence *the soup is boiling* could be interpreted as a warning to the individual about the soup becoming overcooked. Crucially, it is not the words themselves that determine how a phrase or word will be interpreted: "the communicator produced a piece of evidence of her meaning - the ostensive stimulus - and the addressee infers the meaning from this piece of evidence and context" (Carston, 2002, p.87). In other words, it is how a person infers the meaning of a sentence, based on personal knowledge and context, which determines how a sentence is ultimately interpreted.

Relevance theory assumes two central inferential processes: broadening and loosening. In broadening, a word with a restrictive sense is extended to refer to large number of items (e.g., *kleenex* for all types of tissue papers), whereas in narrowing, literalness is in some sense preserved (e.g., stating *this is a kleenex* to refer to tissue of the actual brand name). Note that broadening and loosening depend not on the words themselves, nor whether a phrase should be interpreted literally or figuratively (i.e., metaphors are not simply a special case of broadening). For example, if someone says their *chiropractor is a magician* to someone seeking a magician for their birthday party, then the sentence would be interpreted literally and the narrow sense of *magician* (the actual occupation) would be inferred. In contrast, if someone was complaining about back pain to a friend, and the friend replied *my chiropractor is a magician,* then the listener would be expected to broaden *magician* to include the sense of individuals who are able to do amazing feats.

Similar to other direct theories, relevance theory also does not consider metaphor processes to be particularly special. Instead, the processes of broadening and loosening are assumed for all forms of language: "the same inferential procedure is used in interpreting all these different types of utterance" (p.95). Therefore, relevance theory is a general theory of how people interpret language, rather than specifically how figurative language is processed. As remarked by Sperber and Wilson (2008): "when you compare metaphors to other uses of words, you find a bit more of this and a bit less of that, but nothing deserving of a special theory, let alone a grand one." (p.103).

Glucksberg and colleagues in articulating their Categorization theory of metaphor similarly argue that no special processes are needed for metaphors other than those normally used for any given sentence. Also, unlike Career of Metaphor theory and other indirect theories of metaphor, Glucksberg and colleagues predict that obtaining a figurative meaning will not first require accessing the literal meaning. Instead, Glucksberg and Keysar (1979) argue that metaphors act like substitutes for categories without a lexical label. They note that basic-level units are commonly used to stand for categories: "all languages have names for basic level objects, but some do not have names for superordinate categories . . . the strategy of using the name of a prototypical category member to refer to a superordinate category that does not have a conventional name of its own appears in spoken languages" (p.409).

Glucksberg and Keysar (1979) argue metaphors such as *my job is a jail* function in a similar manner: "the category referred to as 'a jail' can be described by a list of distinguishing features, but it is difficult to enumerate these features exhaustively . . . by naming the category 'jail', 'my job' inherits those properties of 'jail' that can plausibly be attributed to 'my job. The words 'a jail' can refer either to a specific instant, 'jail', or to the class, 'jail'" (p.410). In other words, a word such as *shark,* when used in a nominal metaphor (i.e., *X is Y*), could refer to either the actual animal, or serve as an exemplar for the category of dangerous things because the vehicle is present in the "category" position (i.e., the vehicle position). Therefore, Categorization theory assumes vehicles are capable of attributing properties, even when they are not conventional category labels, because vehicles are assumed to have *dual-reference*: they can refer to either the literal representation or serve as an exemplar for a more abstract category whose category label has not been lexicalized (Glucksberg, 2003). When a given vehicle is read, both meanings (the basic-level word and the category) would be activated in parallel, and context would determine if the literal entity or the abstract category is the more appropriate meaning for interpretation. For example, when reading *great whites are sharks*, the literal representation would be more appropriate, whereas the abstract category meaning would be the correct one for the metaphor *lawyers are sharks*.

Dual-reference allows Categorization theory to explain why previous studies found figurative language could be processed as fast as literal language (as discussed earlier). Because the literal and abstract representations are activated in parallel, the processing times needed for forming a literal or figurative interpretation are the same. Categorization Theory predicts, however, that people will inhibit certain properties when processing a metaphor. For example, the properties *gills* and *dorsal fin* would be inhibited when interpreting the metaphor *lawyers are sharks*. Categorization theory also predicts that ease of comprehension will be determined by how easily one can perceive the properties of the vehicle (i.e., the category being represented) as also being true of the topic in the metaphor. More specifically, determining the relevant topic-vehicle relationship is predicted to be easier when the metaphor is apt. Chiappe and Kennedy (1999) define aptness as the extent to which the vehicle term captures salient properties of the topic. For example, people generally consider the sentence *politics is a jungle* as more apt than *politics is a beach* because the salient properties of *jungle* (i.e., *difficulty*, *trouble*, *danger*) are considered truer of *politics* than the salient properties associated with *beach* (i.e., *relaxation*, *fun*, *enjoyment*). Support for Categorization theory's prediction that aptness speeds metaphor processing has been found in several studies. As mentioned earlier, for example, Blasko and Connine (1993) reported that related figurative properties were activated as fast as related literal properties when the metaphors were highly apt, even if the metaphors themselves were not highly familiar.

Jones and Estes (2006) noted that studies finding support for conventionality as a significant predictor of reading times (e.g., Bowdle & Gentner, 2005) had not controlled for the aptness levels of the statements, which is problematic because higher conventionality ratings are often positively correlated with higher aptness ratings (e.g., Chiappe, Kennedy, and Chiappe, 2003; Thibodeau & Durgin, 2011). Therefore, it can be difficult to determine whether faster processing times is more related to higher levels of aptness or if they are related to conventionality when one of the variables is not included in the study. To circumvent these problems, Jones and Estes compared the processing times for statements that were similar in conventionality, but different in aptness. For example, both *beavers are lumberjacks* and *termites are lumberjacks* would be assumed to have the same conventionality level because the vehicle term in both sentences is *lumberjacks*. *Beavers are lumberjacks* is a more apt statement, however, because properties associated with *lumberjacks* (e.g., *cutting down wood*) is more salient for *beavers* than for *termites.* By comparing the reading times for these types of expressions, Jones and Estes were able to carefully control for the effects of conventionality and aptness in their reading times.

Whereas Career of Metaphor theory would predict no processing time differences for metaphors with the same vehicle term, Jones and Estes (2006) found that more apt metaphors were read faster than less apt metaphors. Glucksberg and Haulght (2006a) found similar results using the actual items from Bowdle and Gentner (2005), and noted that many of the items labeled as non-conventional by Bowdle and Gentner were also not very apt. In summary, these results suggest that previous studies which attributed faster processing times to higher conventionality levels may have reflected an actual aptness effect that had not been examined in the study.

The metaphor preference results found by Bowdle and Gentner (2005) may have also reflected an aptness effect. Chiappe, Kennedy, and Smykowsky (2003) found a significant positive correlation between aptness ratings and participants' metaphor preference ratings—similar to the results found by Bowdle and Gentner (2005) for conventionality ratings. Participants reported preferring reading topic-vehicle pairs as metaphors when the topic-vehicle relationship was viewed as apt (e.g., *time is money)*, but preferred the topic-vehicle pair as a simile when the relationship was not considered apt (e.g., *a tree is an umbrella*). Chiappe, Kennedy, and Chiappe (2003) used commonality analysis to compare conventionality and aptness ratings as predictors of metaphor preference ratings. Aptness ratings were found to explain more unique variance than conventionality ratings, which suggests that aptness as opposed to conventionality is a better predictor of participants' metaphor preference ratings.

Finally, regarding how metaphors and similes are interpreted, Glucksberg and colleagues (e.g., Glucksberg & Haught, 2006a, 2006b) have argued that the vehicle refers to a literal representation in similes, but a more abstract category in metaphors. In this manner, both Categorization theory and Career of Metaphor theory predict that similes will be interpreted as literal comparisons. Categorization theory, however, predicts that even metaphors whose vehicles have no conventional figurative meaning will produce a figurative representation as a result of dual-reference. Therefore, Categorization theory predicts that all metaphors will produce figurative interpretations, whereas similes are predicted to produce literal interpretations. Glucksberg and Haught (2006a) presented evidence supporting this prediction. They found that participants listed more figurative properties (e.g., *brilliant*) for metaphors (e.g., *ideas are diamonds*), but more literal properties for the simile (e.g., *shiny* for *ideas are like diamonds*). Glucksberg and Haught also wrote paragraphs reflecting more literal or figurative properties for a particular vehicle term (e.g., *old shark*), and asked participants whether the paragraph reflected more the metaphor or simile version of the topic-vehicle pair (e.g., *my lawyer is an old shark vs. my lawyers is like an old shark*). Participants reported that the paragraph with more figurative properties better matched the metaphor statement (e.g., *cunning* in the paragraph for *my lawyers was an old shark*), whereas the paragraph with more literal properties was viewed as better matching the simile sentence (e.g., *slow* in the paragraph for *my lawyer was an old shark* because being more slow is a tendency of older animals).

In summary, numerous theories have discussed what sort of meaning might be initially activated when a metaphor is read, and the consequences of this initially activated meaning for metaphor comprehension. More specifically, the hypothesis is that metaphors should be require more processing than comparable literal statements. Note also that this discussion of metaphor comprehension has often focused on a comparison of metaphors to similes: whether metaphors are understood as similes to obtain the intended figurative meaning. Few studies, however, have examined what specific properties are actually brought to mind when metaphors are read compared to similes. In Chapter 2, we asked participants to produce property lists to examine to what extent metaphors and similes do bring different properties to mind. Similarly, while numerous studies have examined whether metaphors or comparable literal sentences take longer to read, most of these results reflect full sentence reading time. An examination focused at the vehicle position could be more sensitive to differences in metaphor-simile processing. We did so using a moving window paradigm in Chapter 3, and with eye tracking in Chapter 4 to produce results reflecting the vehicle region only. Finally, the study of metaphor in a population known to have impaired cognitive abilities could provide insight into which specific processes are used for metaphor, and what abilities become impaired or preserved in different cognitive impaired populations. Towards this goal, Chapter 5 asked probable Alzheimer's Disease patients to interpret metaphors and similes, while also also examining which factors influence metaphor and simile comprehension.

## The Present Thesis

The series of studies presented in this thesis are used to test predictions from Career of Metaphor theory and Categorization theory regarding the processing and interpretation of metaphors and similes. Specifically, to what extent are metaphors processed and interpreted like equivalent similes (i.e., when the topic and vehicle terms are the same); and second, what variables (aptness or conventionality) best predict metaphor comprehension ease and processing time. The results found will help us examine whether figurative language processing is occasionally an indirect process, as predicted by Career of Metaphor theory, or always direct, as predicted by Categorization theory.

*Outline of the Chapters*

Chapter 2 compares participants' interpretations of metaphors and similes, and collects data for multiple variables thought to affect metaphor processing (e.g., aptness and conventionality). This study informs us to what extent metaphors and similes are semantically distinct, and more specifically, whether any differences observed can be considered a figurative-literal distinction. In Chapter 2, we also compared the frequency of metaphors and equivalent similes written by individuals on the Internet. The collected ratings were correlated with the Internet data to examine whether aptness, conventionality, interpretive diversity, or familiarity ratings could predict when people preferred writing a topic-vehicle pair as a metaphor or as a simile. Career of Metaphor theory predicts the metaphor form will be preferred when the vehicle term has a high conventionality rating, while categorization theory predicts the metaphor form will be preferred when the aptness level of the expression is high.

Chapters 3 and 4 both compare the online processing of metaphor and simile statements. Chapter 3 did so using self-paced reading in a moving-window paradigm, while Chapter 4 used eye tracking. One advantage to using eye tracking is the ability to record measurements other than processing time (e.g., number of regressions, saccade lengths). These measurements could suggest that distinct processing takes place, even when processing times for the two expressions are comparable. The self-paced reading studies also examined whether expressions rated more apt or conventional would have faster vehicle reading times. Whereas Career of Metaphor theory predicts that higher conventionality ratings will be associated with faster reading times, Categorization theory predicts more apt expressions will be processed faster.

Lastly, Chapter 5 examines metaphor and simile comprehension in people with Alzheimer's Disease (AD). It has been reported that people diagnosed with AD have difficulty understanding figurative language, although variables related to the statement (e.g., familiarity) can impact whether interpretation is good or poor (Amanzio, Geminiani, Leotta, & Cappa, 2008). In this study, we examined aptness, in addition to familiarity, as a predictor for when people with AD would provide good interpretations of metaphors. Categorization theory predicts that more apt expressions will be more easily interpreted; thus, AD patients could show good interpretation for metaphors rated apt. We also examined whether participants' interpretations would be similar or different for comparable metaphors and similes (e.g., *music is medicine* vs. *music is like medicine*).

Because the topic-vehicle pairs in metaphors and similes are the same, lexical effects are controlled when comparing these expressions. Also, because Categorization theory and Career of Metaphor theory predict that similes will be understood as literal comparisons, comparing the processing and interpretation of metaphor and simile statements allows us to examine processing for comparable figurative and literal statements that contain the same lexical items.

# Chapter 2: Ratings, Frequency Counts, and Interpretations for 84 Metaphors and Similes

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Abstract

Interpretive diversity scores and ratings of aptness, familiarity, and conventionality were determined for 84 topic-vehicle pairs (e.g., *life-journey*) as metaphors (*life is a journey*) and as similes (*life is like a journey*). Participants also provided properties elicited by these statements, as well as the topic and vehicle terms in isolation. Metaphors were found to activate more salient properties than similes. We also tested the ratings as theoretical predictors for when participants preferred reading topic-vehicle pairs as metaphors and when they appeared more often as metaphors on the Internet. In both cases, aptness was found to be the most important predictor. These different results have implications for theories of metaphor, as they are more consistent with Categorization theory (Glucksberg, 2008) than with Career of Metaphor theory (Gentner & Bowdle, 2008). Collected Norms might be used in psycholinguistic studies to investigate the interpretation of metaphors and similes.

Metaphors and similes relate a topic (such as *lawyers*) to a vehicle (such as *sharks*). In contrast to metaphors (e.g., *lawyers are sharks*), similes include a word such as *like* before the vehicle (e.g., *lawyers are like sharks*). Examining whether these expressions are interpreted and processed similarly has been a major question in multiple theories of figurative language (Gibbs, 2008). In addition to type of expression (metaphor or simile), psycholinguistic studies have found that multiple variables are important factors for how a metaphor is comprehended (Giora, 2003) and when a metaphor is used (Pierce & Chiappe, 2008). We collected ratings of aptness, conventionality, and familiarity for 84 topic-vehicle pairs when written as metaphors, and when written as similes. We also collected norms on what properties were brought to mind when participants read these metaphors and similes. A similar procedure was done for the topic and vehicle terms in isolation. Our main goal was to provide ratings and property norms that could facilitate future studies that include metaphor or simile sentences in their studies. We begin by briefly reviewing how these variables have been discussed by different metaphor theories.

*Career of Metaphor Theory and the Role of Conventionality*

The so-called Standard Pragmatic Model (e.g., Grice, 1975; Searle, 1979) proposes a possible serial model of language processing, whereby figurative meaning is obtained after a statement is identified as being literally false.  Such a model reflects the assumption that metaphors violate conversational maxims (Grice, 1975) and trigger processes not used for the interpretation of literal language. For example, a metaphor (*cities are jungles*) would be processed in three stages. First, there would be an attempt to achieve a literal sentence meaning of the metaphor representation, but then quickly followed by a realization that the statement is false (i.e. not literally true) because *cities* are not actually *jungles*. After it is realized that the expression's *sentence meaning* is not literal, a search for an alternative meaning begins (*speaker's meaning;* Searle, 1979). A commonly proposed strategy was to understand a metaphor as a comparison (i.e., simile; Davidson, 1979). For example, to understand the metaphor *cities are jungles*, someone would understand the statement as a simile (*cities are like jungles*) and subsequently engage in a thought process of which properties of *jungles* are also true of *cities*.

Gentner and Bowdle extended the arguments that metaphors engage comparative processes in their Career of Metaphor theory (Bowdle & Gentner, 2005; Genter & Bowdle, 2008; Gentner & Wolff, 1997). Gentner and Bowdle argue that novel metaphors also initiate a comparative process, whereby novel metaphors are also understood as similes as defined by the computational structure-mapping theory (Gentner, 1983). First, an alignment stage determines what properties are shared between the topic and the vehicle. For example, to understand a sentence such as *rage is a volcano*, the different predicates (associated properties) of *rage* and *volcano* would be matched and placed in parallel correspondence in a symmetric alignment process. Next, properties related to the vehicle are projected onto the topic. In this manner, the metaphor *rage is a volcano* would be understood as an analogy: *rage is explosive just as volcanoes are explosive*. In this case, *rage* and *volcano* are understood as having the shared relation *explosive*.

According to Career of Metaphor theory, vehicle conventionality is the most important predictor for how easily a metaphor is comprehended (Bowdle & Gentner, 2005). Vehicle conventionality is defined as the strength of association between a vehicle term and a figurative meaning. For example, stating *Jim is a snowflake* can easily bring to mind that *Jim* is unique because the term *snowflake* is related to the concept *uniqueness*. In contrast, *Jim is a binder* is harder to interpret because *binder* has no strongly associated figurative meaning (Gentner & Bowdle, 2008).

Vehicles are thought to acquire their conventional figurative meanings from being used in comparative statements. For example, a term such as *blockbuster*, as in the sentence *that movie was a blockbuster*, would have originally acquired its figurative meaning from speakers often expressing the vehicle within a simile (i.e., *that movie is like a blockbuster*). From people engaging in this comparative process for similes, a particular figurative meaning for the vehicle eventually becomes dominant (i.e., conventional). This dominant meaning is then lexicalized and stored in memory. It is at this stage that a vehicle is considered to have an associated conventional meaning.

One processing consequence for conventional vehicles is that the comparative processing required for vehicles with no conventional meaning can now be replaced with categorical processing where the vehicle simply predicates a figurative meaning onto the topic. This figurative meaning is retrieved directly from memory, and the projection of this meaning onto the topic is considered easier than the alignment of properties that occurs during comparative processing. Consistent with this argument, studies have found that conventional metaphors are read faster than less conventional metaphors (Blank, 1988, Bowdle & Gentner, 2005; Gentner & Wolff, 1997; Giora, 1997).

*Categorization Theory and the Role of Aptness*

A major alternative to Career of Metaphor theory is Categorization theory (Glucksberg, 2003). Rather than predicting that a metaphor such as *lawyers are sharks* must be interpreted literally first, and as a simile, it is argued that metaphors are understood as categorization statements. Also, whereas Career of Metaphor theory views categorization processing as possible only for metaphors with conventional vehicles (Gentner & Bowdle, 2008), Categorization theory predicts that all metaphors—conventional or not—are understood as categorizations (Glucksberg, 2008). As mentioned above, a possible obstacle for interpreting a metaphor as a categorization statement is that the statement is literally false: lawyers are *not* sharks. Categorization theory's solution is to view the vehicle not as the category label, but as an exemplar of a category whose label has not been lexicalized. In the case of *lawyers are sharks*, the vehicle term *shark* is used to refer to a category of predatory creatures. In turn, people comprehend *lawyers are sharks* as meaning that lawyers belong to the category of predatory creatures whose exemplar in this sentence is *sharks*. Therefore, how easily people comprehend metaphors is related to how easily they can construct this taxonomic relationship between a topic and a vehicle (Thibodeau & Durgin, 2011).

Categorization theory predicts that constructing the taxonomic relationship between the topic and vehicle is easier when metaphors are apt (Glucksberg, 2008). Chiappe and Kennedy (1999) defined aptness "as the extent to which a comparison manages to capture salient properties of the topic" (p.671). In other words, apt metaphors are taken to be those whose vehicle term by hypothesis activates many properties from memory that are also true of the topic. Activating properties that are salient for both the topic and the vehicle aids with establishing the categorical relationship, and makes comprehending metaphors easier. Specifically, categorization is easier when the created classification is seen as relevant and informative, determined by the number of salient properties being attributed to the topic by the vehicle (Glucksberg & Keysar, 1990; Glucksberg, 1993; Jones & Estes, 2006). Supporting this prediction, multiple studies have found that the more apt a metaphor is, the faster its processing and comprehension (Blasko & Connine, 1993; Chiappe & Kennedy, 1999, Chiappe, Kennedy, & Chiappe, 2003; Chiappe, Kennedy, & Smykowski, 2003; Glucksberg & McGlone, 1999; Jones & Estes, 2005; 2006).

Categorization theory also assumes that vehicles have dual-reference: serving as an exemplar of a superordinate category in metaphors, but referring to the literal representation in similes. For example, while *shark* would refer to a category of predatory creatures in a metaphor, it would refer to the literal fish in a simile. Hasson, Estes, and Glucksberg (2001) found support for this prediction when they asked participants to write paraphrases of metaphor and simile statements. Paraphrases for similes such as *ideas are like diamonds* elicited more literal properties related to the vehicle (e.g., *shiny*). Glucksberg and Haught (2006a) found further support when they asked participants whether a paragraph, written to reflect more literal properties of a vehicle term (e.g., *shark*), was closer to the meaning of the metaphor *lawyers are sharks* or the simile *lawyers are like sharks*. Participants generally chose the simile form as better reflecting the paragraph.

*Familiarity*

Familiarity with a given metaphor would presumably make processing easier, reflecting the general effect that practice with any particular task typically leads to faster processing; thus, shortening the time required for that particular task. Consistent with this argument, studies do find that more familiar metaphors are read faster than less familiar metaphors (e.g., Blasko & Briihl, 1997, Blasko & Briihl, 1997; Blasko & Connine, 1993). For example, Blasko and Briihl's eye tracking study found faster reading times for familiar metaphors compared to less familiar ones. This difference suggests the novel metaphors required more effortful processing than the familiar metaphors. Gentner and Bowdle (2008) and Glucksberg (2008), however, argue that aptness and conventionality are actually more important variables than familiarity because they make metaphor comprehension permissible even when the expressions are novel.

Familiarity and conventionality are not the same variable; thus, more familiar metaphors are not necessarily more conventional. Familiarity ratings refer to a specific expression (e.g., *time is money*) whereas conventionality ratings refer to the vehicle word only (*money*). Gentner and Bowdle (2008) argue that conventionality is more important than familiarity. For example, one may not be familiar with the metaphor *computers are drugs*, however, because *drug* has the conventional figurative meaning of *addiction*, the metaphor *computers are drugs* can be interpreted as meaning that computers are addictive.

Glucksberg (2003, 2008) has argued that aptness is more important than familiarity for metaphor comprehension. Similar to arguments made by Gentner and Bowdle (2008), Glucksberg argues that metaphors, even when not familiar, can be correctly and easily interpreted if the statements are apt. For example, the metaphor *music is medicine* is perhaps not very familiar, but participants typically find this metaphor apt and easy to comprehend (i.e., that *music* is *soothing*). Blasko and Connine (1993) also found results supporting the argument that aptness is more important than familiarity. In a lexical-decision task, Blasko and Connine found that participants could access figurative meanings as quickly as literal meanings after viewing a metaphor prime when the primes were familiar. This result held, however, even when the metaphors were not familiar, if the metaphors were particularly apt.

*Interpretive Diversity*

Interpretive diversity is calculated using Shannon's (1948) formula for estimating the entropy of a given source, that is, the amount of information (and thus, uncertainty) that a source generates:

$$H(X) = -\Sigma\, p(x_i) \log_2 p(x_i)$$

where $H(X)$ is the entropy value at source $X$, and $p(x_i)$ is a range of possibilities (*x1, x2, x3…*) not all of which have the same probability of occurrence. The formula then, serves to calculate the overall probability of a given event (in fact, a message), when there are several possible outcomes, each with its own probability of occurrence. While discussion of the specifics of the mathematical equation goes beyond the scope of the present article, it provides us with the means for calculating how properties elicited in the present Normative study may shed light on how metaphors and similes might be interpreted.

Utsumi (2005, 2007) was the first to apply this formula to the study of metaphor by calculating the values associated with properties (thus, the probability values associated with each possibility *x1, x2, x3…*), which supposedly are activated from memory when people process a particular expression. Values of interpretive diversity take maximal value when there are many equally salient properties, while taking a minimum value 0 if one salience is dominant to all others (i.e., only one dominant meaning is present). When examining the properties activated by metaphors and similes, greater values of interpretive diversity would reflect a larger amount of equally salient properties being activated. Therefore, if a topic-vehicle pair evokes three salient properties, while only one is activated for another topic-vehicle pair, the first pair would have a larger interpretive diversity score. If two expressions evoke an equal number of properties, however, then the expression whose salient properties are more similarly salient would be the one greater in interpretive diversity. These scores can be informative regarding the number of properties an expression activates and the saliency differences among these properties.

To date, only two studies by Utsumi have investigated the role of interpretive diversity in metaphor interpretation. Utsumi (2005) collected interpret-diversity ratings for a small set of topic-vehicle pairs, and found that pairs with greater interpretive diversity were comprehended more easily, especially when the metaphors produced a poetic effect (i.e., an appreciation for the meaning of the metaphor). In the second study, Utsumi (2007) found that metaphors rated more apt and familiar had higher interpretive diversity scores, but the vehicle words in these metaphors did not have higher conventionality ratings. Therefore, these results suggest that metaphors with higher levels of interpretive diversity are also more apt and more easily comprehended. It should be noted, however, that Utsumi's studies used Japanese metaphors. This is the first study to collect interpretive diversity ratings for English metaphors.

## Normative Study

The purpose of this study is to report ratings of aptness, conventionality, familiarity, and interpretive diversity on 84 topic-vehicle pairs when read as metaphors (*x is y*) and similes (*x is like y*); as well as the properties elicited by topic-vehicle pairs (*x-y*) when read in isolation. We also examined to what extent metaphor and simile expressions were similar on the different ratings and property lists collected. Categorization theory and Career of Metaphor theory make different predictions for the property lists of metaphors and similes. Career of Metaphor theory (Bowdle & Gentner, 2005; Gentner & Bowdle, 2008) assumes that metaphor vehicles gain their figurative meaning from the use of the vehicle word in simile expressions. Therefore, this theory predicts metaphors and similes with the same vehicle word should elicit the same properties because the vehicle consistently activates the same salient properties from memory. Support for this prediction was found when Chiappe and Kennedy (2000) asked participants to list the number of properties they felt each metaphor and simile statement was expressing. Consistent with Career of Metaphor theory, metaphors and similes were found to activate a similar number of properties.

A different prediction is made by Categorization theory because dual-reference predicts that the vehicle activates literal properties in similes, but figurative and literal properties in metaphors (Hasson, Estes, & Glucksberg, 2001; Glucksberg & Haught, 2006a; Glucksberg & Haugh, 2006b). Evidence supporting this prediction in the present study would be a larger number of properties for metaphors compared to similes. To test the prediction that similes would activate more literal features, we attempted to measure the degree to which elicited properties were literal or figurative by asking participants to rate the property's connotativeness.

Connotative properties are seen as reflecting more emergent properties, whereas denotative properties are those that reflect more literal properties (Danesi, 1998). For example, when describing a cat, *furry* would be a more denotative property than *sneaky*.

Participants rated each of the salient properties elicited from metaphors and similes on the extent to which it reflected a denotative or connotative property of the vehicle. From these ratings, we were able to measure to what extent metaphor and simile expressions evoked connotative or denotative properties. If similes do activate more literal properties than metaphors, then higher ratings of connotativeness would be expected for the properties written for metaphor versions of topic-vehicle pairs.

## Method

### *Participants*

A total of 280 Concordia University undergraduate students received credit towards a Psychology course or monetary compensation for participation in the study. All participants were native speakers of English.

### *Stimuli*

The stimuli consisted of 84 topic-vehicle pairs written as metaphor and simile sentences. Sixty-six of these topic-vehicle pairs have been used in previous research (Chiappe, Kennedy, & Chiappe, 2003; Roncero, Kennedy, & Smyth, 2006). An effort was made to collect further expressions not previously investigated in empirical research. Consistent with the method used by Roncero et al. (2006), the search phrases *common metaphor*, *common simile*, *an example of a metaphor is*, and *an example of a simile is* were typed into the Google search engine. Possible topic-vehicle pairs were then accepted if they produced a minimum total of three metaphor and simile statements combined. Twelve additional topic-vehicle pairs were added as a result of this procedure.

*Collection of Properties*

Sixty participants were given a booklet that contained the metaphors, similes, or the topic and vehicle terms in isolation. Twenty participants received a booklet containing metaphors, and 20 participants received a booklet containing similes only. For each expression listed in the booklet, participants were asked to list three properties that they felt the vehicle word was expressing about the topic. For example, participants could have written the properties *soothing, healing,* and *enjoyable* for the metaphor *music is medicine.* Three separate lines were written below each expression, and participants were asked to list each property on a separate line. This manipulation allowed us to measure whether a property had been written first (on the top line), second (on the middle line), or third (on the final line).

An additional 20 participants received a booklet containing a list of words, which were a topic or vehicle words written in isolation (e.g., *money* from the metaphor *time is money*). Participants were asked to list properties related to the each word. For example, for the word *money*, participants could have written the properties *valuable* and *green*. However, because these words presented in isolation may be interpreted more literally than when presented in metaphors and similes, we were concerned that participants might only write literal properties (e.g., *green* for *money*) if they were restricted to listing only three properties. To obtain a wide range of properties for each topic and vehicle term in isolation, we allowed and encouraged participants to list up to 10 properties for each word listed in the booklet.

For each expression, we tabulated how often a property was listed for each statement and word. An effort was made to keep terms as separate as possible. For example, although *strong* and *powerful* might reflect similar meanings, there are also semantic differences between these words. Collapsing the ratings for semantically similar words can reduce the amount of variation inherent in the set of properties elicited. We restricted collapsing responses to when words shared the same morphological root (e.g., *sleep* and *sleepiness*). By tabulating how often the different properties were listed, we were able to determine the most commonly listed properties for each metaphor and simile, as well as for each topic and vehicle words in isolation. An associated saliency rating was also determined for each property by checking if the property was listed first, second, or third by the participant. A property was given a score of one, if written first, two if written second, and three if written third. Therefore, properties more often written first would have an associated saliency rating average closer to one. These associated saliency ratings were used to calculate the interpretive diversity score of each expression, and which properties would be used for the conventionality and connotativeness ratings.

*Conventionality Ratings*

The property listed most frequently for each expression was the one used for determining the conventionality rating of a metaphor and simile expressions. When several properties were equally the most frequent, we chose the one with the lower associated saliency rating (i.e., the one whose average was closer to one). Twenty participants then rated the conventionality of the most frequently generated property for each vehicle when read within metaphors, while another twenty participants received the same list of vehicle words, but the properties generated most frequently for vehicles when read within similes.  Consistent with past studies (e.g., Bowdle & Gentner, 2005; Gentner & Wolff, 1997, Jones & Estes, 2006) we defined conventionality as the strength of association between a concept (the vehicle word) and a specific figurative meaning (the most frequently listed property for that vehicle). More specifically, participants received a booklet that contained the vehicles and an associated property from either the metaphor or simile, and were asked how common it was to use that vehicle to express the listed property. For example, *addiction* was found to be the most salient property for *love is a drug*, and thus in the conventionality booklet participants were asked to what extent the word *drug* is used to convey *addiction* is statements such as *x is a drug.* A scale was then presented asking participants to give a rating from one (not at all conventional) to ten (very conventional).

*Connotativeness Ratings*

In order to examine whether metaphors or similes elicit more literal properties, we examined to what extent properties reflected connotative features. We considered properties *salient* when they were reported by at least 25% the participants sampled, and will hereafter refer to such properties as salient properties. Eight metaphors (9.5%) and 13 similes (15.4%) had no properties reaching this salience level. Therefore, connotative ratings were collected for only 68 metaphors and similes.

We created a booklet containing, for each vehicle word, a list of the associated salient properties produced for the metaphors and similes. Participants were asked to rate to what extent each property reflected either a connotative or denotative property of that vehicle on a scale ranging from one to five, where one was labelled *strictly denotative*, two as *more denotative than connotative,* three as *both denotative and connotative*, four as *more connotative than* denotative, and five was labelled *strictly connotative.*

Because connotativeness can be a difficult variable to rate, we used a large sample size of 100 participants to collect these ratings. Furthermore, the difference between a denotative and a connotative property was explained to the participants by means of a short quiz, to ensure they understood the distinction. In the quiz, they were asked if *rectangular* and *artistic* were connotative or denotative properties of *painting,* and if *fur* and *playful* were connotative or denotative properties of *cat.* Participants who correctly stated *rectangular* was a more denotative property for painting, while *artistic* was more connotative, and that *fur* was more denotative for *cat*, whereas *playful* was more connotative, were allowed to give connotative ratings for the different properties. If a participant did not answer these quiz questions correctly, the concepts of connotativeness and denotativeness were explained again and they were given a third quiz question where they were asked if *hairy* and *aggressive* were more denotative or connotative properties of *people*. Participants who correctly answered *hairy* as more denotative, but *aggressive* as more connotative, were then allowed to give ratings for properties. If an incorrect answer was again given, the participant was excused from the study. Four participants were excused from the study because they failed this final quiz.

*Aptness and Familiarity Ratings*

In order to collect aptness ratings, two booklets were created: one that presented topic-vehicle pairs as metaphors (*life is a journey*), and one presenting topic-vehicle pairs as similes (*life is like a journey*). There was a scale ranging from one to ten beneath each statement with one labelled as *not all apt* and ten labelled *very apt*. Twenty participants received booklets that listed metaphors, while another 20 participants received booklets with similes. Participants were told that they would read statements that involve a relationship between two terms, a topic and a vehicle, and their task was to rate how apt they found each statement by circling the number that reflected their rating. Participants were told that apt expressions were those where the second term, the vehicle, captured salient properties of the first term, the topic. *Politics is a jungle* was given as an example of an apt statement, whereas *politics is a beach* was given as an example of a less apt statement.

A similar procedure was used for collecting familiarity ratings. However, rather than presenting scales for aptness, scales were created for familiarity from one to ten, with one labelled *not at all familiar* and ten labelled *very familiar.* Forty additional participants received booklets that contained either metaphors or similes and were asked to circle the number that reflected how familiar they found each expression. Specifically, they were asked to report to what extent they had heard or read this statement in the past.

## Results

### *Ratings*

The metaphors had aptness ratings ranging from 1.65 to 9.22, with an average aptness rating of 5.95 ($SD = 1.80$). Aptness ratings for similes ranged from 2.04 to 9.52, with an average aptness rating of 5.69 ($SD = 1.66$). The aptness difference was significant ($t$ (83) = 2.27, $p < .05$, $r = .24$), although the correlation between these ratings was also significant and large ($r$ (84) = .82, p < .001). This result suggests that the aptness level for a given expression depends more on the topic and vehicle in that expression, rather than whether the expression was a metaphor or simile.

Familiarity scores for metaphors ranged from 1.1 to 10, with an average familiarity score of 4.2 (*SD* = 2.09). Familiarity scores for similes ranged from 1.12 to 9.68, with an average rating familiarity score of 4.58 (*SD* = 2.23). The distribution for metaphor familiarity ratings was positively skewed ($z = 2.49$, $p < .05$), and metaphor familiarity ratings were significant on Kolmogorov-Smirnov tests of normality ($D$ (84) = .09, $p < .05$). Therefore, non-parametric tests were used for analyses that used metaphor familiarity ratings (i.e., Spearman correlations for correlations, and the Wilcoxon Signed-rank test for comparisons). The correlation between metaphor and smile familiarity ratings was large and significant ($r_s$ (84) = .85, $p < .001$), although participants were found to give higher familiarity ratings for simile statements than for metaphor statement ($T = 1154$, $p < .01$, $r = -.31$).

Metaphor conventionality scores ranged from 1.70 to 9.85 (*M = 7.20, SD* = 1.87), while simile conventionality scores ranged from 2.12 to 9.94 (*M* = 7.40, *SD* = 1.86). Both conventionality ratings were found to be negatively skewed (metaphor ratings, $z = -3.37$, $p < .01$; simile ratings, $z = -3.47$, $p < .01$) and both were significant on tests of normality (metaphors, $D$ (84) = .16, $p < .05$; similes, $D$ (84) = .16, $p < .05$); thus, we again used non-parametric tests for conventionality ratings. Conventionality ratings for metaphors and similes were not found to be significantly different ($T = 1444$, $p = .13$, $r = -.17$). A significant correlation was also found between the ratings ($r_s$ (84) = .34, $p < .001$).

To calculate interpretive diversity, we used the method outlined by Utsumi (2005, 2007), placing values into Shannon's equation for entropy ($H(X) = -\Sigma\, p(x_i) \log_2 p(x_i)$). We counted the number of times a property was listed for a vehicle to create a list of properties ($x_i$), with corresponding saliency values as relative saliencies ($p$). Consistent with Utsumi (2007), we excluded those properties listed only once. All values were then plugged into Shannon's entropy equation to determine an interpretive diversity value for each metaphor and simile. Metaphors were found to have interpretive diversity scores ranging from 3.10 to 5.52, with an average score of 4.49 ($SD = .48$). Similes were found to have interpretive diversity scores ranging from 2.89 to 5.52, with an average score of 4.55 ($SD = .47$). The metaphor interpretive diversity ratings were positively skewed ($z = 2.01$, $p < .05$) and significant on test of normality ($D$ (84) = .11, $p < .05$). We used non-parametric tests for analyses with interpretive diversity ratings. The difference between metaphor and simile interpretive diversity scores was not significant ($T = 1559$, $p = .31$, $r = -.11$), but the values for metaphors and similes were significantly related ($r_s$ (84) = .61, $p < .01$).

To allow for a theoretical discussion on how these measures could relate to each other, we collapsed the ratings across sentence type. This decision was motivated by the significant correlations (> .8) found for measure of aptness and familiarity, and the non-significant differences found between metaphor and simile expressions on conventionality and interpretive diversity ratings. Spearman correlations were run on the mean ratings for each expression. The correlation between conventionality ratings and aptness ratings was not significant ($r_s$ (84) = .19, $p = .09$), but a significant correlation was found between conventionality and familiarity ($r_s$ (84) = .30, $p < .05$). The correlation between interpretive diversity scores and conventionality ratings was significant, but negative ($r_s$ (84) = -.36, $p < .001$). Therefore, the higher the conventionality rating for a vehicle, the lower the level of interpretive diversity associated with that vehicle. Aptness ratings were not found to correlate with interpretive diversity ratings ($r_s$ = .09, $p$ = .41), but a positive correlation was found with averaged familiarity ratings ($r_s$ (84) = .73, $p$ < .001). Thus, more familiar expressions were also considered more apt. Lastly, there was no significant correlation between interpretive diversity ratings and familiarity ratings ($r_s$ = .19, $p$ = .09). The different ratings for metaphors and similes are presented in Table 2A of the Appendix.

*Properties*

Participants wrote numerous properties for each metaphor and simile, as well as each topic and vehicle word in isolation (See Tables 2B and 2C in the Appendix). The average number of properties listed for metaphors per topic-vehicle was 8.15 (*SD* = 2.20), while the mean number of properties per topic-vehicle for similes was 7.93 (*SD = 2.32*). Both distributions were significant on tests of normality (metaphors $D$ (84) = .11, $p$ <.05; similes $D$ (84) = .10, $p$ < .05); thus, we compared these distributions using non-parametric tests. The difference between metaphors and similes was not significant ($T$ = 37.11, $p$ = .27). It is possible, however, that this lack of difference reflects participants being always encouraged to list three properties for metaphors and similes. Therefore, as was done for the connotativeness ratings, we restricted our comparison to salient properties: those listed by at least five individuals. Thus, only the salient properties for 68 metaphor and simile expressions were compared to see whether metaphors or similes activated more salient properties. Metaphors elicited a mean of 1.95 salient properties (*sd* = .94), while the mean for simile elicited properties was 1.62 (*sd = .84*). The distribution of simile salient properties was positively skewed ($z$ = 3.91, $p$ < .01), and significant on tests of normality ($D$ (68) = .23, $p$ < .05); thus, non-parametric tests were used to examine if metaphors or simile elicited more salient properties. It was found that metaphors did elicit more salient properties than similes ($T = 176$, $p < .001$, $r = .39$). We next examined whether the salient properties elicited by similes were more denotative than those written for metaphors. Salient properties for metaphors had a mean connotative rating of 3.05 ($SD = .82$), while salient properties for similes had a mean connotative rating of 3.01 ($SD = .88$). These distributions were found to be normal, and the difference was found to be not significant ($t$ (70) = .64, $p = .53$). Therefore, the properties activated by similes were not found to be more denotative than those properties determined as salient for metaphors.

A significant correlation was found between the number of salient properties for metaphors and similes ($r_s$ (84) = .47, $p < .001$). Therefore, whenever a simile was associated with many salient properties, a large number was also found for the metaphor. To determine to what extent metaphor and similes had similar salient property lists, we gave metaphors and similes with the same topic-vehicle pair a match score. For example, if a simile had three salient properties, while the metaphor had four salient properties, three of which were those determined salient for the simile expression, then the comparison was given a match score of one. In contrast, if a simile had two salient properties, while the metaphor had three, and only one of these properties was also salient for the metaphor, then the comparison would receive a match score of 0.5 because only half of the salient properties in one were also present in the other. The same procedure was done for comparisons where the simile had more salient properties. If a metaphor had two salient properties, while the simile had three, but two of those three properties were the ones found salient for the metaphor, then the match score was one. In this manner, an average match score close to zero would suggest that metaphors and similes elicited completely different salient properties, whereas an average match score closer to one would suggest the metaphors and similes activated a similar set. This procedure is similar to that used by Roberts and Kruez (1994) and Graeasser (1981). Comparing the salient properties for metaphors and similes in this study, the mean match score was found to be quite high: 0.83 (*SD* = .35), indicating that the salient properties activated by our metaphors and similes were very similar. Indeed, high match scores were found when the number of salient properties was low or high. For example, only one salient property was found for *love is a drug* and *love is like a drug*, but in both cases this property was *addiction*. Similarly, three salient properties were found for both *Clouds are cotton* and *clouds are like cotton*, and for both expressions these properties were *round, soft,* and *fluffy*.

Finally, we examined whether the properties activated by the metaphors and similes were more related to the properties related to the topic or the vehicle. The three most listed properties for each topic and vehicle term in isolation were compared to the three most listed properties for metaphors and similes. In cases where there was a tie for the third most frequent property, the property with the lower associated saliency rating was selected. Comparing the properties listed for each metaphor and simile, to those listed for each topic and vehicle term in isolation, a match score out of three was given for how many of the properties were common between the term (topic or vehicle) and the metaphor or simile. Therefore, scores closer to three represent 100% overlap, while scores closer to zero reflect minimal match. The mean match score between properties listed for metaphors and vehicles was 0.65 (*SD* = .63), and 0.40 (*SD = 56*) between metaphors and topics. Both distributions were not normal (vehicles, *D* (84) = .28, *p* <

.001; topics, *D* (84) = .40, $p < .001$). The Wilcoxon test found the match with vehicle properties was greater than that found for topics in metaphors (*T* (84) = 271, $p < .05$, *r* =-.29). A similar pattern emerged for similes. The average match score between properties listed for similes and vehicles was 0.60 (*SD* = .68), and 0.39 (*SD = .54*) between similes and topics. The distributions were not normal (vehicles, *D* (84) = .31, $p < .05$; topics, *D* (84) = .40, $p < .001$). The comparison between simile-vehicle overlap scores to simile-topic overlap scores was significantly different (*T* (84) = 240.50, $p < .05$, *r* =.25). Therefore, both metaphors and similes appear to activate properties more related to the vehicle term than to the topic.

The low overlap scores (< 1) between expressions and topic-vehicle terms in isolation suggest metaphor and similes activate properties not elicited by the topic and vehicle terms in isolation. To examine this hypothesis, we computed overlap scores between the three most frequent properties for each topic-vehicle pair as a metaphor to the three most frequent properties for similes. This comparison produced an averaged overlap score of 1.46 (*SD* = .84) for metaphors to similes, while the overlap score for similes to metaphors was 1.38 (*SD* = .83). These overlap scores were significantly larger than those found in comparison to vehicle properties (metaphors, *T* (84) = 200, $p < .01$, *r* = -.63; similes, *T* (84) = 112, $p < .01$; *r* = -.62). Therefore, both metaphors and similes produced emergent properties: properties not elicited when the topic and vehicle terms were presented in isolation.

# Discussion

*Metaphors versus Similes*

We collected ratings for aptness, conventionality, and familiarity for topic-vehicle terms as metaphors and similes. We also collected property lists for each of these expressions, and from these property lists calculated interpretive diversity scores and collected connotativeness ratings. For the different ratings, metaphors and similes were highly comparable. While similes were rated significantly less apt than metaphors, and similes were rated significantly more familiar, the correlations between these ratings were high (>.8). Neither conventionality ratings nor interpretative diversity ratings were significantly different for metaphors and similes.

The lack of a conventionality difference between metaphors and similes is consistent with Career of Metaphor theory (Bowdle & Gentner, 2005), as we would expect expressions with the same vehicle term to have the same levels of vehicle conventionality. The null difference between metaphors and similes for interpretive diversity scores, however, is somewhat surprising. One might have predicted that similes, being interpreted as comparisons, would activate more properties than metaphors. One possible explanation is that the procedure of encouraging participants to list three properties for both metaphors and similes may have led participants to overly produce properties, even when the given properties were not promptly activated. Indeed, comparing property totals for metaphors and similes, no significant difference emerged. Because asking participants to always list three properties could have made the metaphor and simile properties totals similar, we narrowed our property comparison to those listed by at least 5 participants—hereafter called salient properties. We also collected connotativeness ratings on these salient properties to see whether one expression produced a list of more connotative properties—which, by hypothesis, are more figurative. Metaphors were found to have produced more salient properties, but the levels of connotativeness were similar.

In summary, these results suggest that metaphors and similes are highly comparable. Finding more salient properties for metaphors, however, is consistent with Categorization theory's argument that metaphor vehicles have dual-reference: the vehicle word is predicted to encode the literal base-term in similes, but both the base-term and an associated figurative category in metaphors (Glucksberg, 2003). Although finding similar levels of connotativeness is inconsistent with the prediction that similes will elicit more literal properties (Glucksberg & Haught, 2006). Furthermore, the salient properties for metaphors and similes were often equivalent.

We did note specific examples, however, where the simile does seem to activate more literal properties, as predicted by Glucksberg and Haught (2006). For example, *processors* was the most frequent property for *minds are like computers*, but *complicated* was the most frequent property for *minds are computers*; and while *red* was a salient property for *love is like heart*, this property was less salient (<5) for *love is a heart*. We also observed cases where properties that were less frequent for the simile expression showed more saliency and frequency for the metaphor expression. For example, *powerful* was not very frequent for *god is like fire*, but was the most frequent property listed for *god is fire.* In summary, while there does appear to be a large amount of similarity between metaphors and similes, consistent with Career of Metaphor theory (Bowdle & Gentner, 2005), something *extra* does appear to occur for the metaphors. Metaphors seem to activate properties that are either not activated or have a lower saliency value for similes. In other words, reading a metaphor rather than a simile seems to make certain properties more salient.

*Ratings*

Three significant correlations were found between the ratings: a positive relationship between conventionality and familiarity, a positive relationship between aptness and familiarity, and a negative relationship between conventionality and interpretive diversity. The positive correlation between conventionality and familiarity is consistent with Career of Metaphor theory's argument that a figurative meaning attributed to a particular vehicle word becomes stronger the more often a vehicle word is used to convey that meaning over time.

Because interpretive diversity reflects to what extent a metaphor or simile is associated with many equally salient properties, the negative correlation between conventionality and interpretive diversity has implications for how vehicle conventionality could develop. Specifically, a vehicle word will be less likely to build a strong association with a specific property when there are other salient properties that compete to be associated with that vehicle term. For example, the property lists show examples of conventional vehicles where one property is dominant over all others: *absorbent* for *memory is a sponge; addictive* for *love is a drug*, *slow* for *time is a snail*, *opening* for *Christ is a door, complex* for *minds are computers*; *protecting* for *trees are umbrellas*, and *hard* for *heart is a stone*. But there are also several expressions where multiple properties are salient. Examples include *soft, white*, and *fluffy* for *clouds are like* *cotton*; *colourful* and *beautiful* for *love is a rainbow*; *flows* and *long* for *memory is a river*. Therefore, while it is possible for one salient meaning to become associated with a vehicle term, some vehicles can bring many salient properties to mind.

The significant correlation between aptness and familiarity replicates the one found by Thibodeau and Durgin (2011). They interpreted their results as reflecting the fact that participants' ratings for familiarity and aptness might not be fully independent. More specifically, familiar expressions are those that are presumably activated faster, and participants that view certain expressions as apt may be influenced by how easily properties related to that expression come to mind. However, it is also possible that certain expressions become familiar because they are considered good metaphors (Chiappe & Kennedy, 2000). People tell other individuals the metaphors they find apt, and in this manner, aptness breeds familiarity. Consequently, it can be generally expected that apt metaphors will also be familiar, and the positive correlation found here and in previous studies (e.g. Chaippe, Kennedy, & Chaippe, 2003) will be the typical finding. For these reasons, it can be difficult to determine to what extent ratings such as aptness and familiarity reflect different variables.

In order to further tease apart the variables collected in the present ratings, we conducted another study on the nature of metaphors and similes. More specifically, we were interested in evaluating our variables as predictors for the preference and production of metaphor or simile versions of particular topic-vehicle pairs. We reasoned that particular variables (e.g., familiarity and aptness) might predict the choice of a given pair to be expressed as a metaphor or simile.

Metaphor Preference Study

It has been suggested that metaphors convey more "force" than similes (Bowdle & Gentner, 2005; Chiappe & Kennedy, 2001; Ortony, 1979; Roberts & Kreux, 1994). Compare the metaphor *I think Richard is a lion* and the simile *I think Richard is like a lion*. The metaphor seems to express greater fortitude as it says that Richard *is* a lion. Chiappe and Kennedy (2001) argue that metaphors convey more strength because they are read as categorization statements. Stating that *x is y* conveys that *x* has all of the properties that are true of *y*, whereas stating *x is like y* implies that some, but not all of the properties related to *y* are also related to *x*. For example, a chemist would label something as *water* if it has all the necessary properties of water, whereas something *like water* would mean certain necessary properties might be absent. Therefore, people may choose to use a metaphor rather than a simile when they want to implicate that several salient properties are shared between the topic and the vehicle (Glucksberg & Keysar, 1990, 1993).

As previously mentioned, Chiappe and Kennedy (1999, 2001) define the degree of salient properties shared by a topic and vehicle term as *aptness.* Because people are predicted to prefer the metaphor when they believe the topic and vehicle share many properties, more apt topic-vehicle pairs are predicted to be preferred as metaphors. That is, Chiappe and Kennedy predict more apt topic-vehicle pairs, it is predicted that the metaphor's categorical form will be preferred because the categorical structure (*x is y*) suggests more topic-vehicle similarity than a comparison structure (*x is like* y). Consistent with this prediction, Chiappe and Kennedy (1999) found that the higher the aptness, the more a particular topic-vehicle pair is preferred as a metaphor (see also

Chiappe, Kennedy, & Chiappe, 2003; Chiappe, Kennedy, & Smykowski, 2003). Chiappe and Kennedy (2001) also found that the more participants judged the topic and vehicle words within a pair as similar, the more participants reported preferring those topic-vehicle pairs as metaphors. These results are consistent with the argument that the metaphor is preferred when the topic and vehicle are seen as sharing many salient properties.

The major competitor to aptness as a predictor of metaphor preference has been vehicle conventionality as outlined by Career of Metaphor theory (Gentner & Wolff, 1997, Bowdle & Gentner, 2005, Gentner & Bowdle, 2008). Bowdle and Gentner (2005), for instance, presented participants with topic-vehicle pairs and asked them whether they preferred the terms within a metaphor or a simile. Bowdle and Gentner assumed that participants would prefer the form that matched the categorical or comparative processing participants had used to interpret that topic-vehicle pair. Thus, if people comprehend more conventional metaphors as categorizations rather than comparisons, then they should also prefer reading the topic-vehicle pair as a metaphor because its categorical structure initiates categorical processing ("grammatical concordance", Bowdle & Gentner, 2005). In contrast, when categorization is not possible because the vehicle is not conventional, a comparative process is needed and participants are predicted to prefer the simile structure because its structure initiates comparative processing. Consistent with the above predictions, topic-vehicle pairs with more conventional vehicles were preferred as metaphors rather than similes.

More recent studies, however, have cast doubts on Bowdle and Gentner's (2005) results. Jones and Estes (2005) directly tested whether more conventional vehicles induced more categorical processing. Participants first read a literal or figurative prime (*that librarian is/saw a mouse*) and then immediately asked participants whether the topic (*librarian*) was a non-, partial, or full member of the vehicle category (*mouse*). Category attribution was larger after figurative than literal primes, and also greater for more conventional metaphors than less conventional ones. However, this effect disappeared when aptness ratings were included as a covariate. Repeating the study with aptness ratings, category attribution was larger for more apt metaphors. These results suggest that aptness, rather than conventionality, promotes categorization and a preference for a metaphor rather than a simile.

It has also been determined that the novel metaphors used by Bowdle and Gentner (2005) were less apt than the conventional metaphors (Glucksberg & Haught, 2006a, Jones & Estes, 2006). Therefore, the findings attributed to conventionality, could also be attributed to aptness, as the more conventional metaphors were also more apt than the less conventional metaphors (Glucksberg, 2008). In a follow-up study, Jones and Estes (2006) contrasted aptness and conventionality using items that carefully controlled for these variables. Metaphors had similar vehicles, but different topics (e.g., *a rooster is an alarm clock* versus *a robin is an alarm clock*). Because the vehicle is the same, the conventionality level is the same, but aptness is reduced when the salient meaning associated with the vehicle is a less salient property for that topic. For example, *rooster is an alarm clock* is more apt than *a robin is an alarm clock* because the relevant property (*the sound of birds waking people in the morning)* is a more salient property of *roosters* than of *robins*. Jones and Estes found aptness, not conventionality, predicted preference for metaphors over similes, as well as faster reading times.

Metaphor preference is generally collected from participants by presenting a metaphor along with an adjacent comparable simile statement, and asking participants to what extent they prefer the metaphor or the simile expression. Such metaphor preference ratings, however, could lack ecological validity because they may not capture how people actually use metaphors and similes on a general basis. More specifically, preference for reading a topic-vehicle pair as a metaphor may not predict whether someone will actually later produce that topic-vehicle pair as a metaphor when given the chance to do so. In order to circumvent these methodological problems, we decided to collect preference ratings using the classic method of gathering ratings from participants, but also used an additional source to determine when people prefer a topic-vehicle pair as a metaphor or a simile: Google search results. We counted how often people used a topic-vehicle pair as a metaphor or as a simile on the Internet to determine frequency counts for each topic-vehicle pair as a metaphor and as a simile, and subtracted topic-vehicle counts from each other to create frequency difference scores. These scores served as our Internet version of the metaphor preference ratings from participants. We then examined if the metaphor preference ratings collected from participants could predict these frequency difference scores, and also ran regressions with both the metaphor preference ratings and frequency difference scores using the ratings collected in the Normative study (aptness, conventionality, familiarity, interpretive diversity). Running regressions with comparable data, one from participants and one with Internet frequency counts, allows us to examine to what extent our ratings collected in the laboratory can predict actual real world use.

Lastly, we were interested in extending the results reported by Roncero, Kennedy, and Smyth (2006), who found that similes were more often followed by explanations than metaphors. This result is consistent with participants' reports that similes more often than metaphors are used to clarify an expressed relationship (Roberts & Kreuz, 1994). We checked for that result in the present study, but also ran correlations to see what type of expression was more likely to be followed by an explanation. We also checked if the explanations were being used to highlight salient or non-salient properties. To do this, we compared the properties expressed by explanations on the Internet to the properties collected in the Normative study.

## Method

### *Participants*

A total of 104 Concordia University students, all native speakers of English, were recruited to participate in the present preference ratings task. They all received course credit for participation.

### *Stimuli*

The same 84 topic-vehicle pairs from the Normative study were used in the present study.

### *Ratings*

For metaphor preference ratings, the 104 participants were presented with metaphors and similes beside each other and asked to what extent they preferred the form as a metaphor or as a simile. In the rating scale, 1 was labelled *simile only*, 2 was labelled *simile more than metaphor*, 3 was labelled *no preference*, 4 was labelled *metaphor more than simile*, while 5 was labelled *metaphor only*. For the rest of the ratings, we used the averaged aptness ratings, averaged conventionality ratings, averaged familiarity ratings, and the averaged interpretive diversity ratings collected in the Normative study.

*Internet Productions and Explanations*

The frequency counts for 84 metaphors and similes were obtained employing the method used by Roncero et al. (2006). Topic-vehicle pairs were written as metaphors (e.g., *rage is a volcano*) and similes (e.g., *rage is like a volcano*). Each sentence was then searched on Google, which displayed a list of websites containing each sentence and its linguistic context. A count of distinct websites containing the searched item constituted the frequency count for that sentence.

Thibodeau and Durgin (2011) used Google search totals as their frequency counts. The problem with such counts is that it does not capture unique productions and often overestimates the number of productions. For example, Google may list many counts for *wisdom is an ocean* because there is a book with this title and the search engine is counting all the times this book title appears on any web page. Such counts also do not reflect the spontaneous use of metaphor on the Internet; for example, when people are using metaphor in conversations (e.g., blogs and posts on message boards). To ensure our counts reflected unique and spontaneous sentences, constraints from Roncero et al. (2006) were used to determine whether a specific production could be included in the frequency count. For example, one constraint is that repetitions of the same production listed within the same website were recorded as a single production. This procedure ensures no single website can dominate the recorded frequency. Furthermore, we followed the constraint of *1 web page = 1 production*; thus, we only obtained unique productions of metaphors and similes. Repetitions were not included in our frequency counts. We also ensured that all instances with the same pattern would be recorded as one production. For example, all instances of *the mind is an umbrella – best when open* would be recorded as a single production because the same linguistic context (i.e. *best when open)* is repeated in every production. Recording such statements as a single production prevents a few uses of the same expression dominating the results. Finally, any examples from academic discussions or journal articles on metaphor were not included to help ensure only spontaneous productions were included in the counts.

It is true, however, that Google can potentially yield many thousands of occurrences for a particular topic-vehicle pair as a metaphor or simile (Thibodeau & Durgin, 2011). Therefore, we chose a cut-off point that was feasible for collecting our data. Consistent with Roncero et al. (2006), only the first 30 legitimate productions of each metaphor and simile were counted. This cut-off was reached by 21 of the topic-vehicle pairs (25%).

We also coded whether the metaphor or simile was followed by an explanation. The sentence after a metaphor or simile was accepted as an explanation if it didn't violate the constraint of *no elaboration* from Roncero et al. (2006). This constraint separates actual explanations from elaborations. More specifically, a sentence after a metaphor or simile was accepted as an explanation if it was introduced with the word *because*. When the subsequent sentence was introduced with a different conjunction, or no conjunction, the word *because* replaced the conjunction (or was simply inserted if none was present). After inserting the word *because*, the sentence was accepted as an explanation when it could be interpreted as an explanation for the expression. For example, *life is a journey* *you take on a boat* would not be accepted because the section after the metaphor does not have the meaning of an explanation after inserting the word *because* (i.e., *life is a journey because you take on a boat*). In contrast, a sentence such as *music is medicine as it is very soothing* would be accepted because the section after the metaphor works an explanation when the word *because* replaces the word *as* (i.e., *music is medicine because it is very soothing*). We also followed the constraint of *no repetition* to ensure that only unique explanations were included in the count. For example, finding *time is like money because it is valuable* several times would only be counted as one in the explanation count. Therefore, the number of explanations found reflects the number of *different* explanations that were found.

## Results

### *Internet Frequency Counts*

A total of 1004 metaphors and 780 similes were collected. The average frequency count per topic-vehicle pair was 11.95 ($SD$ = 12.52) for metaphor sentences and 9.29 ($SD$ = 10.51) for simile sentences. Both distributions were significant on tests of normality (metaphors, $D$ (84) = .24, $p$ < .01; similes, $D$ (84) = .19, $p$ < .01); thus, we used non-parametric tests for analyses that included these scores. The average for metaphors was found to be significantly greater than that found for similes ($T$ = 409.50, $p$ < .01, $r$ =.31). However, there was also a strong positive correlation between metaphor and simile frequency counts ($r_s$ = .84, $p$ < .05). Therefore, when a metaphor form is frequent, the simile form is also frequent. To better examine when the different variables predict topic-vehicle frequency on the Internet, we collapsed the frequency scores across sentence type. The averaged frequency scores were found to have a positive correlation with aptness ($r_s$ = .36, $p$ < .01) and familiarity ratings ($r_s$ = .56), but not with conventionality ratings ($r_s$ = .20, $p$ = .07), or interpretive diversity scores ($r_s$ = .18, $p$ = .11). However, because aptness and familiarity were found to have a significant correlation in the Normative study, we ran a backwards stepwise multiple regression to control for suppression effects to examine which variable was a better predictor of the averaged frequency scores. The removal criterion for each step was p > .10. For the averaged frequency scores, aptness was removed after step 1 ($t$ = -.604, $p$ = .55). The final model was significant ($F$ (1,82) = 37.8, $p$ < .01, *Adj.* $R^2$ = .31) with familiarity as the only significant predictor ($t$ = 6.15, $p$ < .01, $\beta$ = .56). We also compared the zero-order correlations to the semi-partial correlations for aptness and familiarity with the averaged frequency scores, partialling out the variance attributed to the other variable. While the semi-partial correlation with familiarity was slightly reduced (.56 to .42), there was a much larger reduction for aptness ratings (.36 to -.05). These results suggest that much of the correlation between aptness ratings and the averaged frequency scores comes from its shared variance with familiarity. These results also indicate that our familiarity ratings, while collected from participants, are a good reflection of general frequency as they correlated significantly with the averaged Internet frequency scores.

*Predicting Metaphor and Simile Use*

Frequency difference scores were created by subtracting the number of similes found for a topic-vehicle pair from the number of metaphors found. We then correlated these scores with the metaphor preference ratings to examine if the preference ratings could predict when people prefer using a metaphor construction. A significant correlation was found between the metaphor preference ratings and the frequency difference scores

($r_s = .50$, $p < .001$). Therefore, those topic-vehicle pairs preferred as metaphors were also those that appeared more often on the Internet as a metaphor rather than a simile. The frequency difference scores were significant on test of normality ($D$ (84) = .25, $p < .01$). Thus, we used Spearman correlations to examine if different variables were significant predictors of frequency difference scores. Aptness was a significant predictor ($r_s = .34$, $p < .01$), as was interpretive diversity ($r_s = .23$, $p < .05$), and familiarity ($r_s = .26$, $p < .05$), but not conventionality ($r_s = -.04$, $p = .45$). Running these ratings with the metaphor preference ratings from participants produced a similar pattern of results. Aptness was a significant predictor (aptness, $r_s = .61$, $p < .001$), as well as interpretive diversity ($r = .26$, $p < .05$) and familiarity ($r = .47$, $p < .001$); but not conventionality, ($r_s = .04$, $p = .72$).

To better understand the importance of these different predictors for each set of preference ratings, we ran backward stepwise regressions to control for possible suppression effects The removal criterion for each step was p > .10. For the metaphor frequency difference scores, familiarity was removed after step 1 ($t = .02$, $p = .98$), and conventionality after step 2 ($t = .10$, $p = .92$). The final model was significant and included aptness and interpretive diversity as predictors ($F$ (2,81) = 6.40, $p < .01$, $Adj.\ R^2 = .12$). Aptness was a significant predictor ($t$ =3.01, $p < .01$, $\beta = .31$), while marginal significance was found for interpretive diversity ($t = 1.80$, $p = .08$, $\beta = .19$). Aptness was also found to have a larger semi-partial correlation (.31) than interpretive diversity scores (.19). The larger standardized beta score for aptness, as well as the larger semi-partial correlation, suggest aptness was a more important predictor than interpretive diversity for the frequency difference scores.

For the metaphor preference ratings, the results were similar. Conventionality was removed after step 1 ($t$ = .44, $p$ = .66), and familiarity after step 2 ($t$ = .76, $p$ = .45). The final model was significant, and included aptness and interpretive diversity as predictors ($F$ (2, 81) = 28.63, $p$ < .01, *Adj.* $R^2$ = .40). Aptness was a significant predictor ($t$ = 6.74, $p$ < .01, $\beta$ = .57), as was interpretive diversity ($t$ = 3.16, $p$ < .01, $\beta$ = .27). The semi-partial correlation was larger for aptness (.57) than for interpretive diversity (.27). Therefore, the regression for both types of metaphor preference indicators produced similar results, and in each case, aptness was found to be the most important predictor.

*Explanations*

A total of 234 explanations were found with similes compared to only 53 found with metaphors. The average explanation count per topic-vehicle pair was 0.63 ($SD$ = 1.23) for metaphor sentences compared to 2.79 ($SD$ = 3.40) for simile sentences. Tests of normality were also significant for these distributions (metaphors, $D$ (84) = .38, $p$ < .01; similes, $D$ (84) = .21, $p$ < .01). The average for similes was found to be significantly greater than that found for metaphors ($T$ = 35.5, $p$ < .01, $r$ = .64). This finding replicates the result found by Roncero et al. (2006) that explanations occur more often with simile expressions than with metaphor expressions. We next ran correlations between simile explanation counts and ratings of aptness, conventionality, interpretive diversity, and familiarity. The correlation with familiarity scores was significant ($r_s$ = .38) but not with any of the other ratings (conventionality $r_s$ = .19, $p$ = .28; aptness $r_s$ = .19, $p$ = .11; interpretive diversity, $r_s$ = .18, $p$ = .11). Therefore, the statements considered the most familiar were the most likely to be written as a simile and followed by an explanation.

We were concerned that different explanations for the same expression were in fact expressing similar ideas. For example, the statement *Lawyers are like sharks because they seek blood* and *Lawyers are sharks because they are blood-thirsty* both express the property *blood* for *lawyers are like sharks*. In order to verify that simile explanations were expressing more ideas than metaphor explanations, we identified the properties written in the explanations. Thus, the property *blood* would be recorded as one of the expressed ideas for *lawyers are like sharks because they are blood-thirsty*. Using this procedure for explanations with metaphors and similes, we found metaphor explanations expressed a total of 44 properties, while simile explanations expressed 129 different properties. Non-parametric tests were used to compare metaphor and simile expressions as both lists were significant on tests of normality (metaphors, $D$ (84) = .38, $p < .001$; similes, $D$ (84) = .19, $p < .001$). The topic-vehicle pair average was found to be larger in similes ($M$ = 1.54, $SD$ = 1.75) than in metaphors ($M$ = .52, $SD$ = 1.0; $T$ = -5.74, $p < .001$). Thus, explanations of the similes expressed more properties than those found in explanations after metaphors. Running correlations with the different ratings, a significant correlation was again found with familiarity ($r_s = .38$, $p < .01$), but not with the other ratings (aptness, $r_s = .14$, $p = .19$; conventionality, $r_s = .16$, $p = .14$; interpretive diversity, $r_s = .18$, $p = .10$).

To examine whether the properties being expressed by similes were salient properties of the expressions, we compared the property lists from the Normative study for simile expressions to the properties list found in this study for simile explanations. For every expression, we gave a count of one when the listed idea matched a property stated by at least two participants for the simile expression in the Normative study. In total, 51 of the 130 properties (i.e., 39%) were found to express properties participants had written in the Normative study. Therefore, the majority of the properties expressed in simile explanations were not properties listed by at least two individuals in the Normative study.

## Discussion

Our first goal in this study was to examine our ratings from the Normative study as theoretical predictors of metaphor preference. We collected metaphor preference ratings from participants to determine to what extent participants preferred using a topic-vehicle pair as a metaphor. We also counted the number of times a topic-vehicle pair appeared as a metaphor and as a simile on the Internet. From these counts, we subtracted the simile frequency counts from the metaphor frequency counts to determine to what extent a topic-vehicle pair was used more often as a metaphor (frequency difference scores). We then examined whether the ratings from our Normative study, as well as the new metaphor preference ratings, could predict when people prefer using a metaphor or simile on the Internet. Finally, we compared how people use metaphors and similes on the Internet to test the prediction that explanations would occur more often with simile expressions than with metaphor expressions.

Metaphor preference ratings positively correlated with preference for using the metaphor form on the Internet. Therefore, participants' preference ratings can predict which topic-vehicle pairs will be used more often as a metaphor on the Internet. Furthermore, the ratings from our Normative study were found to have predictive value. The familiarity ratings alone were able to predict Internet frequency scores, while aptness and interpretive diversity were both found to predict metaphor preference ratings and frequency difference scores. Therefore, our ratings do appear to have ecological validity and can predict how metaphors and similes will be used beyond the laboratory setting. These results also allow us to address the concern raised by Thibodeau and Durgin (2011), and better differentiate our ratings of aptness and familiarity. Whereas familiarity, but not aptness, was a significant predictor of frequency on the Internet, aptness, but not familiarity, was a significant predictor of metaphor preference. These results suggest our familiarity ratings do reflect the general prevalence of these statements (i.e., the expression's frequency).

The finding that aptness is the most important predictor of metaphor preference ratings replicates previous studies that have also reported this finding (Chiappe, Kennedy, & Chiappe, 2003; Chiappe, Kennedy, & Smykowski, 2003; Jones & Estes, 2006). This study also extends those results by finding that aptness can predict when people prefer writing a given topic-vehicle pair as a metaphor on the Internet. Meanwhile, the finding that conventionality ratings were not significant predictors of either metaphor preference ratings or frequency difference scores casts further doubt regarding vehicle conventionality as a better predictor than aptness of metaphor preference. It should also be noted that in this study our ratings of aptness and conventionality were not correlated.

Interpretive diversity was also found to be a significant predictor of metaphor preference ratings. Like aptness, interpretive diversity scores are larger when topic-vehicle pairs share a larger number of important properties. Pairs with higher interpretive diversity scores have previously been found to be preferred as metaphors (Utsumi, 2007); however, whereas Utsumi found interpretive diversity scores were a better predictor of metaphor preference ratings, we found aptness to be the more important variable.

Possible explanations for this difference include the fact that the present study and that of Utsumi's used different languages (English vs. Japanese), and that the present study used a much larger sample of topic-vehicle pairs than did Utsimi (30 in Utsumi's study vs. 84 in the present study). Both variables, nevertheless, have now consistently been found to be good predictors of metaphor preference ratings. Further research is needed to determine whether aptness or interpretive diversity is the *better* predictor of metaphor preference and people's use of a metaphor on the Internet.

Lastly, we replicated and extended the results found by Roncero et al. (2006) that similes, more often than metaphors, are followed by explanations. Furthermore, we found that the most frequent expressions were also the ones that were most often explained. We also examined the meanings being expressed by the explanations, and found that a larger number of properties were being expressed by explanations of the similes. Comparing these properties to those properties collected in the Normative study, we found that the majority of the Internet properties were not salient. Therefore, when people choose to use an explanation, they often highlight properties low in saliency (i.e., ones that do not easily come to mind). For example, an Internet writer would be unlikely to state *the bible is like a sword because it can be used as a weapon or be protective*—salient properties found in the Normative study for *bible is like a sword*—because such statements would be considered redundant (Grice, 1975). Instead, explanations allow individuals to express more clearly their opinion of a particular topic, and evoke properties that may have otherwise not been entertained in thought by the reader.

When Roberts and Kreuz (1994) asked participants to list pragmatic goals being served by metaphors and similes, they found *to be humorous* and *to deemphasize* were listed for similes, but not metaphors. While we did not directly test for this hypothesis, we did observe examples consistent with these goals for similes. For example, no explanations were given for *men are fish,* but several explanations were given for *men are like fish* that stressed men as being stupid or easily caught. For example, *men are like fish because they are dumb and will bite anything shiny*. We interpret such explanations as attempts to be humorous. Meanwhile, examples of *to deemphasize* were also found, in that the property highlighted by the explanation was the opposite of what is generally seen as the salient meaning for the statement. For example, for *memory is a sponge*, the salient properties reported by participants in the Normative study were *absorption* and *retentiveness*. In contrast, an explanation for *memory is like a sponge* made reference to memory being *leaky* and *full of holes* just as water leaks from a sponge.

## General Discussion

The data collected across the present two studies provide a rich variety of information for our corpora of topic-vehicle pairs as metaphors and similes. In the Normative study, we collected ratings of aptness, conventionality, interpretive diversity, connotativeness, and calculated interpretive diversity scores (see Table 2A in the appendix). We also collected property interpretation norms for these expressions, as well as the topic and vehicle terms in isolation (see Table 2B and 2C in the appendix). In the metaphor preference study, we collected metaphor preferences ratings, frequency counts, explanation counts, as well as the properties that the produced explanations expressed. The familiarity ratings collected from participants were found to be a significant predictor of these Internet Frequency counts, validating our familiarity ratings as reflecting the general prevalence of these expressions. Also, the familiarity ratings, but not the aptness ratings, were found to be a more important predictor of the Internet frequency counts; whereas aptness, but not familiarity, was a significant predictor of when people preferred reading a topic-vehicle pair as a metaphor and when a topic-vehicle pair was found more often as a metaphor on the Internet. Therefore, we believe these results address the concerns raised by Thibodeau and Durgin (2011) about the cross-contamination of aptness and familiarity ratings, and conclude that our aptness and familiarity ratings do reflect different variables.

In the Normative study, we examined the semantic similarity of metaphor and simile expressions by comparing the property lists produced from participants. Categorization theory predicts a semantic difference between these expressions (Glucksberg, 2003; Glucksberg & Haught, 2006) as the metaphor vehicle has dual-reference reflecting both the figurative category and the literal referent, whereas the simile vehicle refers only to the literal referent. In contrast, Career of Metaphor theory (Bowdle & Gentner, 2005; Gentner & Bowdle, 2008) predicts that metaphors and similes are semantically equivalent because metaphor vehicles derive their meaning from having been understood as comparison statements (i.e., similes). We found that the property lists for metaphors and similes were comparable, yet different. First, there does not appear to be a strict dichotomy whereby metaphors activate figurative properties, but similes activate literal properties, because the property lists were not different on ratings of connotativeness. Metaphors and similes also had comparable interpretive diversity scores, and the match score between metaphors and simile properties was high (>.8). We also observed a greater “clustering” of properties for metaphors. When we compared only those properties listed by at least 25% of the participants (those considered salient properties), we found that metaphors elicited more of these salient properties than similes. Also, some properties were found to be salient for the metaphor expression, but not for the equivalent simile expression. One could interpret these results as consistent with the argument that a metaphor vehicle represents *both* the figurative category and the literal referent, whereas the simile vehicle represents only the literal referent. Specifically, the similarity across the property lists would reflect the literal referent, while the additional salient properties found for the metaphor could reflect the figurative category. It should be noted, however, that the salient properties found for metaphors were sometimes also found for the simile expression, but at a lower frequency level (i.e., < 25% of the sample). Thus, metaphors do not seem to activate *different* properties than similes; rather, they seem to strengthen the activation of certain properties.

The Internet production study provides greater ecological validity for the ratings collected in the Normative study, and has implications for past studies investigating metaphor preference. First, the metaphor preference ratings did correlate with the Internet frequency difference scores. Second, the regressions for the ratings and the two forms of metaphor preference both reported aptness as the most important predictor, with interpretive diversity as a marginal predictor. Neither familiarity nor conventionality emerged as significant predictors of metaphor reference. This parallelism suggests our ratings predict both when people prefer reading a metaphor and when they prefer using a metaphor on the Internet. Moreover, aptness was the best predictor of these preferences. Finding that aptness, but not conventionality, could predict both metaphor preference in participants and which topic-vehicle pairs appeared more often as metaphors on the Internet is consistent with the arguments from Categorization theory (Glucksberg, 2008), and lends additional evidence that aptness, not conventionality, is the better predictor of when people prefer a topic-vehicle pair as a metaphor (Jones & Estes, 2006).

One important caveat to the above conclusion is that people may choose to use a simile for certain pragmatic reasons. In the Internet production study, we found that people tend to highlight a non-salient property about a topic by using a simile followed by an explanation with that property. Consistent with results found by Roberts and Kreuz (1994), people will sometimes use such explanations to add humour or deemphasize an expression (i.e., express the opposite of the dominant meaning). We also found the more frequent statements were the ones most often written as similes followed by explanations. Comparing the properties found in explanations to the property lists collected in the Normative study, we found most of the properties written in explanations were not salient. Therefore, people prefer to use an explanation to highlight a property other than the one expected to be salient from the metaphor alone. This finding is consistent with Grice's (1975) maxim of quantity, in that people should contribute no more information than is required. Thus, when people expect the statement alone to be sufficient, they will typically use a metaphor, but use a simile with an explanation when they want to say something novel.

The finding from the Normative study that metaphors produce more salient properties than similes might also explain why in the Internet production study we found people preferred using a simile followed by an explanation more often than a metaphor followed by an explanation. The metaphor makes certain properties more salient, whereas people may want to highlight an alternate property. Therefore, people may use a simile to reduce the saliency of that property and then highlight a different property in their subsequent explanation.

*Conclusions*

The results found in the Normative study were supportive of arguments suggesting little distinction between metaphor and simile expressions, as the two expression types were comparable for the ratings and property lists collected. However, there was a trend for metaphors to yield more salient properties. The metaphor preference study suggests that this saliency difference may represent a key distinction between metaphors and similes. More specifically, this study found that people tend to produce metaphor expressions with no explanations with the expectation that salient properties will be activated, but produce simile expressions with explanations to express a less salient or even novel property. The ratings and preference norms collected in the present study also provide researchers with a rich source of information on key variables said to influence how metaphors and parallel similes containing the same topic and vehicle words are produced and comprehended. This resource, beyond serving for the preparation of experimental materials, represents a snapshot of how metaphors—a most pervasive phenomenon in language—are mentally represented.

# Chapter 3: Self-Paced Reading of Metaphors and Similes

While studies 1 and 2 of Chapter 2 produced numerous results, perhaps the most interesting outcome was the property lists for metaphor, similes, and vehicle terms in isolation. These data allowed us to examine to what extent the property lists reflected the target word itself or the structure presented (metaphor or simile). The larger amount of overlap between metaphors and similes compared to the list written for the vehicle in isolation suggests metaphors and similes do activate "emergent properties". These properties also have similar levels of connotativeness. One key difference found, however, was that metaphor property lists often had certain properties listed with higher frequency.

Based on the results found in Chapter 2, it is possible that reading a metaphor leads to increased activation for certain properties, whereas a similar process does not take place for similes. In turn, this activation difference could make connotative properties more salient for metaphors. This hypothesis is refuted by past studies that have compared metaphor reading times to more literal statements and reported differences between the two sentence types. It is possible, however, that previous studies missed such differences because they examined full sentence reading times. We hypothesized that using a paradigm that isolated reading times to the vehicle would produce significantly different vehicle reading times if a processing difference between metaphors and similes existed. In Chapter 3, we present studies that employed a self-paced moving-window paradigm, while Chapter 4 presents a study that focused on reading times at the vehicle position using eye tracking.

In Chapter 3, then, we ran two experiments using a self-paced moving-window paradigm to compare the reading times for vehicles (e.g., *sharks*) when read in metaphors (e.g., *lawyers are sharks*) and similes (e.g., *lawyers are like sharks*). The second experiment is a novel study comparing the processing of metaphors and similes written using a negative structure (e.g., *lawyers are not sharks*). Furthermore, we tested the prediction that metaphors would prime figurative properties, whereas similes would show greater priming for literal properties. Two key results emerged from these experiments. First, in both experiments the simile vehicles were actually found to have a longer reading times. We provide a possible explanation for this result, but revisit this result and compare it to the opposite results found in Chapter 4 where eye-tracking was used. It is possible that the result found in this chapter reflects the use of a moving-window paradigm (among other possible reasons for the conflicting results found here and chapter 4). The second key result was explanations reflecting a connotative property were read faster after metaphors than similes, whereas the reverse was true for explanations reflecting the literal entity, which were read faster after similes. This result builds on the semantic difference result found in Chapter 1 and is consistent with the hypothesis that reading a metaphor leads to an activation increase of the vehicle's connotative properties.

It should be noted that the reading times in Experiment 1 were collected in my Masters' thesis, however, whereas my Masters' thesis compared vehicle reading times for 104 topic-vehicle pairs, Experiment 1 has re-analyzed this data for only the 84 topic-vehicle pairs from Chapter 2. This manuscript is in preparation for submission to *The Journal of Experimental Psychology: Learning, Memory, and Cognition.*

Alike or Different: Comparing the online processing of metaphors and similes

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Abstract

Recent studies have suggested that metaphors (*education is a tree*) and similes (*education is like a tree*) might engage similar forms of processing (e.g., Bowdle & Gentner, 2005). Consistent with this argument, experiments comparing the processing of metaphors and similes have often reported null results (e.g., Jones & Estes, 2006). Many of these studies, however, used omnibus sentence reading times that may not have been sensitive enough to capture processing differences between metaphors and similes. We compared metaphor-simile processing using a self-paced moving window paradigm to isolate differences at the vehicle position, where figurative processing is assumed to be initiated. In Experiment 1, simile vehicles were found to have longer reading times, while neither aptness nor conventionality was a significant predictor of reading times. In Experiment 2, we examined whether similes convey a more literal meaning by following the metaphors and similes (*e.g., lawyers are/are like sharks*) with explanations that expressed either a figurative property (*dangerous*), or made mention of a vehicle's literal property (*fish*). A significant interaction was found: explanations expressing a figurative property were read faster when they followed metaphors, whereas explanations expressing a literal property were read faster when they followed similes. These results suggest that metaphors and similes are not identical; rather, they are distinct statements that are processed differently and convey different meanings.

Metaphors and similes relate a topic (such as *lawyers*) to a vehicle (such as *sharks*). In contrast to metaphors (e.g., *lawyers are sharks*), similes with the same topic-vehicle pair include a word such as *like* before the vehicle (e.g., *lawyers are like sharks*). Previous studies have compared comprehension latencies for metaphors and similes, where participants are asked to press a button once they believe they have understood a given metaphor or simile (e.g., Chiappe, Kennedy, & Chiappe, 2003; Jones & Estes, 2006). These studies found no difference in comprehension time between metaphors and similes (but see Johnson, 1996, for an exception), suggesting that metaphors and similes are not processed nor interpreted differently (Glucksberg, 2008). However, the offline nature of the tasks employed so far (e.g., the time taken to read and judge a sentence) also makes it possible that processing differences while reading the two statements were not captured by the omnibus response times (i.e., reading times for the entire sentence as opposed to individual words within the sentence).

In order to investigate the online processing involved when reading metaphors and similes, and how these forms are interpreted, we conducted two experiments that had participants read metaphors and similes in a word-by-word self-paced reading time paradigm with explanations after either a metaphor (e.g., *cities are jungles*) or an equivalent simile (e.g., *cities are like jungles*). Using a moving-window paradigm – which is a more sensitive measure than the omnibus response times – allowed us to examine only the vehicle reading times after each statement. The first experiment focused on how metaphors and similes are processed, and tested predictions outlined by Career of Metaphor theory. The second experiment further investigated whether or not metaphors and similes convey similar meanings.

*Career of Metaphor Theory*

Career of Metaphor theory (Bowdle & Gentner, 2005; Gentner & Bowdle, 2008) predicts novel metaphors (e.g., *life is a bottle*) to cause initial comprehension problems because the vehicle term (*bottle*) lacks an associated figurative meaning that can be projected onto the topic. The proposed solution is to understand such statements as similes (i.e., *life is like a bottle*) which then triggers a process of feature matching and projection between the topic and vehicle. This way the novel expression is understood as an analogy; for example, *life is like a bottle because both can be filled up*. Over time, as the vehicle's career progresses from being used in multiple statements with various topic terms, an associated conventional figurative meaning becomes created and stored in memory. At this point in the vehicle's career, Career of Metaphor theory predicts that metaphorical statements no longer need to be understood as comparisons, and can instead be understood as categorical statements directly because it is now possible to retrieve an associated figurative meaning from memory and project that meaning onto the topic. This form of categorical processing is also considered easier than the more laborious comparative process. Therefore, Career of Metaphor theory predicts that topic-vehicle pairs whose vehicles have a conventional figurative meaning should be read faster than pairs where the vehicle has no conventional figurative meaning because these pairs must be understood as comparisons. Bowdle and Gentner (2005) have found support for these predictions when they compared reading times for metaphors with different levels of conventionality: more conventional metaphors were read faster.

Because conventionalization is argued to reflect a shift from comparative processing to categorical processing, Career of Metaphor theory also predicts that people will show a corresponding shift for whether they prefer a topic-vehicle pair as a metaphor or as a simile. More specifically, because novel topic-vehicle pairs, whose vehicles have no conventional figurative meaning, are understood as comparisons, people should prefer reading such pairs as similes because the simile structure (*x is like y*) evokes a comparative process. In contrast, topic-vehicle pairs containing vehicles with conventional figurative meanings would be preferred as metaphors because these type of topic-vehicle pairs are understood using categorical processing (i.e., the figurative meaning is retrieved directly from memory), and the metaphor form (*x is y*) implies categorization. Bowdle and Gentner (2005) found support for these predictions: participants stated a preference for reading novel topic-vehicle pairs as similes, but more conventional topic-vehicle pairs as metaphors. These findings support the argument that as conventionalization for a given vehicle term increases, the ability to engage in categorical processing also increases.

Note, however, that conventionalization (the process of a vehicle obtaining an associated figurative meaning) is not predicted to change the meaning attached to a given vehicle term. The categorization process proposed by Career of Metaphor theory for metaphors with conventional vehicles is ultimately a cognitive "short-cut". To use an analogy, the first time a child learns three times six is eighteen, it is a relatively laborious cognitive process compared to the eventual point where the child can simply retrieve the associated answer from memory. Career of Metaphor theory is ultimately proposing a similar progression for metaphor interpretation: at first, a more laborious comparative process is needed to obtain the associated figurative meaning, but with practice, the comparative process is no longer needed, nor used, because the associated meaning can instead be retrieved directly from semantic memory. Therefore, when categorical processing is possible because the vehicle term has a conventional figurative meaning, that specific meaning is the same one that had previously been obtained countless times using comparative processing. For this reason, Career of Metaphor theory predicts that metaphors and comparable similes (e.g., *lawyers are sharks* and *lawyers are like sharks*) should have the same interpretation (Glucksberg, 2008; Glucksberg & Haught, 2006) because conventionality affects the type of processing employed (categorical or comparative), but not the interpretation that is ultimately derived.

*Conventionality vs. Aptness*

Career of Metaphor theory refers to the degree of association between a vehicle and an associated figurative meaning as a vehicle's conventionality level (Bowdle & Gentner, 2005). Less conventional vehicles have no associated figurative meanings, while conventional vehicles have figurative meanings that come easily to mind. For example, pairing the vehicle *drug* with different topic terms activates an associated figurative meaning of *addiction* (e.g., *love is a drug, chocolate is a drug, tv is a drug*). In contrast, a term such as *bottle*, which has little or no associated figurative meaning, seems to activate no figurative meaning when paired with the same topic terms (*e.g., love is a bottle, chocolate is a bottle, tv is a bottle*). These later sentences would be considered less conventional. Therefore, following Career of Metaphor theory, a topic-vehicle pair is conventional when the vehicle in that pair has a conventional figurative meaning.

Whereas conventionality is restricted to the vehicle term, aptness (Chiappe & Kennedy, 1999) refers to the relationship between a topic and vehicle within a given pair.

Apt metaphors are defined as expressions where the vehicle term captures many salient properties of the topic. For example, people consider a statement such as *politics is a jungle* as more apt than *politics is a beach* because the vehicle term *jungle* better captures salient properties of politics (e.g., disagreement, difficulties, chaos) whereas a salient property expressed by *beach* (e.g., *relaxation*) is not considered a salient property of *politics*; thus, *politics is a jungle* is considered less apt than *politics is a beach*. Like conventionality, Chiappe and Kennedy (2000) have argued that aptness can be a predictor for when categorical processing is possible because categorical statements are preferred when people feel the vehicle captures many salient properties of the topic (i.e., when they are apt). For example, if someone wanted to state something had all the properties of a particular category, they would use a categorical statement to express that meaning (e.g. *x is water*), but would use a simile if they wanted to convey that only some, but not all properties of a particular category were present in an object, (e.g., *x is like water).* Supporting these arguments, Chiappe, Kennedy, Smykowski (2003) found that participants preferred the metaphor form for a given topic-vehicle pair when the statements were considered more apt. Chiappe, Kennedy, and Chiappe (2003) also found that aptness ratings, compared to conventionality ratings, were a better predictor of participants' metaphor preferences.

It has been challenging, however, to determine whether conventionality or aptness has a greater effect on metaphor processing times because the two variables are often significantly correlated (Thibodeau & Durgin, 2011). For example, Glucksberg (2008), as well as Jones and Estes (2005, 2006), note that the less conventional items used by Bowdle and Gentner (2005) were also less apt than their more conventional items—

suggesting that the conventionality effect they found may have actually reflected an aptness effect. To test the hypothesis that conventionality effects are masked aptness effects, Jones and Estes (2006) contrasted aptness and conventionality by comparing the reading times of metaphors with the same vehicle term, but different topics (e.g., *a tree is an umbrella* vs. *a magazine is an umbrella*). Because conventionality ratings concern only the vehicle terms, the conventionality level for both statements is the same. In contrast, because aptness takes into account the topic and the vehicle together, metaphors with different topic terms would have different aptness ratings despite having the same vehicle term. For example, *a tree is an umbrella* is more apt than *a magazine is an umbrella* because the attributed property (*protects from rain*) is more typical of *trees* than of *magazines.* Jones and Estes found that participants preferred reading more apt topic-vehicle pairs as metaphors, and that more apt metaphors were also read faster. In contrast, conventionality did not reliably predict either metaphor preference or reading times, furthering the argument that it is aptness rather than conventionality that has a strong effect on metaphor processing.

We chose to use our ratings of aptness and conventionality (see Chapter 2) because these ratings were not significantly correlated. In this manner, we avoided the problem faced in previous studies where aptness and conventionality were actually significantly correlated (e.g., Bowdle & Gentner, 2005; Jones & Estes, 2005). Whereas Career of Metaphor theory predicts more conventional vehicles to have faster reading times, others (e.g., Glucksberg & Haught, 2008; Jones & Estes, 2006) have reported results suggesting that more apt topic-vehicle pairs will also have faster vehicle reading times. These studies, however, used omnibus reading times rather than reading times isolated to the vehicle region as was done in the present study. Because conventionality ratings are associated strictly with the vehicle term, it is possible that conventionality ratings will be a better predictor of reading times when those reading times are also isolated to the vehicle position rather than the entire sentence.

## Experiment 1

The present experiment was conducted to compare the reading times for metaphor and simile vehicles. Most studies so far have found no metaphor-simile reading time differences (e.g., Jones & Estes, 2006), however the present study employed an online self-paced reading technique that could enable us to better measure reading times at the vehicle region. In this manner, we could isolate the key constituent of each expression type. While we predicted null results between metaphor and simile vehicles because this was the most common previous result, we also thought this novel technique might find differences that had been missed in previous studies that had used the omnibus reading time measures.

We were also interested in testing the predictions from Career of Metaphor theory regarding conventionality and the interpretation of metaphors and similes. More specifically, we wanted to know whether conventionality or aptness would be a better predictor of vehicle reading times. Career of Metaphor theory (Bowdle & Gentner, 2005; Gentner & Bowdle, 2008) predicts a significant positive correlation between conventionality ratings and vehicle reading times, and that conventionality ratings are a more important predictor of reading times than aptness. In contrast, others (e.g., Chiappe & Kennedy, 2000; Glucksberg, 2008; Jones & Estes, 2006) have argued that aptness is a more important predictor of faster reading times. Finding a significant positive correlation between aptness ratings and vehicle reading times would support these predictions.

Finally, we tested for the Career of Metaphor theory prediction that metaphors and comparable similes have the same interpretation. To test this prediction, the same explanation phrase was written after metaphors and similes. It was predicted that if metaphors are interpreted as implicit similes, or vice-versa, then the reading times for the same explanations after metaphors and similes should be similar. In other words, if reading *cities are jungles* is no different from reading *cities are like jungles,* then the explanation *because wild animals wait at every turn* should produce similar explanation reading times after metaphors and similes because the preceding linguistic context would have effectively been the same.

Method

*Participants*

One hundred and eighteen students from Concordia University participated in this experiment, had normal or corrected-to-normal vision, and were given monetary compensation for participating in the study. They were all native speakers of English. Forty participants provided aptness ratings, while 40 participants provided conventionality ratings, and 38 participants read the sentences on the computer.

*Materials*

The 84 topic-vehicle pairs used in Experiment 1 were presented in sentences as similes or metaphors (e.g., *life is a journey* or *life is like a journey*). The 84 topic-vehicle pairs were inserted into sentences with the following structure, with + representing the position boundaries (i.e., parts of the sentence which were visible individually): Introduction + topic + (*is* / *is like*) + vehicle + *because* + explanation + closing statement. Crucially, metaphor and simile sentences differed only at the (*is* / *is like*) position. For example, the topic-vehicle pair *life-journey* when written as a metaphor sentence was "*Bob says life is a journey because each choice we make is like taking a new path*. *It was mentioned to a friend*", and when written as a simile, the sentence was "*Bob says life is like a journey because each choice we make is like taking a new path. It was mentioned to a friend*." Introductions always consisted of two words, and had the form *Bob says*, *Mary thinks*, *Ted believes*, and so on. Reading times for the word *because* were analyzed for possible spill-over effects from the vehicle. Closing statements had the form "*It was* _____" with the blank filled by a phrase that provided the statement with a sense of time or place; for example, *It was written on a website*; *It was uttered to a man*, and so on. These closing statements were used to capture any spill-over effects after the vehicles and explanations.

Explanations for topic-vehicle pairs were obtained by writing the topic-vehicle pair as a simile into the Google search engine. The first explanation presented by the search engine was accepted if it did not violate the constraints from Roncero, Kennedy, and Smyth (2006). If the first explanation presented by the search engine violated these constraints, the next explanation was checked, and so on, until an explanation which did not violate the constraints was found. If no explanation appeared on the Internet, a reasonable explanation was created.

*Aptness and Conventionality Ratings*

These ratings had been collected in a previous study (Normative Study of Chapter 2 in this thesis). For aptness ratings, 20 participants were given a booklet that presented the topic-vehicle pairs as metaphors (*life is a journey*), while a second group of 20 participants read a similar booklet that contained similes rather than metaphors. Below each item in both booklets, a scale ranging from 0 to 10 was presented. Participants were asked to circle the aptness ranking that reflected their judgements of the statements' aptness (0 representing low aptness, and 10 representing high levels of aptness). Participants were told that aptness reflects "the extent to which the second word in the word-pair captures important features of the first word." *Politics is a jungle* was given as an example of an apt statement, whereas *politics is a beach* was given as an example of a less apt statement. In our previous study, the aptness ratings for metaphors and similes were found to have a strong positive correlation (>.8), favouring the use of averaged aptness ratings. For this reason, averaged aptness ratings were also used in the present study.

To collect conventionality ratings, participants were presented booklets that had either metaphor or simile statements. For each statement, participants were asked to list what properties they felt the vehicle term was expressing about the topic. For example, a participant could have written the properties *valuable* and *important* for the metaphor *time is money*. A third group of 20 participants received a booklet with metaphor statements, while a fourth group of 20 participants received a booklet with simile statements. We gave these separate booklets in case the different forms would elicit different properties; however, the most frequently written property for a given topic-vehicle pair as a metaphor or simile was often the same property.

Conventionality ratings were then collected by giving 40 participants a booklet containing vehicle terms and the property that had been listed most frequently for that vehicle as a metaphor or simile in the previous property elicitation task. Half of the participants received a booklet containing properties that had been written for metaphors, while the other half received a booklet with the properties that had been written for similes. Participants were asked to indicate on a scale from 0 to 10 how common it was to use that vehicle term to express the presented property. For example, *addiction* was the property written most frequently for *love is a drug*, and participants were asked how common it was to use the word *drug* in a statement such *x is a drug* to express the meaning that *x* is addictive. In the previous study, the metaphor and simile conventionality ratings were found to be not significantly different, promoting the use of averaged conventionality ratings. In this study, we also chose to use the averaged conventionality ratings in the analyses.

*Procedure*

Stimuli were presented on a 20” Viewsonic monitor attached to a Macintosh computer running PsyScope (Cohen, MacWhinney, Flatt, & Provost, 1993). Responses were collected on a CMU response box which had three buttons. The middle button was used to collect reading times and the two other buttons were used to collect decision times (left- *no*, right- *yes*). The experiment lasted 30 minutes without a break. We also asked participants to use only one finger: their index finger on their right hand if they were right-handed, or the index finger on their left hand if they were left-handed. After the moving-window paradigm was explained, participants read 15 practice items consisting of both metaphors and similes. The sentences were first presented completely as dashes replacing each letter in the sentence. Once the participant pressed a button, the introduction would appear, while the rest of the sentence would still be represented as dashes. When the participant pressed the button a second time, the topic would appear, and the introduction would be replaced with dashes. Therefore, only one sentence fragment was on the screen at a time.

## Results

### *Outlier Removal*

In order to eliminate outliers, RTs shorter than 200 ms and larger than 5000 ms were first removed. Next, the linguistic form by position means were calculated for each participant based on the remaining RTs. A participant's RTs were then removed if they were larger than the mean (plus 2.4 standard deviations), or smaller than the mean (minus 2.4 standard deviations). This standard deviation value is the number recommended by Van Selst and Jolicoeur (1994) for the removal of outliers in a sample size of the magnitude obtained in the present experiment. RTs removed at this stage were replaced with the cutoff values (i.e., $M + 2.4$ *SD* for RTs greater than this value, and $M - 2.4$ *SD* for RTs smaller than this value). From these values, the linguistic form by position means were calculated, and used in all subsequent analyses.

*Reading Times*

A two-way repeated measures ANOVA, with position and linguistic form as the within-groups factors, was run. Mauchly's test of sphericity was significant ($p < .001$); thus, Greenhouse-Geisser levels of significance were used. Not surprisingly, with different blocks having different word lengths, a main effect of position was found ($F1$ (2.36, 87.26) = 197.34, $p < .001$; $F2$ (1.17, 97.02) = 837.27, $p < .001$); and with simile sentences having an extra word, it was not surprising to find a main effect for linguistic form ($F1$ (1, 37) = 25.04, $p < .001$; $F2$ (1, 83) = 6.43, $p < .05$). Crucially, the interaction was significant ($F$ (1.84, 68.07) = 7.80, $p < .05$; $F2$ (1.37, 113.69) = 5.35, $p < .05$). Planned comparisons (paired *t*-tests), were run to compare metaphor and simile RTs at positions subsequent to the (*is/is like*) position: positions 4-7. For position 4 (the vehicle), RTs for simile vehicles were significantly slower than RTs for metaphor vehicles ($t1$ (37) = 4.17, $p < .01$; $t2$ (83) = 2.17, $p < .05$). RTs for position 5 (*because*) were virtually identical ($t1$ (37) = -0.25, $p = .805$; $t2$ (83) = -0.15, $p = .88$). For position 6 (the explanations), simile explanation RTs were significantly slower than metaphor explanation RTs ($t1$ (37) = 3.23, $p < .01$; $t2$ (83) = 2.50, $p < .05$). For block 7 (closing statement), the result was not significantly different ($t1$ (37) = 1.42, $p = .17$; $t2$ (83) = 1.09, $p = .28$). Mean reading times in milliseconds for the vehicle and explanation sentence fragments are displayed in Table 3A.

Table 3A: Vehicle and Explanation Reading Times

*Mean RTs (and SDs) for the vehicle and explanation sentence fragments (in milliseconds)*

| | Vehicle* | Explanation* |
|---|---|---|
| Metaphor | 388 (96) | 735.86 (456) |
| Simile | 418 (89) | 850.92 (531) |

*$p < .05$

*Aptness and Conventionality Ratings*

We next ran correlations between reading times for those regions where significant differences had been found (i.e., the vehicle and explanation regions) and the different ratings collected: aptness, conventionality, and metaphor preference. For aptness ratings, there was no significant correlation for either the vehicle position (metaphor vehicles, $r$ (84) = .08, $p$ = .23; simile vehicles, $r$ (84) = .19, $p$ = .08), or the explanation position (metaphor explanations, $r$ (84) = .03, $p$ = .78; simile explanations, $r$ (84) = .01, $p$ = .92). Reading times also did not correlate with metaphor preference ratings (metaphor vehicles, $r$ (84) = .08, $p$ = .48; simile vehicles, $r$ (84) = .04, $p$ = .75). There was also no significant correlation with the conventionality ratings and vehicle reading times (metaphor vehicles, $r$ (84) = .11, $p$ = .31; simile vehicles, $r$ (84) = -.07, $p$ = 53), nor with explanation reading times (metaphor explanations, $r$ (84) = -.09, $p$ = .42; simile explanations, $r$ (84) = .02, $p$ = .87). Therefore, neither aptness nor conventionality ratings were a predictor of vehicle reading times.

# Discussion

We compared reading times for metaphor and simile vehicles, as well as explanations after these statements. Vehicle reading times were longer when vehicles were read within a simile. Previous studies had failed to find reading time differences between metaphors and similes (e.g., Jones & Estes, 2006); however, it is possible that recording the omnibus reading time for the entire sentence rather than only the vehicle region, as was done in this experiment, was not a sensitive enough measure to capture the processing difference between metaphors and similes.

Contrary to expected predictions, neither aptness nor conventionality ratings were significant predictors of reading times. As the only difference in our sentences was the word *like*, and reading times were not related to aptness or conventional level of the topic-vehicle pairs, we suggest that the linguistic frame (*x is y* versus *x is like y*) must trigger different processes for metaphors and similes. Furthermore, such processes must ultimately be slower for similes, causing the observed slower reading times.

One possible explanation is that similes initiate comparative processes regardless of the aptness or conventionality level, while metaphors initiate categorical processing, regardless the aptness or conventionality of a given topic-vehicle pair. This argument is consistent with other theories. For example, category-based approaches note that metaphors have the same grammatical form as categorisation statements, and argue that vehicles in metaphors act as predicates which project properties onto the topic (e.g., Glucksberg & Keysar, 1990). Similarly, Gentner and Bowdle (2008) recognize the role of syntactic structure in their concept of *grammatical concordance*, in that “linguistic form tells us something about function” (p.119), and argue that the linguistic frame for metaphors invites a categorisation process, whereas the linguistic frame of similes invites a comparison process. As previously discussed, the comparison process is assumed to be more computationally complex than the projection required for metaphors, and finding longer reading times for simile vehicles in the present study is consistent with this argument. However, we did not find reading times to be related to a topic-vehicle pairs' conventionality level, as would be predicted by Career of Metaphor theory, nor the aptness level of a given topic-vehicle pair, as argued by past researchers (e.g., Glucksberg, 2008). Instead, reading times were best predicted by the linguistic structure that was read (metaphor or simile), which suggests metaphors and similes are consistently processed as different statements.

We also did not find support for the hypothesis that metaphors and similes have similar meanings, as predicted by Career of Metaphor theory (e.g., Bowdle & Gentner, 2005). We hypothesized that reading the same explanation after either a metaphor or a simile would produce similar reading times if indeed *time is like money* has the same interpretation as *time is money*. Instead, explanations after similes had slower reading times. We suggest that this difference reflects the differences in interpretation that similes and metaphor produce. Metaphors and similes may engender different interpretive processes, which reflect both in the way their vehicles are read and in the way their explanations are treated as a function of the preceding expression. We decided to test this hypothesis further in Experiment 2. More specifically, we tested the prediction that a metaphor will yield a faster reading of a subsequent explanation when that explanations highlights a figurative property of the vehicle, but the reverse pattern should be true of the simile expressions: a literal property of the simile vehicle should yield for faster reading.

Experiment 2

Glucksberg and Haught (2006a, 2006b) argue that the vehicle term in metaphors and similes is different, such that *shark* refers to the figurative referent of *shark* in the metaphor *lawyers are sharks*, but to the literal referent of *shark* in the simile *lawyers are like sharks*. Support for this hypothesis comes from comparisons of participants' interpretations of metaphors and similes. For example, in *ideas are diamonds* participants would infer the property *brilliant*, while the property *shiny* (a literal property of diamonds) had a greater probability of being inferred for *ideas are like diamonds* (Glucksberg & Haught, 2006a). This result suggests that metaphors receive a figurative interpretation, while similes are interpreted literally.

To test the hypothesis that simile vehicles are interpreted more literally, we decided to write explanations to appear after metaphors and similes that reflected either a figurative property of the expression (*education is (like) a tree because education grows*), or highlighted the vehicle as a literal entity by referring to a literal property (*education is (like) a tree because education is a plant*). For these sentences, we expected the sentence with the figurative property would be read faster after metaphors because the expression will prime the salient figurative property. In contrast, as the vehicle is interpreted literally in similes, we predicted explanations with the literal property would be read faster after similes.

One potential problem was that explanations containing the literal property could be read slower because the statements themselves are objectively false. As lawyers are not literally fish, for example, reading the sentence *lawyers are (like) sharks because lawyers are fish* could cause confusion and slow reading times more so than statements that assert a related figurative property (i.e., *lawyers are (like) sharks because lawyers are dangerous*). To avoid this potential confound, we chose to write both the expression and the subsequent explanation using a negative structure (i.e., *lawyers are not (like) sharks because lawyers are not dangerous* and *lawyers are not (like) sharks because lawyers are not fish*). In this manner, both sentences can be seen as being objectively true as lawyers are not literally fish, and on a matter of opinion, people may deem lawyers as not dangerous.

Writing our statements in a negative structure also allowed us to examine questions related to comprehending a negated figurative statement. For example, it has been argued that understanding a negative statement first requires processing that statement as an affirmative statement, which subsequently causes negated statements to have longer reading times (Hasson & Glucksberg, 2006; MacDonold & Just, 1989; Mayo, Schul, & Burnstein, 2004). The schema-plus-tag model (Clark & Chase, 1972), for instance, proposes that negative statements of the form *A is not B* are understood by representing the proposition as [NOT [A is B]]. Consequently, understanding a negative sentence is assumed to take longer than understanding a positive sentence because two steps are required for comprehension: processing the positive core, followed by negating that same core. In contrast, a statement of the form *A is B* would be predicted to have shorter reading times because it is interpreted directly as [A is B]. For example, when people read the statement *lawyers are sharks*, they would be predicted to only entertain the assertion that lawyers are dangerous. However, reading the negated statement *lawyers are not sharks*, people would mentally represent both the negated statement, as well as the counter-statement (i.e., *lawyers are sharks*), and the need to mentally represent both statements would result in longer reading times.

Support for these predictions comes from a study by Hasson and Glucksberg (2006). They found that positive metaphors (e.g., *my daughter is an angel*) primed affirmative-related properties (*sweet*), but not negative-related properties (*nasty*), in a subsequent lexical decision task, whereas the negated metaphors (*my daughter is no angel*) primed both affirmative- and negative-related properties at 500 ms after presentation of the metaphor. They also found that at 150 ms after presentation of a negated metaphor that the priming effect was actually stronger for the affirmative-related properties, whereas at 1000 ms, a priming effect was only found for the negative-related properties. These results are consistent with the argument that people comprehend positive statements directly, whereas negative statements are understood by first interpreting the negated statement as an affirmative, followed by subsequently negating this propositional core. We decided to further test the hypothesis that negated statements take longer to process than positive statements by comparing the reading times found for the vehicles in Experiment 2 to when they were written in an affirmative structure in Experiment 1. Consistent with past studies, we predicted that reading times for negated metaphors and simile vehicles would be longer than when they had been read as positive statements.

In summary, using the same paradigm as Experiment 1, we again contrasted the vehicle and explanation reading times of metaphors and similes. However, in this experiment, we also manipulated these sentences in two manners. First, we presented the expressions in a negative structure (e.g., *education is not (like) a tree)*. Second, we followed the sentence with an explanation that stated either a salient figurative property of the vehicle or made reference to one of the vehicle's literal properties. Similar to Experiment 1, we expected vehicles in negative similes to have longer reading times because they are, by hypothesis, understood as comparative statements rather than categorizations. When comparing these vehicle reading times to those found in Experiment 1, we also predicted a significant difference, and that reading times would be longer for the negated vehicles. Explanations containing a figurative property (*lawyers are not sharks because lawyers are not dangerous*) were predicted to be read faster after metaphor expressions, while those containing a literal referent (*lawyers are not sharks because lawyers are not fish*) were predicted to be read faster after simile expressions.

## Method

### *Participants*

One hundred and twenty participants from Concordia University were given course credit or monetary compensation for participating in this study. All participants stated they were native speakers of English, and had normal or corrected-to-normal vision.

*Materials*

From the topic-vehicle pairs used in Experiment 1, we used 20 topic-vehicle pairs to compare vehicle reading times in negative metaphors and similes. We ensured the same vehicle term was not presented more than once, and picked vehicles that could activate both a salient figurative attribute, but also a strong literal representation. Towards this goal, we used the property that had been written most often for a given topic-vehicle pair by participants for the conventionality ratings. More specifically, the most frequent property written for a given topic-vehicle pair as a metaphor was the property used in the explanations that expressed figurative properties. For the literal sentences, a literal property was selected. This literal property was often the vehicle's literal category (e.g, *plant* for the metaphor *education is a tree*, and *fish* for the metaphor *lawyers are sharks*). A list of the negative topic-vehicle pairs, as well the properties used in the explanations, are presented in Figure 3B.

*Design*

Because our expressions, until the explanation region, would differ only by the word *like*, we were concerned that presenting participants both our metaphor and simile expressions might lead to some participants ignoring the presence of the word *like* in the sentence. To address this concern, we ran our expression by explanation conditions as separate groups. Thus, one group read negative metaphors followed by explanations expressing figurative attributes, while the next group read negative similes followed by explanations expressing figurative attributes. Two additional groups were run for metaphors and similes followed by explanations expressing a literal property. The sentences were presented with the same structure as Experiment 1: Introduction + topic + (*is not* / *is not like*) + vehicle + *because* + explanation + closing statement. For each of the four groups, the 20 experimental items were presented with 30 filler items. The filler items were positive metaphors and similes that contained topic-vehicle pairs not used in the set of experimental items, which were also followed by related explanations. The filler sentences were written with a positive structure rather than a negative structure.

*Procedure*

The procedure was similar as employed in Experiment 1. Participants were asked to read normally for comprehension. We also asked participants after reading each sentence to rate how apt they found the sentence. *Politics is a jungle* was given as an example of an apt statement, whereas *politics is a beach* was given as an example of a less apt statement. Also, because many of the filler sentences were actual jokes (e.g., *men are like couches because you often find them in front of the TV*), we also asked participants to rate how funny they found each sentence. Only the aptness ratings were included in our analysis. The experiment lasted 30 minutes.

## Results

*Outlier Removal*

For each participant, outlier removal proceeded as was done in study 1. All vehicle RTs shorter than 200 ms and larger than 5000 ms were removed. For the explanation region, RTs shorter than 200 ms and larger than 10000 ms were removed. For each participant, the mean and standard deviation of the remaining RTs for the vehicle and explanation region were then calculated. A participant's RT was removed if it was larger than the mean plus 2.391 standard deviations, or smaller than the mean minus 2.391 standard deviations. This standard deviation value is the number recommended by Van Selst and Jolicoeur (1994) for the removal of outliers in a sample size of the present magnitude. RTs removed at this stage were replaced with the boundaries (i.e., $M + 2.391$ $SD$ for RTs greater than this value, and $M - 2.391$ $SD$ for RTs smaller than this value). A total of 139 RTs were changed (corresponding to 5.8% of the dataset).

Because we ran independent groups, we also ran outlier removal across participants within a condition to ensure the distribution of outliers across the different conditions was the same. For the vehicle and explanation conditions, participants whose mean RT was larger than the group mean plus (or minus) 2.43 standard deviations had their means removed and not replaced. This criterion is the one recommended by Van Selst and Jolicoeur (1994). Five participants had both their vehicle and explanation reading times removed because they were identified as outliers. As both the vehicle and explanation reading times from these participants were found to be outliers, it is possible that these participants incorrectly reported their first language as English. An additional two reading times were removed from the vehicle condition and an additional three reading times were removed from the explanation condition, for a total removal of 15 participant reading times (6.25% of the dataset). No outlier removal was done for the aptness ratings.

*Analyses*

For the vehicle region, the mean vehicle RT for negative similes was 837 ($SD$ = 327; $Mdn$ = 721.08), while for negative metaphor the mean vehicle RT was 665 ($SD$ =

199; *Mdn* = 650.37). The RTs for the simile condition were not normally distributed (*D* (57) = .172, $p < .001$). Levene's test for equality of variances was also found to be significant ($p < .001$). Therefore, we ran independent t-tests that were bootstapped on 1000 samples (Mooney & Duval, 1993). The difference was found to be significantly different ($t_1$ (92.66) = 3.37, $p < .001$, $r = .33$). A paired t-test also found the difference significant by items ($t_2$ (19) = -9.97, $p < .001$, $r = .92$).

We used the RTs from the items analysis to compare the RTs for the vehicles used in Experiment 2 to RTs for the vehicles when they were read in a positive context in the Experiment 1. For both metaphors and similes, vehicles read in the negative context were found to have significantly slower RTs (positive metaphors, $t_2$ (19) = 8.115, $p < .001$, $r = .88$; positive similes, $t_2$ (19) = -12.01, $p < .001$, $r = .94$). These results support the prediction that negative statements take longer to process than affirmative statements.

For explanations after metaphors, the mean reading time for explanations expressing a figurative property was 1694 ms (*SD* = 610), while the mean for explanations expressing a literal property was 2084 (*SD* = 874). For similes, the mean reading time for explanations expressing a figurative property was 2091 ms (*SD* = 742), while explanations expressing a literal property had a mean reading time of 1754.61 ms (*SD* = 645.90). To compare these reading times, a univariate ANOVA was run with explanation reading times as the dependent variable. Sentence structure (metaphor or simile) and literality (figurative or literal) were the fixed factors. The main effect of sentence structure was not significant ($F$ (1, 108) = .06, $p = .81$, $\omega^2 = .004$), nor was the main effect of literality ($F$ (1, 108) = .04, $p = .85$, $\omega^2 = .004$). However, the sentence by literality interaction was significant ($F$ (1, 108) = 7.0, $p < .001$, $\omega^2 = 0.03$). The distributions for the metaphor literal explanations were not normally distributed (*D* (29) = .17, $p < .05$), nor were the figurative attribute explanations after similes (*D* (27) = .17, $p < .05$). Therefore, we followed-up the significant interaction by using independent t-tests that were bootstrapped on 1000 samples to compare reading times for explanation after metaphors and similes. Consistent with the significant interaction found, we found different results for metaphors and similes. While for metaphors the explanations expressing figurative properties were read faster than those expressing a literal referent ($t$ (55) = -1.823, $p < .01$, $r = .24$), the reverse result was found for similes: explanations expressing a literal property were read faster ($t$ (53) = 1.912, $p < .01$, $r = .25$). These results are presented in Appendix 3C. The comparison for similes was also significant by items ($t_2$ (19) = -4.97, $p < .001$, $r = .75$), and approaching significance for the comparison after metaphors by items ($t_2$ (19) = -1.56, $p = .14$, $r = .34$), but in the same direction as that observed in the analysis by subjects.

Lastly, the aptness ratings were entered into a univariate analysis of variance with the ratings as the dependent variable. Sentence structure and literality were again entered as the fixed factors. The main effect of sentence structure was not significant ($F$ (1, 108) = .734, $p = .393$), while the main effect of literality was significant ($F$ (1,108) = 22.39, $p < .05$). The interaction effect was not found to be significant ($F$ (1, 108) = .50, $p = .48$). These results suggest that participants found both negative metaphors and negative similes more apt when their explanations expressed a literal property. Supporting this hypothesis, sentences with explanations expressing a figurative property had an average aptness rating of 3.31 (*SD* = .87), while those expressing a literal property had a mean aptness ratings of 4.41 (*SD* = 1.45), and this difference was significantly different ($t$

(96.823) = 5.036, $p < .001$, $r = .42$); Levene's test for equality of variance was significant, $p < .001$). We also compared aptness ratings within the metaphor and simile conditions. Metaphors followed by explanations expressing a literal property were rated more apt ($M = 4.27$, $SD = 1.51$) than when followed by an explanation expressing a figurative property ($M = 3.30$, $SD = .83$; $t$ (45.10) = 3.063, $p < .05$, $r = .37$; Levene's test for equality of variances was significant, $p < .01$). Similarly for similes, explanations expressing a figurative property were rated less apt ($M = 3.31$, $SD = .93$) than when the explanation expressed a literal property ($M = 4.55$, $SD = 1.4$; $t$ (50.38) = 4.04, $p < .01$, $r = .47$; Levene's test for equality of variances was significant, $p < .01$). Therefore, in both cases, those sentences with explanations expressing figurative properties were rated less apt. These comparisons were also significant by items (metaphors, $t_2$ (19) = -4.58, $p < .001$, $r = .72$; similes, $t_2$ (19) = 6.45, $p < .001$, $r = .83$). Consistent with Experiment 1, no significant correlations were found between aptness ratings and the vehicle or explanation reading times.

## Discussion

Similar to Experiment 1, participants read metaphors and similes followed by explanations. Sentences were read using a self-paced moving window, which allowed us to compare reading times for the vehicle region alone. Similar to Experiment 1, vehicles had longer reading times when they were read within a simile compared to when the same word was read in a metaphor. Furthermore, this result was found despite the sentences being written in a negative structure (e.g., *lawyers are not (like) sharks*). We also compared the vehicle reading times in Experiment 2 to when they were read in a positive structure in Experiment 1. For both metaphors and similes, vehicle reading times were longer for the negative sentences. This result is consistent with past studies that suggest negation slows down processing time because people must first evaluate the truth value of the negated statement (Glucksberg & Hasson, 1990; MacDonold & Just, 1989; Mayo, Schul, & Burnstein, 2004).

Explanations in Experiment 2 were written to refer to either a figurative property of the vehicle (e.g., *dangerous* for *shark*), or referred to a more literal property of the vehicle (e.g. *fish* for shark). Consistent with our predictions, explanations that expressed a figurative property were read faster when they followed metaphors, whereas the reverse was observed for similes: explanations that referred to literal properties of the vehicle were read faster after similes. These results are also consistent with past arguments by Glucksberg (Glucksberg, 2008; Glucksberg & Haught, 2006a, 2006b) that while the vehicle is interpreted figuratively in metaphors, it is interpreted literally within similes. These results are presented in Table 3C

Table 3C: Figurative and Literal Explanation Reading Times

*Mean Vehicle and Explanation RTs (and SDs) per property type (in milliseconds)*

| | Vehicle* | Figurative Explanation* | Literal Explanation* |
|---|---|---|---|
| Metaphors | 665 (198) | 1694 (43) | 2084 (874) |
| Simile | 837 (327) | 2091 (742) | 1754 (645) |

*$p < .05$

Statements were rated more apt when the explanation expressed a literal property (*e.g. lawyers are not (like) sharks because lawyers are not fish*) than when it expressed a figurative property (*e.g., lawyers are not (like) sharks because lawyers are not* *dangerous*). Thus, participants deemed the statements less acceptable when it negated a figurative property. Indeed, the average aptness rating for explanations negating a figurative property was below the scale's mid-point of 3.5 (labelled moderately apt) for both metaphors and similes, whereas the average aptness rating for explanations negating a literal property were both above this mid-point. When these same items in Experiment 1 were written in a positive structure, and rated in isolation, they had an average aptness rating of 5.2 on 10-point scale, where 5 had been labelled moderately apt. Therefore, negating the figurative properties does appear to have decreased the relative aptness rating for the items.

This last result provides indirect evidence for Hasson and Glucksberg's (2006) argument that negated metaphors first activate affirmative-related properties rather than negative-related properties. Had reading a negated statement such as *lawyers are not sharks* activated properties associated with *kindness* (a negative related property), then aptness ratings would have probably shown a relative increase because the written sentence would have matched the activated mental representation of lawyers being kind. Instead, the results suggest that when people read a statement such as *lawyers are not sharks*, they first process the affirmative statement (*lawyers are sharks*), which in turn activates a salient affirmative-related property (i.e., *dangerous*). Thus, a statement such as *lawyers are not sharks* would *first* be interpreted as meaning that *lawyers are not dangerous*, rather than meaning that *lawyers are kind* (Giora et al., 2005). When participants then read a sentence that contradicts this mental representation (i.e., *lawyers are not sharks because lawyers are not dangerous*), it is possible that participants rate the statement as less apt because it does not match the salient representation just activated.

# General Discussion

Results from both Experiment 1 and 2 suggest that metaphor and similes are distinct types of expressions, even when they both employ the same topic-vehicle pairs. Vehicles of similes had longer reading times compared to the same vehicles in metaphors. This result was found whether the expressions were affirmative (*lawyers are/are like sharks*) or negative (*lawyers are not/are not like sharks*), while reading times were not related to either the aptness or conventionality level of a given topic-vehicle pair.

The longer reading times for similes suggests that the two expressions rely on different comprehension processes. One possible interpretation for this consistent difference is that the vehicle is assigned a more literal or more figurative meaning, depending on the type of structure that it is embedded in (*x is y* in metaphors, or *x is like y* in similes). Experiment 2 found support for this prediction because explanations with figurative properties were read faster after metaphors, while those with literal properties were read faster after similes.

The finding that metaphors and similes may elicit different vehicle representations, and ultimately how the topic-vehicle pair relationship itself is interpreted, is problematic for theories such as Career of Metaphor theory which predict that novel metaphor statements can be understood by being understood as similes. If vehicles are treated literally within similes, and conventionalization does not change the meaning produced in a simile versus a metaphor, then metaphors should also create literal representations of the vehicle. Instead, the results found in this study support the argument that the vehicle is treated figuratively in metaphors, but literally in similes.

Consequently, the results are more supportive of theories such as Categorization theory (Glucksberg, 2008) which argues that metaphors are understood as categorizations, consistent with a metaphor's embedded *x is y* structure. Categorization theory, however, also predicts aptness to affect metaphor processing, and we did not find aptness ratings to be related to vehicle reading times.

Adopting the hypothesis that similes would be understood as comparisons, but metaphors as categorizations, as a result of their embedded structure, the subsequent question is why understanding similes as comparisons would cause longer vehicle reading times? Both Categorization theory (Glucksberg & Keysar, 1990; Johnson, 1996) and Career of Metaphor theory (Bowdle & Gentner, 2005) predict that similes will be more difficult to interpret than metaphors. As discussed in Career of Metaphor theory, for example, a comparison (i.e., simile) requires an alignment process between the topic and vehicle followed by a projection of those properties found to be in common. In contrast, for categorical processing, a meaning associated with the vehicle term is simply projecting onto the topic—there is no previous alignment stage. Thus, categorical processing is predicted to be faster than comparative processing because less processing stages are required. Therefore, while we did not find support for the predictions that aptness and conventionality would affect reading times, we did find support for the prediction that vehicles require more processing time when read within similes.

*Conclusion*

Across the two studies, the results suggest that metaphors and similes are neither processed similarly, not yield similar interpretations. Vehicles produced longer reading times when read in similes, suggesting that processing similes is more difficult than processing comparable metaphors. Furthermore, while the metaphor vehicle does appear to obtain a figurative interpretation, the representation of the simile vehicle seems to remain literal. In summary, whereas previous researchers and theorists since Artistotle (trans. 1926) have argued that metaphors and similes are alike—processed similarly and produce the same interpretation—the present results suggest that both the processing and interpretation of metaphors and similes are better viewed as different.

## Chapter 4: Examining the reading of Metaphors and Similes with Eye Tracking

The results found in Chapter 3 were somewhat surprising as they we would have predicted longer metaphor vehicles reading times based on both the results from in Chapter 2, as well as the prediction by Career of Metaphor theory that metaphors would have longer processing than similes. The results are consistent, however, with the predictions that a comparison is easier to understand than a predication statement. Earlier versions of categorization theory also predicted similes would be more difficult to read than metaphors because they would need to be converted to metaphors for comprehension. Johnson (1995) found support for this hypothesis. When he compared sentence reading times for metaphors and similes read at the end of paragraphs, we found longer reading times for similes.

The longer simile vehicle reading times found in Chapter 3, however, are not consistent with the earlier discussion regarding connotative properties receiving more activation when read in metaphors, as this would have predicted longer reading times for metaphor vehicles. One possible explanation is that sentence comprehension processes masked those processes exclusive to the vehicle such as a shift in the activation level of associated properties. Supporting this hypothesis, the eye-tracking study presented in Chapter 4 found shorter saccade lengths for metaphor vehicles, regardless the familiarity. This result is consistent with the hypothesis that reading a vehicle in a metaphor causes increased activation for connotative properties. This paper was submitted for publication to the *Journal of Experimental Psychology: Learning, Memory, and Cognition* with the author order of Roncero, Ashby, and de Almeida. The manuscript is now in preparation for submission to another journal.

# Metaphors are not (like) similes: Evidence from eye movements

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Abstract

Since Aristotle, numerous papers have discussed whether metaphors (*life is a journey*) and comparable similes (*life is like a journey*) convey the same meaning. In this study, eye movements were recorded as participants read sentences containing metaphors and comparable similes followed by explanations (e.g., *Mary believes liquor is/is like a crutch because it is used in difficult situations*). We measured reading times and the spatial pattern of fixations as a function of the expression's familiarity and aptness, as well as the expression type (i.e., metaphor or simile). First-pass reading times were comparable for familiar metaphors and similes, but longer for unfamiliar metaphors, indicating that familiarity plays an early role in figurative language processing. Several measures also indicated that metaphors were initially more difficult to process than similes irrespective of the aptness or familiarity level. These results provide initial evidence for differences in the early processing of metaphors and similes.

# Metaphors are not (like) similes: Evidence from eye movements

Metaphors usually express a relationship between a topic (e.g. *guilt*) and a vehicle (e.g., *infection)* using a linguistic form such as *X is Y* (e.g., *guilt is an infection*). Similes also relate a topic and a vehicle, but typically include comparative words such as *like*, as in *X is like Y* (e.g., *guilt is like an infection*). Although the surface forms of these expressions differ by simply one word, readers may process them in fundamentally different ways; similes can be processed as literal expressions whereas metaphors might entail specific figurative language processes. Central questions in figurative language research include whether figurative language recruits processes that are similar to those used for understanding literal expressions, and how familiarity and aptness affect metaphor processing. The present study investigates these questions by monitoring eye movements during silent reading. Using several eye movement measures, we examined the initial, online processes that occur when interpreting topic-vehicle relations in metaphors, how these processes compare to those involved in processing similes, and the effects of familiarity and aptness on metaphor processing.

## Theories of metaphor processing

Comparison theory. The idea that the meaning of a metaphorical expression of the form *X is Y* entails similarity between topic and vehicle has been prevalent, at least since Aristotle (trans. 1926). This idea has been incorporated in the works of many contemporary psychologists, linguists, and philosophers (e.g., Ortony, 1979; Miller, 1979; Gentner, 1983). The key point of the comparison theory is that a metaphor carries the meaning of a simile (as in *X is like Y*) except for the omission of a comparative word such as *like*. In Gentner's (1983) early model, for example, the comparison process to understand a statement involves accessing the knowledge domains of the topic and the vehicle, and then mapping their shared relations. For example, to comprehend the expression *crime is a disease,* a reader would identify the shared relation between *crime* and *disease* (e.g., both are contagious). Then, the arguments of the relation would be aligned (i.e. *crime* with *disease*, and *neighborhood* with *population*) to create analogies such as *crime spreads through neighborhoods like a disease spreads in a population* (see also Black, 1979). Thus, the comparison theory assumes that metaphors are treated as implicit similes and comprehended as comparisons.

The standard pragmatic model. In its early inception (Searle, 1979; see also Grice, 1989), the standard pragmatic model proposed that the comprehension of metaphors involved three main stages: (a) literal interpretation—when the meaning of the metaphor is interpreted as a literal statement (*sentence meaning*); (b) the realization that the sentence meaning is *defective* (Searle, 1979); and (c) the search for an alternative meaning (which Searle called *speaker's meaning*). Although all proponents of the pragmatic model assume that a literal meaning should be obtained at first (Grice, 1989; Searle, 1979), there is no agreement on how the meaning of a metaphor is achieved, with the establishment of comparisons being among the many possible functions of a metaphor (see Davidson, 1978; Searle, 1979).

One of the common processing predictions that emerged from the pragmatic model was that metaphors should take longer to process than literal statements because, contrary to literal statements, metaphors would require the search for alternative meanings. However, with few exceptions (e.g., Janus & Bever, 1985), most studies have failed to find a processing difference between metaphors and literal expressions, in particular when the metaphors in question were apt or familiar (Blasko & Connine,1993; Gildea & Glucksberg, 1983; Pynte, Besson, Robichon, & Poli, 1996).

After the seeming downfall of the standard pragmatic model, two main theories of metaphor processing became prevalent: categorization theory and career of metaphor theory. Categorization theory claims that readers comprehend metaphors through categorization processes, which are distinct from the comparison processes engaged to process similes (Glucksberg, 2003, 2008; Glucksberg & Keysar, 1990). In contrast, career of metaphor theory (Bowdle & Gentner, 2005; Gentner & Bowdle, 2008) claims that novel metaphors engage comparison processes whereas familiar metaphors engage categorization processes.

In this study, we monitored eye movements as readers silently read metaphor and simile sentences in order to investigate the early, online processing of figurative language. These temporally-sensitive and spatially-sensitive measures yielded novel data that may inform future theories of figurative language processing as well as data that converge with findings from other online studies. To provide a theoretical context for our findings, the following sections review the central claims of two prominent theories of metaphor processing: categorization theory and career of metaphor theory.

Categorization theory. The most recent version of categorization theory assumes that metaphors and similes are processed differently, with similes engaging comparison processes whereas metaphors initiate a categorization process (Glucksberg, 2008). For example, in the literal statement *hammerheads are sharks,* the properties of sharks are interpreted as being true of hammerheads. Similarly, the metaphor *lawyers are sharks* conveys the idea that certain properties of *sharks* are also true of *lawyers*. Metaphors such as *lawyers are sharks*, however, are false in that lawyers are not literally sharks. According to categorization theory, we resolve this apparently false statement by interpreting the vehicle word (e.g., *sharks*) in metaphors as referring to a category that includes the abstract properties of the vehicle rather than to its literal exemplar (Glucksberg & Haught, 2006). In the metaphor *lawyers are sharks*, for example, the vehicle *sharks* represents a category of vicious and aggressive predators, not the actual animal.

Categorization theory claims that the comparison processes used to process novel similes are slower than the categorization processes used to comprehend novel metaphors (Glucksberg, 2008; Glucksberg & Keysar, 1990). According to Glucksberg and colleagues, this is because two objects in a literal expression are similar in innumerable ways, and it takes time for people to determine the relevant vehicle properties that make the comparison, or simile, valid. In a metaphor, however, the vehicle refers to a smaller category of abstract relations, which does not include the literal properties of the vehicle's base term. Thus, categorization theory predicts that novel metaphors will be comprehended faster than novel similes. In support of this prediction, Johnson (1996) compared participants' reading times for metaphors and similes at the end of short paragraphs and found longer reading times for similes. Roncero, Kennedy, and Smyth (2006) also found evidence consistent with the claim that similes can be more difficult to comprehend than metaphors because of the potentially infinite conditions under which the topic and vehicle can be compared. In their comparison of metaphor and simile productions on the Internet, simile statements were followed by explanations clarifying the expressed relationship more often than were metaphor statements. Thus, Internet writers seem to be aware of the interpretation problem posed by similes, and try to aid comprehension by writing explanations for their simile statements.

When metaphors and similes are familiar, however, categorization theory predicts that similar comprehension times will be observed (Glucksberg, 2008). Experience with familiar similes allows readers to recognize quickly which vehicle properties are relevant. The disadvantage of having to sort through the different properties of novel similes is no longer true for familiar similes. Therefore, familiar similes and metaphors should be processed with comparable effort.

Lastly, categorization theory predicts aptness to facilitate metaphor comprehension. In apt metaphors, the vehicle is assumed to use an easily recognizable exemplar that serves as a clear prototype for the expressed metaphor (Glucksberg, 2008), and captures salient properties of the topic (Chiappe & Kennedy, 1999). For example, Jones and Estes (2006) found that more apt metaphors, such as *beavers are lumberjacks,* were comprehended faster and understood better than comparable metaphors in which the same vehicle did a worse job of capturing the salient features in the topic, such as *termites are lumberjacks*. When metaphors are novel and not apt, however, the simile form should be processed more easily (Glucksberg, 2008).

Career of metaphor theory. The career of metaphor theory has proposed that the processes used to comprehend metaphors and similes depend on the conventionality of the topic-vehicle relation, which changes over time (Bowdle & Gentner, 2005; Gentner & Bowdle, 2008). This theory claims that a metaphor vehicle gradually acquires a figurative meaning through the frequent comprehension of similes that have the same vehicle.

Essentially, the claim is that similes become metaphors over time, with the word *like* dropping out.

According to career of metaphor theory, readers use comparison processes to understand similes (Gentner & Bowdle, 2008). Once a simile becomes familiar, it is written in metaphor form (i.e., without the *like*), which invites readers to use categorization processes described by Glucksberg (2008). Career of metaphor theory claims that novel metaphors are more difficult to process than conventional metaphors. When a metaphor is new to a reader, such as *life is a bottle,* the initial categorization process is interrupted because readers do not yet have the categorical relation between topic and vehicle stored in memory (Gentner & Bowdle, 2008). Readers resolve this initial difficulty by launching comparison processes to comprehend the metaphor as a simile (i.e., *life is like a bottle*). Over time, repeated exposure allows a simile vehicle to acquire a conventional figurative meaning. When that happens, readers can access the figurative meaning from a metaphor vehicle directly and understand the figurative relation through a categorization process rather than by initiating a comparison process (Gentner & Bowdle, 2008). This shift from comparison to categorization processes could be expressed linguistically via a preference for the metaphor form (e.g., *crime is a disease*) rather than the equivalent simile form (*crime is like a disease*). Consistent with this hypothesis, Bowdle and Gentner (2005) found that participants preferred the metaphor form when the vehicle had a conventional figurative meaning.

Previous research on simile and metaphor processing

Few studies have directly examined metaphor and simile processing. Previous research has largely consisted of off-line studies in which participants press a button to indicate that they have understood the statement. With the exception of Johnson (1996), studies report few reading time differences for metaphors and similes (e.g., Chiappe, Kennedy, & Chiappe, 2003; Glucksberg & Haught, 2006; Jones & Estes, 2006). This general finding of no difference in comprehension time might suggest that metaphors and similes are not processed differently. But the offline nature of the tasks employed thus far, such as the time taken to read a sentence and then rate it, also raises the possibility that processing differences were not captured by measures of whole sentence reading.

Previous research demonstrates that online studies using temporally sensitive measures, such as event-related potentials or eye movements, are able to detect subtle differences in literal vs. figurative language processing (e.g., Pynte, Besson, Robichon, & Poli, 1996). In an eye movement study that examined metaphor processing, Blasko and Briihl (1997) found that familiar metaphors received shorter first-pass fixations than unfamiliar metaphors. Inhoff, Lima, and Carroll (1984) found that a context which facilitated the figurative meaning of the metaphor reduced reading times (see also Frisson & Pickering, 1999; Pickering & Frisson, 2001). Such online studies have contributed to our knowledge of figurative language processing, however no previous eye movement study has compared figurative and literal language processing using expressions that contain the same lexical items.

The present study

To our knowledge, this is the first study to investigate the early, online processing of metaphors and comparable similes as it unfolds during the silent reading of text. We examined participants' online interpretation of metaphors and similes by measuring their eye movements as they read sentences at their own pace. We also collected familiarity and aptness ratings for these topic-vehicle pairs to examine how processing might be affected by these variables. Eye movement technology tracks comprehension processes with multiple measures that include fixation times and re-reading patterns, which serve as indicators of processing difficulty (Rayner, 1998; 2009). Further, this method allowed us to monitor reading in the vehicle region specifically, yielding a more precise window into the time course of detecting figurative language. We also measured eye movements when reading the explanation region, which was the same plausible explanation for each pair of expressions (e.g., *Friendship is/is like money* *because it is easier made than kept*). Analyses of eye movements in the explanation region allowed detection of any comprehension effects that might arise later in sentence reading (i.e., after the critical vehicle region).

In the present experiment, the simile vehicle regions and the metaphor vehicle regions were visually identical (see Table 4A). By measuring eye movements when reading identical text, we controlled for lexical effects that stem from the processing of particular words. Therefore, it is likely that our findings mainly reflect differences in the higher-order processes that skilled readers use to comprehend similes and metaphors.

Table 4A: Example Simile and Metaphor Materials

Rated Unfamiliar

1. A. Bob says hair is like a rainbow because each head has many different colors.

   B. Bob says hair is a rainbow because each head has many different colors.

2. A. Henry thinks trees are like straws because they suck up nutrients.

   B. Henry thinks trees are straws because they suck up nutrients.

Rated Familiar

3. A. Mary believes liquor is like a crutch because it is used in difficult situations.

   B. Mary believes liquor is a crutch because it is used in difficult situations.

4. A. Amanda says television is like candy because it is both addictive and harmful.

   B. Amanda says television is candy because it is both addictive and harmful.

Our dependent measures included time spent reading in the vehicle region and in the explanation region during initial sentence reading (*first-pass time*), and the time spent processing the vehicle and the explanation if participants re-read the sentence (*second pass time*). We also gathered data about where the eyes traveled in the text (e.g., whether they moved forward to the right to process new text or regressed to the left to re-read previous text) and the length of the saccade after the vehicle was fixated. Longer fixations, shorter saccade amplitudes, and/or more regressions are known to be sensitive indicators of processing difficulty (Rayner, 2009). These measures indicate when the cognitive system first detects figurative language (e.g., metaphor) and how the processes engaged compare to those used for processing literal statements (e.g., similes).

The three main theories of metaphor processing hold specific predictions for the eye movement data. The standard pragmatic model predicts longer first-pass times, shorter forward saccades from the vehicle, and more regressions in the metaphor than the simile conditions, as metaphors must be rejected as literal expressions and alternative meanings need to be sought. Once metaphors have been interpreted, then metaphor and simile processing would proceed in a similar fashion, and be reflected in comparable means for second-pass reading measures. The categorization model predicts faster first pass reading times and longer forward saccades from the vehicle in unfamiliar metaphors than unfamiliar similes. Familiar similes and metaphors should be processed with comparable effort. Also, one might expect fewer regressions from apt novel metaphors than novel similes, as apt metaphors should be processed more easily using categorization processes. Career of metaphor theory also claims that the familiarity of the expression matters. In addition, career of metaphor theory predicts that unfamiliar metaphors will be more difficult to process than unfamiliar similes, as a metaphor would usually appear in print only after the simile form has become familiar. Therefore, career theory would predict longer first-pass times, shorter forward saccades from the vehicle, and more regressions in the unfamiliar metaphor than the simile conditions. Once comparison processes were engaged, however, second-pass times should be comparable for unfamiliar metaphors and similes. Familiar metaphors, however, should be interpreted as easily as similes, reflected by comparable means for first-pass time, length of forward saccades from the vehicle, and regressions in the familiar figurative and literal conditions.

# Method

## Participants

Fifty native English speakers with normal or corrected-to-normal (via contact lenses) vision participated for course credit or payment of $7 US at the University of Massachusetts. Participants were Psychology students, two-thirds female, 18 to 24 year olds.

## Apparatus

An Eyelink 1000 eye tracker monitored the location of the right eye, as participants viewed sentences binocularly. Viewing distance was 60 cm, and 3-4 characters equaled approximately 1° of visual angle. Eye position data were sampled at 1000 Hz.

## Materials

The materials consisted of 66 topic-vehicle pairs (e.g., *wrestler-gorilla)* from which we created sets of metaphors and similes. Items in the simile and metaphor conditions were identical, with the exception of the addition of the word *like* in the simile condition; see Figure 4A for sample items in each condition. Each participant saw half of the topic-vehicle pairs presented as similes and the other half presented as metaphors. The 66 experimental items were combined with 88 filler items from unrelated experiments. Participants answered a yes/no comprehension question with a key press after 25% of the sentences, but they did not know in advance which sentences would be followed by questions.

Previous studies have sometimes created novel metaphor statements by scrambling well-known metaphors. This procedure often leads to metaphors that are difficult to comprehend (e.g., *a sauna is a fish*; Jones & Estes, 2005). Instead, we used a set of topic-vehicle pairs that have been used in previous research (e.g., Chiappe, Kennedy, & Smykowski, 2003), and then restricted that list to those items which had at least four independent productions on the Internet, based on Google search results. Therefore, we expected the statements would be largely comprehensible, but that some would be relatively unfamiliar to participants.

We tested the familiarity of the metaphors by asking 20 students who did not participate in the main experiment to rate the 66 metaphors on a scale of 1 to 7 (with 1 being *not at all familiar* and 7 being *very familiar*). The mean novelty rating for all metaphors was 4.1. Twenty-six items were rated as unfamiliar (1-3, mean = 2.0). Forty items were rated as familiar (3 or higher, mean = 5.2).

We also asked 20 students who did not participate in the main experiment to rate the aptness of 66 metaphors on a scale of 1 to 10 (with 1 being *not at all apt* and 10 being *very apt*). The mean aptness rating for all metaphors was 6.1. Twenty items were rated as very apt (>7). Thirty items were rated as moderately apt (5-7), and sixteen items were rated low in aptness (<5). Therefore, most of our items were fairly apt.

Explanations for topic-vehicle pairs were obtained by entering the topic-vehicle pair as a simile in the Google search engine. The first explanation produced by the search engine was accepted if it followed coherently from the simile. If this was not the case, the next explanation was considered, until an adequate explanation was found. If no explanation appeared on the Internet, one was created (22 of the 66 items).

## Procedure

The experiment lasted 30–45 min. After the participant provided consent, he or she was seated at the eye tracker and instructed as to the format of the experiment. The tracker was then aligned and calibrated. A chin rest and forehead rest minimized head movements. Calibration was checked between trials and the tracker was recalibrated as necessary. Participants were asked to read normally for comprehension, and were told that a comprehension question would appear after some sentences.

## Data analyses

Software developed at the University of Massachusetts was used to delete trial with blinks and to obtain subject and item averages for each condition (http://www.psych.umass.edu/eyelab/software). To address the question of whether skilled readers process metaphors and similes in a similar fashion, we examined two types of eye movement measures: (a) measures of processing time and (b) measures of the spatial pattern of fixations. Table 4B illustrates the two data analysis regions in each item: the vehicle and the explanation.

Table 4B: Vehicle and Explanation Regions used in the Data Analysis

| | Vehicle | Explanation |
|---|---|---|
| Bob says hair is like a | \|rainbow\| | \|because each head has many different colors.\| |
| Bob says hair is a | \|rainbow\| | \|because each head has many different colors.\| |
| Mary believes liquor is like a | \|crutch\| | \|because it is used in difficult situations.\| |
| Mary believes liquor is a | \|crutch\| | \|because it is used in difficult situations.\| |

Measures of processing time indicate how long readers spent reading in a given region. *First-pass time* was calculated as the sum of all consecutive fixations in a region (e.g., the vehicle or the explanation) beginning with the first fixation and including additional fixations up until the eye moved to another area of the sentence. We report data from trials without regressions (>85% of all trials) in order to avoid the potential confound of higher regression rates with faster reading times (Rayner & Sereno, 1994; Altman, 1994). We also report *second-pass time*, or the time spent re-reading a region after returning to it. First-pass and second-pass time reflect early and later effects in language processing (Rayner, 1998).

Measures describing the spatial pattern of fixations indicate where readers were looking as they read the similes and metaphors. In the present study, we analyzed three first-pass measures: *forward saccade length*, which is the length of the saccade after the first fixation in the region; *launch site*, or the length of the saccade that initially enters the region; and *landing position* of the first fixation in the region. These measures of first-pass fixation locations are expressed in terms of number of characters. Two additional measures indicated the spatial pattern of fixations during re-reading. The *regressions-out* measure is calculated as the percentage of all trials in which first-pass fixations on the vehicle or the explanation were followed by a regression to earlier in the sentence. *Regressions-in* reports the percentage of all trials in which a regression landed in the initial region of the sentence and the vehicle region. Percentage data were subject to arcsine transformation for statistical testing.

Predetermined cutoffs were used to trim the data (Rayner, 1998). Fixations on the target word that were under 100 ms were eliminated from the analysis since such short fixations do not seem to reflect cognitive processing of the target word (Rayner, 1998; Rayner & Pollatsek, 1987). To eliminate overly long fixations, we excluded fixations over 500 ms from our analysis. Approximately 2% of the data were lost due to these cutoffs and track losses. The remaining data were subject to two sets of 2 x 2 analyses of variance (ANOVAs) by subjects (*F*1) and items (*F*2). In the first set of ANOVAs, we tested for effects of familiarity (high and low) and expression type (simile and metaphor). In the Subjects analyses, both factors were treated as within-subjects variables. In the items analyses, type of expression was treated as a within factor and familiarity as a between factor. The same eye movement measures were obtained for the vehicle and explanation regions, then subject to statistical analyses. All participants responded accurately to 80% or more of the comprehension questions.

Lexical variables, such as word frequency and length, are known to affects eye movement measures (see Rayner, 1998). Given that most of our materials were natural occurrences found on the internet, rather than laboratory constructions, controlling for lexical differences in our familiar and unfamiliar items was difficult. We conducted post-hoc tests to determine the degree to which our familiar and unfamiliar items differed with respect to letter length and frequency. On average, the unfamiliar vehicles occurred 36 times per million words (*SE*=12.8) and the familiar vehicles occurred 113 times per million words (*SE*=48.5) (Francis & Kucera, 1982). The mean length of the unfamiliar vehicles (7.2) was significantly different from the mean length of the familiar vehicles (5.9), $F(1, 64) = 6.12$, $p<.05$. Given the influence of these lexical factors on eye movements, we included frequency and length as covariates in follow-up items analyses when a familiarity effect appeared. Thus, the familiarity effects we report are those found to be significant after accounting for word frequency and length.

As previous research has suggested that metaphor aptness may also play a critical role in metaphor processing, we ran a second set of ANOVAs to test for aptness effects in each measure. To maximize the number of less apt items, the midpoint of the rating scale (5) served as the boundary between less apt and more apt items. As in previous research, aptness ratings were correlated with familiarity ratings ($r = .28$, $p<.05$). Although aptness effects appeared in a few eye movement measures, only one aptness effect remained significant when both familiarity and aptness were included in the ANOVAs (2x2x2). For completeness, we note null effects of aptness in measures that yielded familiarity effects.

## Results

### The Vehicle Region: Initial Processing Measures

First-pass times. The mean first-pass times for trials without regressions from the analysis region are presented in Table 4C. Initial tests indicated a main effect of familiarity, $F1(1,49)= 37.54$, $p< .001$, $F2(1,64)= 8.33$, $p<.005$, and an interaction between familiarity and expression type, $F1(1,49)= 5.97$, $p< .05$, $F2(1,64)= 10.78$, $p<.005$. Vehicles in familiar similes and metaphors were read 29 ms faster on average than unfamiliar vehicles. When word frequency and length were entered as covariates, these main effects were significant, $F2(1,62)= 25.54$, $p<.0001$, and $F2(1,62)= 42.67$, $p<.0001$, which indicates that lexical differences between familiar and unfamiliar vehicles accounted for the main effect of familiarity. However, the analysis of covariance also confirmed a significant interaction between expression type and familiarity, $F2(1,62)= 5.37$, $p<.05$, suggesting longer first-pass durations for unfamiliar than familiar metaphors, $F2(1,62)= 6.98$, $p<.01$, but no comparable familiarity effect for similes, $F2<1$. A similar analysis that tested aptness, rather than familiarity, indicated no significant interaction between expression type and aptness $F2(1,62)=1.93$, $p>.15$. To ensure that this null result did not stem from inadequate power, we conducted a follow-up simple effects test of expression type for the low aptness items only ($F<1$).

Table 4C: Mean Reading Times for Vehicles

| | | Unfamiliar | Familiar |
|---|---|---|---|
| First-pass time | | | |
| | Simile | 282 | 261 |
| | Metaphor | 308 | 267 |
| Second-pass time | | | |
| | Simile | 205 | 241 |
| | Metaphor | 298 | 263 |

Forward saccade length. Table 4D presents the mean length of the forward saccades following the first fixation on the vehicles in each condition. Tests found a main effect of expression type, $F1(1,49)= 7.95$, $p< .01$, $F2(1,64)= 8.99$, $p<.005$, indicating that forward saccade lengths were significantly shorter in the metaphor than the simile condition. This result is unexpected, given that the average landing position on simile vehicles is closer to the explanation region (see Table 4D); saccades leaving simile vehicles should be shorter than saccades leaving metaphor vehicles. Therefore, the observed difference is not easily accounted for by low-level factors, and it may indicate greater initial difficulty processing metaphors than similes, as saccades are generally shorter when reading more difficult text as well as among less skilled readers (Rayner, 1998). The following two measures are included to provide interested readers with a complete description of significant results that may help with interpreting the saccade length effect.

Launch site. Table 4D also presents the mean number of characters before the vehicle from which saccades to the first vehicle fixation were launched. Statistical tests returned a main effect of expression type, $F1(1,49)= 10.72$, $p< .05$, $F2(1,64)= 10.82$, $p<.005$, indicating that the average initial saccade into the vehicle region was shorter for similes than metaphors, as would be expected if readers were likely to launch a proportion of their saccades to simile vehicles from the preceding word *like*. Neither familiarity nor aptness effects appeared in this measure ($Fs<2$).

Landing position. Table 4D also presents the mean number of characters into the vehicle that first fixations landed on in each condition. On average, the eyes landed a fraction of a character further into simile vehicles than metaphor vehicles, resulting in a main effect of expression type, $F1(1,49)= 14.96$, $p< .001$, $F2(1,64)= 20.71$, $p<.001$. This would be expected, given the nearer launch site on some proportion of simile trials (i.e., saccades of the same length land in different places if the launch site differs). A main effect of familiarity appeared, $F1(1,49)= 19.14$, $p< .001$, $F2(1,64)= 4.911$, $p<.05$, indicating that the eyes landed further into unfamiliar than familiar vehicles. However, the analysis of covariance indicated that this effect could be accounted for by lexical factors such as word frequency, $F2(1,62)= 8.22$, $p<.01$, and word length, $F2(1,62)= 116.74$, $p<.0001$. A similar analysis that tested for aptness indicated no effect ($F<1$).

Table 4D: Spatial Pattern of First-Pass Fixations for Vehicles

| | Unfamiliar | Familiar |
|---|---|---|
| Forward saccade length (characters) | | |
| Simile | 8.6 | 8.4 |
| Metaphor | 8.1 | 8.1 |
| Launch site (characters before Vehicle) | | |
| Simile | 4.9 | 5.1 |
| Metaphor | 5.4 | 5.5 |
| Landing position (characters into Vehicle) | | |
| Simile | 2.9 | 2.5 |
| Metaphor | 2.5 | 2.3 |

The Vehicle Region: Re-reading Measures

Second-pass times. The mean second-pass times for trials in which participants re-read appear in Table 4A. Statistical tests returned a main effect of expression type, $F1(1,49)= 26.34$, $p< .001$, $F2(1,64)= 17.78$, $p<.001$, and means indicated that participants spent more time re-reading vehicles in metaphors than in similes, irrespective of their familiarity or aptness ($Fs<1$).

Regressions out. Table 4E contains the regression means. Although the overall mean regression rate was low (about 8%), expression type did affect this measure. Readers regressed more often when reading metaphor vehicles (14%) than simile vehicles (6%), $F1(1,49)= 23.01$, $p<.001$, $F2(1,64)= 22.42$, $p<.001$, indicating that metaphors were more difficult to process. Since metaphors cannot be resolved literally—for they are literally false—the incremental process of sentence integration may have been interrupted in a few cases and triggered the eyes to return to an earlier point in the sentence to re-evaluate the phrase. Contrasts between regressions-out from the short vehicle regions and the longer explanation regions indicate that readers were more likely to regress from vehicles than from explanations, $F1(1,49)= 6.44$, $p<.05$, $F2(1,64)= 36.25$, $p<.001$. This suggests that readers were more likely to respond immediately to difficulties with sentence integration than to wait until they reached the explanation region, irrespective of expression type.

Regressions-in. Table 4E also indicates, there was a main effect of expression type, $F1(1,49)= 12.45$, $p<.001$, $F2(1,64)= 12.53$, $p<.001$, indicating that readers returned to the vehicle more often when reading metaphors (nearly 7%) than similes (3%).[1]

Table 4E: Regression Data

| | Unfamiliar | Familiar |
|---|---|---|
| Regressions out (%) from the Vehicle | | |
| Simile | 5 | 7 |
| Metaphor | 14 | 14 |
| Regressions out (%) from the Explanation | | |
| Simile | 5 | 4 |
| Metaphor | 9 | 9 |
| Regressions in (%) to Vehicle from Explanation | | |
| Simile | 3 | 3 |
| Metaphor | 7 | 6 |

The Explanation Region: Initial Processing Measure

First-pass time. These means appear in Table 4F. In the explanation region, there was a significant main effect of familiarity in the subjects but not the items analyses, $F1(1,49)= 15.29$, $p< .001$, $F2(1,64)= 1.31$, $p>.25$, and no effect of expression type appeared ($Fs<1$). Tests for an effect of aptness were not significant ($Fs<1$), nor were tests for an interaction with expression type, $F1(1,49)= 2.8$, $p=.10$, $F2(1,64) <1$.

The Explanation Region: Re-reading Measures

Second-pass time. These means are also presented in Table 4F, and there was a significant main effect of expression type, $F1(1,49)= 14.94$, $p< .001$, $F2(1,64)= 4.69$, p<.05. Skilled readers spent longer re-reading explanations that followed metaphors than those that followed similes.

Regressions-out. Aldo shown in Table 4F, readers regressed from metaphor explanations more often (9%) than simile explanations (4.7%), $F1(1,49)= 18.06$, $p<.001$, $F2(1,64)= 20.17$, $p<.001$. The likelihood of regressions from explanations was comparable to that observed when skill readers process non-figurative sentences (Rayner, 1998).[2] In addition, items analyses that accounted for familiarity and frequency indicated that readers were more likely to regress from the explanations of less apt similes (7%) and metaphors (14%) than from more apt similes (4%) and metaphors (8%), $F2(1,62)= 5.09$, $p<.05$.

Table 4F: Mean Reading Time for the Explanation Region

| | Unfamiliar | Familiar |
|---|---|---|
| First-pass time | | |
| Simile | 1090 | 1173 |
| Metaphor | 1119 | 1179 |
| Second-pass time | | |
| Simile | 1007 | 959 |
| Metaphor | 1075 | 1079 |

## Discussion

In the present study, we used eye tracking to investigate the early, online processes involved in reading similes and metaphors. Skilled readers' eye movements were monitored as they silently read metaphors and similes that contained identical words (with the exception of *like*). Several measures indicated that eye movements recorded during metaphor reading differed from those recorded during simile reading, which suggests that readers engaged at least some distinct processes when reading metaphors. This study yielded two novel findings that, together, provide an online view of early metaphor processing as it unfolds during reading.

First, skilled readers seemed to have more initial difficulty processing metaphor than simile expressions. This early metaphor processing difficulty was reflected in one first-pass measure (the length of the first forward-going saccade in the vehicle region) as well as in re-reading patterns (a higher proportion of regressions and longer re-reading times). Second, an *initial metaphor familiarity effect* was observed in first pass reading time, such that readers spent longer reading vehicles in unfamiliar metaphor expressions than when these same vehicles were presented in the corresponding simile expression. In contrast, readers spent a comparable amount of time reading vehicles in familiar metaphors and similes. Furthermore, whereas vehicles were read faster in familiar than unfamiliar metaphors, we observed similar reading times for vehicles in familiar and unfamiliar similes. Thus, familiarity seems to facilitate the early processing of metaphors but not similes. This result is consistent with the familiarity effect that Blasko and Briihl (1997) found, in that unfamiliar metaphors elicited longer whole sentence reading times than familiar metaphors. The present data demonstrate that the familiarity of figurative language affected reading processes as soon as the vehicle word was identified.

Overall, the eye movement data reveal differences in the early reading patterns of metaphors and similes. Rayner (1998; 2009) notes that shorter saccade amplitudes, higher probability of regressions, and longer re-reading times are indicators of reading difficulty. The present study found a similar data pattern when we compared metaphor and simile reading on several measures. Readers made shorter forward saccades when leaving metaphor vehicles than simile vehicles. This effect could not be accounted for by landing position on the vehicle, as saccades were shorter in the simile condition than the metaphor condition when entering the vehicle region. The import of finding that readers make shorter saccades when leaving metaphor vehicles than simile vehicles is not completely clear. At minimum, these data indicate that the cognitive system differentiates between figurative and literal statements very quickly. A more liberal view of the data might claim it suggests an effect of higher-order comprehension processes on the forward progress of the eyes through the text. In other words, it may be that the eyes slow down in response to processing difficulties. Another indication that readers had more difficulty processing metaphor vehicles is the higher probability of regressions and longer re-reading times for metaphor than simile vehicles. Therefore, multiple eye movement measures indicate that early metaphor processing demands more cognitive resources than early simile processing, which converges with other online studies that suggest that comprehending metaphorical sentences recruits more cognitive resources than does comprehending literal sentences (e.g., Coulson &Van Petten, 2002; Lai, Curran, & Menn, 2009; Tartter, Gomes, Dubrovsky, Molholm, & Stewart, 2002).

The eye movement data hold implications for understanding the early phases of online metaphor processing. Information about the timing of these processes is available from first-pass measures of reading time and the spatial pattern of fixations. Finding familiarity effects on the initial reading time for metaphor vehicles, but not similes suggests that skilled readers typically detected unfamiliar metaphors when the vehicle was first fixated, rather than downstream. Therefore, these data demonstrate that familiarity affects the processing of metaphors within 250 ms of fixating the vehicle. This provides converging evidence that skilled readers quickly integrate words into an ongoing semantic representation as soon as they are identified (Rayner, 1998; Rayner & Duffy, 1986), and extends that quick integration to figurative language processing.

The spatial pattern of fixations provides another indicator of the time course of metaphor processing. Recall that readers' saccades were longer going into metaphor than simile vehicles, but saccades were shorter when leaving metaphor than simile vehicles. This shift in relative saccade amplitude constrains the time window of metaphor detection because saccade amplitude is set when the saccade is programmed (Vergilino-Perez & Beauvillain, 2004). In other words, the amplitude effect would be unlikely to appear unless metaphor detection occurred before the leaving saccade was programmed, which occurs around 120 ms before the end of the fixation (in order to account for eye movement programming time). As the mean reading time for metaphor vehicles was 288 ms, readers should have detected the figurative relation no later than 170 ms into the fixation on the vehicle in order for expression type to affect the forward saccade. Therefore, these data suggest that the cognitive system initiates figurative language processing somewhat earlier than has been suggested by other online studies (e.g., Kazmerski, Blasko, & Dessalegn, 2003; Pynte et al., 1996).

Finally, the present study holds several implications for existing theories of metaphor processing. We note that no one theory was fully able to account for our results (nor did our data completely fulfill the predictions of any theory). Because of the nature of eye movement data, we are necessarily measuring only the early phases of metaphor processing. Therefore, predicted effects that did not appear here may arise in later phases of processing. Also, we recognize that null effects of aptness in several measures can be attributed to the composition of our materials, as we intentionally sought metaphors that were relatively apt. Therefore, further research is needed to provide a true test of whether aptness affects early metaphor processing. As we recognize that "absence of proof is not proof of absence" (William Cowper), the following discussion focuses on the significant effects that did appear in this study.

Our online data produced patterns of means that are consistent with some of the predictions derived from career of metaphor theory, categorization theory, and pragmatic theory. First, finding longer reading times on metaphor vehicles that were unfamiliar than those that were familiar, with no corresponding difference appearing in simile condition, was consistent with both career of metaphor theory and categorization theory. Relatively novel metaphors (e.g., *life is a bottle*) may have caused readers difficulty because a categorical relationship between *life* and *bottle* was not yet stored in memory. When reading similes, however, skilled readers may have interpreted the vehicle in its literal form by comparing the topic with the vehicle, irrespective of its familiarity (Gentner & Bowdle, 2008). In contrast, this metaphor familiarity effect on initial vehicle reading time is not predicted by the classic pragmatic model, which does not make specific predictions for familiarity in metaphor processing.

The second prediction of career of metaphor theory, that novel metaphors are resolved by initiating a comparison process, received less support in this study. If unfamiliar metaphors were processed as similes after an initial difficulty, then the re-

reading times and regression patterns for the simile and unfamiliar metaphor expressions would be similar. Instead, re-reading times and regressions rates were longer for metaphors than similes in both the vehicle and explanation regions, irrespective of familiarity, which suggests that when major interpretation difficulties occurred, the effects spanned the full sentence. These data are consistent with pragmatic theory. The longer re-reading times for explanations following metaphors than explanations that follow similes suggests that metaphor interpretation continues long after the eyes have moved on to new text. Finding longer re-reading times and higher regression rates in metaphor reading suggests that metaphors and similes are processed somewhat differently regardless of aptness or familiarity.

One possible explanation for such differences in our re-reading measures is that metaphors are initially processed by predication—rather than categorization—regardless of their familiarity or aptness level, while similes are initially treated as comparisons also regardless of their familiarity or aptness level. This suggestion might help explain why certain reading-time measurements were not affected by familiarity or aptness, but were instead better predicted by the type of expression read (i.e., metaphor or simile). We say *predication* in the case of metaphors because to assume that *lawyers are sharks* is an actual categorization implies that at some level of representation the two arguments—*lawyers* and *sharks*—belong to the same category. The processing consequence, as suggested by other researchers (Gentner & Bowdle, 2008; Glucksberg, 2008, Glucksberg & Haught, 2006) is that the vehicle is treated differently depending on whether it is read in a metaphor or in a simile. Under this hypothesis, the vehicle in metaphors would predicate a property of the topic, whereas in similes the vehicle would have the same entity status as the topic, thus inviting a literal interpretation. That is, a simile vehicle may be taken to be the entity against which the topic is compared, without predicating its content to the topic. The predication involved in metaphor processing may incur extra processing resources, which is consistent with our finding of shorter forward saccade lengths after reading metaphor vehicles than simile vehicles. While our study does not provide direct evidence for such a semantic difference in vehicles, we assume that some difference contributes to the effects we observed in the vehicle region.

In summary, this study examined metaphor and simile processing by recording eye movements during silent reading. Effects appeared during the initial reading of the vehicle as well as during re-reading of the vehicle and explanation regions. In terms of first-pass effects, we found a familiarity effect on metaphor reading time that did not appear for the simile sentences. An effect of expression type appeared very early in the eye movement record: processing differences between similes and metaphors initially registered as differences in forward saccade amplitude. No effect of aptness appeared in our initial reading measures. Re-reading occurred in a minority of trials, with participants re-reading the metaphors more often and for longer than the similes. These later measures were not affected by familiarity. Thus, differences in eye movements when reading metaphors and similes appear to reflect primarily the different interpretive processes yielded by the two types of expressions, as suggested by the standard pragmatic model (Searle, 1979; Grice, 1989). For example, those familiar with the *Forest Gump* simile, *Life is like a box of chocolates* (and its explanation, *you never know what you are going to get*) may find that the entity *box of chocolates* brings to mind a literal representation of a box of chocolates (and its diverse and mysterious flavors). In contrast, its parallel metaphor form, *Life is a box of chocolates* may take *box of chocolates* to predicate something about life—possibly its diversity, sweetness, and so forth. The explanation brings to the original simile the conditions for the expressed comparison, but it would arguably be disruptive of the established predication. We suggest that the two expressions engender different interpretations—and thus that metaphors may be *like* similes, but that metaphors are *not* similes.

Endnotes

1. A similar pattern held for the initial region of the sentence as well, $F1(1,49)= 28.62$, $p<.001$, $F2(1,64)= 42.51$, $p<.001$. An interaction between expression type and region was also significant $F1(1,49)= 8.06$, $p<.01$, $F2(1,64)= 10.09$, $p<.005$, indicating the higher proportion of regressions into the initial regions of metaphors.
2. Regressions-in were not calculated for the final, explanation, region in the sentence because its position prevents readers from entering it with a regressive saccade.

# Chapter 5: Alzheimer's Disease Patients' Interpretations of Metaphors and Similes

The results found in Chapter 4 were more consistent with the prediction that metaphors would require increased processing. In the discussion chapter, I will address some possible reasons for why this paradigm and moving window could have produced different results. In my opinion, the most important result was the longer saccade lengths found for metaphor vehicles regardless the familiarity level. This result suggests that some process remains unique to metaphor which requires additional cognitive effort. Furthermore, faster reading times for more familiar metaphors, but not similes, is consistent with the prediction that a particular meaning becomes associated with a metaphor vehicle. Note, however, that we did not find evidence suggesting metaphors are understood as similes. Instead, metaphors remained more difficult than similes at all levels of familiarity.

If metaphors do require a unique process that leads to metaphors and similes being interpreted differently, then this process could be diminished in cognitively impaired populations such as Alzheimer's Disease patients who may have diminished cognitive abilities for understanding metaphors. In contrast, if similes, but not metaphors, are understood literally, and do not require the same cognitive steps needed for understanding metaphors, then this population could retain the ability to comprehend similes. This chapter presents a study that tests this hypothesis by examining the interpretation of metaphors and similes in people diagnosed with probable Alzheimer's Disease (AD).

We had three central research questions in this chapter. First, would AD patients demonstrate better interpretations for metaphors or similes? Assuming metaphors require greater cognitive effort than similes, as suggested by the results found in Chapter 4, AD patients could show greater ease interpreting similes. Our second research question was whether apt and familiar metaphors would be easier to comprehend? Chapter 4 had suggested that more familiar metaphors are easier to comprehend, whereas none of the studies in Chapters 3 and 4 had found a correlation between aptness and reading times. It is possible that in a cognitively impaired population, apt metaphors would be easier to comprehend because they reflect more salient properties; an argument revisited in the final chapter. Our third research question was whether individual differences could predict higher metaphor interpretation scores? We compared patients' abilities to interpret metaphors and similes with multiple cognitive abilities. This assessment can help indicate what processes are important for understanding metaphors and similes.

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At Sunrise Retirement Home, Melissa Hindley and Vanessa Manco assisted with the collection of MoCA and MMSE scores. For the rest of the participants, Nancy Azevedo assisted with data collection. Finally, Marco DeCaro served as the second judge in the allocation of interpretation scores for participants. I analyzed the data, and was the lead author who wrote the first draft. Dr. Roberto G. de Almeida contributed to the writing of the manuscript.

# The Importance of Being Apt:

# Metaphor Comprehension in Alzheimer's Disease

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Abstract

Recent studies have found that patients with Alzheimer's Disease (AD) have no difficulty understanding metaphors that are familiar (e.g., *lawyers are sharks;* Amanzio, Geminiani, Leotta, & Cappa, 2008). Studies with healthy subjects, however, have showed that metaphors that are apt—i.e., those metaphors considered to capture well the relationship between a topic (e.g., *music*) and a vehicle (e.g., *medicine*), as in *music is medicine* – are also easy to understand, even when they are unfamiliar (Blasko & Connine, 1994; Jones & Estes, 2006). We presented AD patients (*N*=11) metaphors that were familiar and apt (e.g. *knowledge is power*), more apt than familiar (e.g., *music is medicine*), more familiar than apt (e.g., *cities are jungles*), or neither apt nor familiar (e.g., *anger is heart*). In an interpretation task, AD patients performed worse than elderly controls only in those items considered familiar but not apt. Independent aptness ratings were found to correlate with participants' metaphor interpretation scores. These results suggest that AD patients produce good metaphor interpretations, even for unfamiliar metaphors, when the statements are highly apt.

Metaphors are said to permeate everyday language use—so much so that some authors believe that most, if not all, our linguistic expressions convey some form of metaphorical concept (Lakoff & Johnson, 1980). Thus, it is somewhat surprising that, to date, only a few studies have investigated how people with Alzheimer's Disease (AD) interpret metaphors (e.g., Amanzio, Germianiani, Leotta, & Cappa, 2008; Papagno, 2001, Winner & Gardner, 1977). We report a study on the interpretation of metaphors by AD patients, examining, in particular, which variables—such as aptness and familiarity—might affect how patients understand the relationship between a topic (*x*) and a vehicle (*y*) in metaphors of the form *x is y* (e.g., *music is medicine*).

*Metaphor Interpretation in People living with Alzheimer's Disease*

In one of the first studies examining metaphor interpretation in AD, Winner and Gardner (1977) presented a metaphorical statement (e.g., *heavy heart*) to seven individuals diagnosed with pre-senile dementia and probable AD, and asked them to pick among four pictures one that best matched the statement. Two of the picture-types used are relevant to the present paper: one that matched the figurative meaning of the metaphor (a picture of a man crying), and a second one which displayed the literal form (a person having difficulty walking due to carrying a large red heart). AD patients were found to pick the picture representing the metaphorical meaning as many times as the picture representing the literal meaning (45% and 44% respectively). The results suggested that AD patients can have difficulty interpreting metaphors via their intended meaning as opposed to a possible literal meaning.

One limitation to the study by Winner and Gardner was a lack of information regarding the impairment level of the participants. Consequently, it remained unclear whether metaphor interpretation difficulties were an early-, middle-, or late-stage symptoms of AD. Also, no cognitive or verbal tests were reported that could have checked for possible relationships between these abilities and metaphor interpretation. Papagno (2001) helped answer some of these questions in a longitudinal study, where AD patients were asked to interpret conventional metaphors whose meanings were expected to be very familiar to participants. At first examination, 19 patients out of 39 (49%) showed normal performance in all language tests. Metaphor comprehension was actually found to be the *least* impaired linguistic ability at first examination. When AD patients were retested at a later stage, there was an overall decrease in verbal fluency and metaphor comprehension, yet a large number of participants still had no trouble providing the correct interpretation for various metaphors. These results led Papagno to conclude that language impairment, especially for figurative language, is not an early symptom of AD and may only occur late into the progression of the disease.

While these results suggested that AD patients are efficient at providing the correct interpretation for metaphors, it is important to remember that there are many additional variables that can affect the ease of comprehending metaphors (Giora, 1997, 2003). Winner and Gardner (1977), for example, reported difficulty for half of their metaphorical statements, but it is not clear whether certain factors related to the items themselves made some metaphors more difficult to comprehend than others. Familiarity, for example, is a variable that can make opaque metaphors and idioms much easier to understand. Idioms (*e.g., to buy the farm*) differ from metaphors in that the intended meaning is not derived from the individual lexical items (Gibbs, 1999). The first time a person hears the idiom *John bought the farm* (which in English means that John has died) the listener may be unaware of the associated figurative meaning and construct a literal meaning based on the denotational meaning of the words in the sentence. Once someone is aware of the figurative meaning, however, it is possible that they can simply retrieve that meaning from memory to deduce the correct interpretation of the idiom. The ability to retrieve a salient meaning from memory is also assumed for conventional metaphors, such as stating that *a film is a blockbuster*, or insult metaphors such as *john is a pig,* where there is a strongly associated conventional figurative meaning. Thus, idioms and conventional metaphors are assumed to initiate similar retrieval processes whereby the meaning is possibly retrieved from memory. For less familiar or new metaphors, such as *genes are blueprints* or *deserts are ovens,* an interpretation is possible, but if one has not heard this statement previously, then one must construct a meaning online. The construction of a sentence's meaning is thus assumed to use certain cognitive abilities, but as such abilities are presumably impaired in AD patients, there is an expected difficulty for constructing the meaning of new metaphors.

Previous studies (Winner & Gardner, 1977; Papagno, 2001) did not report the familiarity level of their items, or simply reported that all of the items were familiar, leaving open the possibility that AD patients had no difficulty interpreting metaphors—as in the case of Papagno's (2001) study—because all the metaphors were familiar. Amanzio, Germiniani, Leotta, and Cappa (2008) tested this familiarity hypothesis by asking participants diagnosed with AD to interpret conventional metaphors as well as novel metaphors. It was predicted that AD patients would show good interpretation for conventional metaphors, whose meanings are very well known, because patients would simply need to retrieve the associated figurative meaning from memory. In contrast, AD patients would have more difficulty with novel metaphors, whose meaning must be constructed. To further support this retrieval-construction hypothesis as the main cause of poor interpretation performance, participants' ability to interpret conventional and new metaphors was compared to their interpretations for idioms, which are also assumed to simply rely on memory retrieval.

The results supported the predictions. In addition to conventional metaphors, AD patients also showed good interpretation (similar to controls) for idioms. Novel metaphors were the only category where AD patients displayed a relative impairment compared to controls. AD patients' performance in verbal and visual reasoning tasks were also the best predictors of metaphor interpretation scores; as well as scores on executive function tasks. Amanzio et al. (2008) took these results to support their argument that the main obstacle faced by individuals when interpreting novel metaphors is the need to construct a meaning that relies on impaired executive functions: "if the central executive is damaged, the ability to create a new resemblance, required to understand a novel metaphor, may be defective" (p.7). When the process was retrieval rather than construction, AD patients performed as well as controls.

## Present Study

The studies examining metaphor interpretation to date have found two main results. First, metaphor interpretation is relatively preserved in AD patients, especially during early and moderate progression stages of the illness. Second, predicting whether people diagnosed with AD will have difficulty interpreting a metaphor must also take into account features related to metaphor itself, such as the item's familiarity level. The goal of the present study was to further investigate metaphor interpretation in AD, in particular, whether the familiarity effect found for metaphors (Amanzio et al., 2008) might actually reflect an aptness effect.

Aptness is defined as how well a statement expresses its figurative meaning (Chiappe & Kennedy, 2000). Past studies have found that unfamiliar statements can be comprehended easily when apt (e.g., Blasko & Connine, 1993), leading some researchers to argue that aptness could possibly be a more important variable for metaphor comprehension than familiarity (e.g., Chiappe, Kennedy, & Chiappe, 2003; Glucksberg, 2003, 2008; Glucksberg & Haught, 2006b). However, determining whether aptness or familiarity is a more important variable has been difficult because several studies report large positive correlations between aptness and familiarity ratings (Jones & Estes, 2006). These results cast doubts on studies that have relied on subjective ratings of familiarity from participants because these ratings may have actually reflected the items' aptness level (Jones & Estes, 2005). For example, the novel metaphors employed by Amanzio et al. (2008) were those that had received an aptness score above 3.5 (on a 7-point scale). However, aptness ratings were never collected for the conventional metaphors, as their only requirement was a familiarity rating above 3.5 (on a 7-point scale), leaving open the possibility that these items were also significantly more apt, as well as more familiar. Therefore, AD patients may have provided more correct interpretations for conventional metaphors in the study by Amanzio et al. (2008) because those items' aptness levels were also significantly higher.

In order to control for the effects of aptness and familiarity in the present study, we created item groups based on familiarity ratings, as was done by Amanzio et al. (2008), but also categorized items based on aptness ratings to ultimately create four item groups. Based on the results found in previous studies, we expected our aptness and familiarity ratings would be highly correlated; thus, we did not expect to find items that would be familiar, but not apt, or vice-versa. Instead, we created groups that were either high or low on both variables, and item groups that were relatively higher in either familiarity or aptness. By comparing the scores for items high on both aptness and familiarity to a group of items that is relatively lower on one of these variables, we can examine whether a decrease in aptness or familiarity would have a greater impact on metaphor interpretation scores. For example, if aptness is a more important variable than familiarity, then AD patients should demonstrate good interpretation scores, compared to elderly controls, for those items that are considered apt, despite being rated less familiar. In contrast, if familiarity is more important than aptness, then statements considered more familiar than apt should be well interpreted despite the lower aptness level.

We also decided to run correlations between the different ratings and the metaphor interpretation scores to determine whether an item's aptness or familiarity rating was a better predictor of metaphor interpretation scores. One concern, however, was that our familiarity ratings might reflect aptness rather than general prevalence. When Thibodeau and Durgin (2011) collected aptness ratings, familiarity ratings, and an objective measure of familiarity (Google production counts), they found the familiarity ratings were positively correlated with aptness ratings, but not with Google production totals. In contrast, aptness ratings were correlated positively with both familiarity ratings and Google production totals. Therefore, the familiarity ratings seemed to reflect the items' aptness rather than their general frequency. More specifically, people seem to rate a statement as familiar when they also consider the statement apt, but less familiar if it is not considered apt. To control for the possibility that our familiarity ratings would reflect the item's aptness rather than its general frequency, we also collected Google Internet frequency counts as an objective measure of the item's familiarity level. By running correlations between the ratings and scores collected, we could check whether our familiarity ratings were more related to the item's aptness level, or reflective of the item's general frequency in the real world. Furthermore, this procedure allowed us to examine Google counts as a predictor of AD patients' metaphor interpretation scores.

*Additional Cognitive and Linguistic Variables*

In addition to examining how different levels of familiarity and aptness impact metaphor interpretation, we examined whether a participant's ability to infer a relationship between two objects would predict their ability to interpret metaphors. Constructing the meaning of a metaphor often involves understanding the relationship between two terms (e.g., *time-money*), hereafter called the topic (*time*) and the vehicle (*money*). The topic is typically mentioned first and is the subject of the statement. For example, *time is money* is a statement about *time*. The vehicle, *money*, is understood to predicate something about *time*, and the listener is required to understand what properties about *time* are being made salient by *money* when someone states the metaphor *time is money*. Therefore, we were especially interested in scores obtained in the similarity judgments task from the WAIS-IV. In this task, participants are asked what is similar between two objects (e.g., *horse-tiger*, *food-gasoline*) with different scores allocated based on the quality of the answer provided. This score is a good measure of a participant's ability to create a new resemblance between two objects. Participants' with higher similarity judgment scores were predicted to also produce better metaphor interpretations.

An additional cognitive test was the digit span task (a sub-test of the WAIS-IV) as a measure of a person's working memory capacity. Constructing the meaning of a metaphor presumably requires being able to hold both the topic and vehicle terms in working memory, and participants with an extremely short digit span might not be able to hold the topic term once the vehicle term itself is processed. Consequently, participants found to have a very limited digit span would also be expected to display poor metaphor interpretation abilities.

The final question of interest was whether participants would have an easier time interpreting a metaphor such as *the mall is a zoo* if it was presented as a simile (*the mall is like a zoo*). Career of Metaphor theory (Bowdle & Gentner, 2005; Gentner & Bowdle, 2008) argues that the comprehension of a novel metaphor involves a comparison process between the terms within a metaphor (e.g., *teachers-sculptors*). More specifically, to understand a new metaphor such as *teachers are sculptors*, the metaphor must be understood as a simile (a metaphorical comparison) via the form *teachers are like sculptors*. Relying on Career of Metaphor theory, we can recast the difficulties faced by people diagnosed with AD when trying to interpret a new metaphor. When a novel expression is presented as a metaphor (e.g., *hair is a rainbow*), the hearer is invited to access a stored metaphorical sense that does not in fact exist, making comprehension initially difficult. By hypothesis, the comprehension process must be restarted, but with the metaphor understood as a simile (*hair is like a rainbow*). AD patients, however, have central executive impairments (Amaznio et al., 2008; Baddeley, Della Sala, Gray, Papagno, & Spinnler, 1997), and these impairments could hinder their ability to mentally convert a metaphor into a simile. To test the hypothesis that the main obstacle faced by AD patients when interpreting a new metaphor is converting that form into a simile, the present study asked participants to interpret both metaphors (e.g., *deserts are ovens*) and comparable similes (*deserts are like ovens*). If AD patients have difficulty interpreting new metaphors because they are unable to mentally convert such statements into similes, then they should produce better interpretations when metaphors are presented as similes.

## Method

### *Participants*

Eleven patients with probable AD (age range 55-84, $M = 74$), diagnosed with mild-to-moderate cognitive impairment were recruited with assistance from the Alzheimer's Society of Montreal, as well as Sunrise of Beaconsfield, a retirement community in Beaconsfield, Quebec. Participants were referred to us as individuals who had been given a diagnosis of AD according to the criteria specified by the National Institute of Neurological and Communicative Disorders and Stroke-Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA; McKhann et al., 1984), and had no other diagnosed dementia or pathology. The study was fully explained to each participant and they gave written informed consent to participate in the study. Furthermore, MoCAs and MMSEs were administered to all AD patients, with the requirement that all participants demonstrate an ability to understand and follow commands, and have an MMSE score of at least 16. All participants passed this criteria, and were able to comply with the requirements of cognitive testing.

Ten elderly controls (age range 63-86) were recruited from either Sunrise of Beaconsfield, were caregivers of the participants diagnosed with AD, or recruited from the general public. For elderly controls, only the MoCA was administered, with the requirement that all elderly controls obtain a score above 25. All participants (AD patients and elderly controls) were native speakers of English, or had a fluent command of English ($n = 2$) having both attended university in English and worked professionally their entire lives in English. Therefore, these participants' English proficiency level was considered sufficient for the present study. All participants had a minimum education level of 6 years. Demographic and neuropsychology data for the two participant groups are presented in Table 5A:

Table 5A: Demographic and Neuropsychology Data for AD Patients and Controls

| Participant<br>C=Control<br>P=Patient | Age | Education (years) | MoCA | MMSE | Digit Span | Similarity Judgment Score |
|---|---|---|---|---|---|---|
| P | 84 | 17 | 19 | 26 | 10 | 13 |
| P | 68 | 14 | 21 | 29 | 14 | 29 |
| P | 82 | 15 | 26 | 29 | 14 | 29 |
| P | 55 | 15 | 14 | 16 | 8 | 21 |
| P | 71 | 14 | 16 | 23 | 10 | 23 |
| P | 83 | 17 | 22 | 30 | 12 | 21 |
| P | 84 | 21 | 17 | 26 | 13 | 11 |
| P | 76 | 13 | 14 | 21 | 13 | 0 |
| P | 86 | 11 | 16 | 18 | 13 | 19 |
| P | 81 | 11 | 13 | 24 | 8 | 23 |
| P | 71 | 12 | 04 | 16 | 8 | 0 |
| Average Patient Score Mean (SD) | 76.45 (9.44) | 14.54 (2.98) | 16.55 (5.73) | 23.45 (5.15) | 10.64 (2.66) | 17.18 (10.13) |
| | | | | | | |
| C | 63 | 16 | 28 | | 7 | 23 |
| C | 76 | 15 | 26 | | 12 | 27 |
| C | 65 | 16 | 29 | | 13 | 25 |
| C | 73 | 13 | 28 | | 10 | 26 |
| C | 65 | 15 | 27 | | 12 | 29 |
| C | 86 | 15 | 29 | | 11 | 28 |
| C | 75 | 15 | 29 | | 13 | 25 |
| C | 69 | 15 | 28 | | 12 | 28 |
| C | 70 | 08 | 28 | | 11 | 26 |
| C | 81 | 14 | 28 | | 10 | 25 |
| Average Control Score Mean (SD) | 72.3 (7.41) | 14.2 (2.35) | 28 (.94) | | 11.6 (1.07) | 26.2 (1.81) |

*Aptness and Familiarity Ratings*

Nineteen elderly controls (age range 60-83; 10 females), all native speakers of English, were recruited from the general public and given monetary compensation for completing a rating task. These participants did not take part in the subsequent metaphor interpretation task. They were presented with two booklets each containing the same 82 metaphors (e.g., *trees are umbrellas*), with a scale ranging from 1 to 7 displayed beneath each metaphor. In one booklet, participants were asked to rate how apt they found each metaphor, where 1 was labeled *not apt,* 4 as *moderately apt*, and 7 as *very apt.* Aptness was explained as how valid they found each statement. *Politics is a jungle* was given as an example of an apt statement, while *politics is a beach* was given as an example of a less apt statement. For the second booklet, participants were asked to rate how familiar they found each statement. Familiarity was explained as how often they had read or heard this statement in the past, with 1 labeled as *not familiar,* 4 as *moderately familiar,* and 7 as *very familiar*. Although the two booklets contained the same items, the items were sorted differently in each booklet.

*Google Production Frequencies*

When Thibodeau and Durgin (2011) collected Internet production counts of metaphors, they obtained the raw search totals produced by the Google search engine. This method, however, overlooks possible confounds that can inflate the counts for certain items. For example, if a metaphor statement is the title of a particular song or book, such as *wisdom is an ocean*, there will be a large number of commercial sites selling books that have that particular item listed, and all of those sites would be included in Google's search total. Another problem with Google search totals is that they include the same expression being used repeatedly within a website. Thus, if someone were to use a particular metaphor 100 times on a given website, those 100 counts would be included in Google search totals. Indeed, clicking on the various links for different expressions, a web searcher will discover that the production totals are often dominated by a few websites. Therefore, while an expression may be reported as appearing a million times, there are not necessarily a million separate websites listing that expression.

We decided instead to collect Internet production totals using the more conservative method designed by Roncero, Kennedy, and Smyth (2006). This search method also uses Google search count totals, but has specific guidelines for whether a metaphor production can be included in the count total. These guidelines are designed to ensure that count totals reflect only spontaneous uses of metaphor; thus, repetitions of the same book title or song title, or when people quote the same sentence repeatedly within a website, are counted only once within the total. This method is more laborious than simply collecting raw Google search totals, as it requires inspecting each production against the guidelines. For that reason, the method is generally applied to only the first 30 productions found for each expression, as most metaphors typically do not reach this number of productions.

*Selection of Metaphors*

Prior to selecting the metaphors, we decided that only 20 metaphors would be presented to AD patients because a larger number of items would conceivably cause fatigue. We also decided that we would create four item groups based on the familiarity and aptness ratings: apt and familiar; more apt than familiar; more familiar than apt; neither apt nor familiar. Eight items were chosen and categorized as familiar and apt because the aptness and familiarity rating for each item was greater than 5. To produce the list of items considered neither familiar nor apt, the five items with the lowest averaged familiarity and aptness rating were chosen. Items defined as more familiar than apt, were those that had a familiarity rating greater than 5, but an aptness rating between 3 and 5. The reverse was true for items considered more apt than familiar: an aptness rating greater than 5, but a familiarity rating between 3-5. Three metaphors were selected and defined as familiar, but less apt, while four metaphors were selected and defined as more apt than familiar. There were no items that had either an aptness or familiarity rating greater than 5 combined with a rating lower than 3 on the other scale.

*Interpretation Norms*

In order to collect interpretation norms—i.e., to obtain the most common interpretation for each expression—a booklet containing the 20 selected metaphors was created. This booklet was presented to another 20 healthy elderly controls (age range 60-84; 14 females). These participants did not partake in the ratings norms nor did they serve as controls in the interpretation task. In this booklet, each metaphor was presented within a sentence that asked participants to state which property was being expressed about the topic (e.g., *Education is a stairway because education is…*). Each sentence was presented with a line placed underneath where participants could write their answers. This method helped facilitate answers that would reflect a particular property or adjective, and simplify determining the salient interpretation.

The different properties expressed by each participant were collapsed under a single property label when they were considered synonyms. For example, *ruthless* and *aggressive* for *lawyers are sharks* were grouped together under the property label *ruthless*, while *valuable* and *important* for *time is money* were both categorized under the property label *important*. Participants also sometimes wrote elaborate sentences that had the similar meaning of a particular property label, without necessarily using a synonym of that particular property label. For example, one participant wrote *lawyers are sharks because lawyers are* ***out to get you!*** This sentence was categorized as expressing the property label *ruthless* for *lawyers are sharks* because the sentence conveys the belief that lawyers are *ruthless*.

Two judges were involved in coding the responses. The first judge created the set of property labels that reflected the properties written for each metaphor. The same judge, together with a second judge, then verified the accuracy of the property labels based on the participants' responses. The two judges resolved any discrepancy. A particular property label was considered a salient property for that metaphor if it had been stated by a minimum of three participants. Those property labels that had been mentioned by at least two participants were considered less salient properties. Finally, properties stated only once were considered non-salient properties. A list of the metaphors sorted by item group, accompanied by their salient and less salient properties, is presented in Table 5B of the Appendix.

*Materials*

Two booklets were created for the metaphor interpretation task. One booklet listed half the original metaphors as similes, while the other half of the metaphors were rewritten as similes (e.g., *cities are like jungles* rather than *cities are jungles*). In the second booklet, the topic-vehicle pairs were in the same order, but those items that were metaphors in booklet 1 were written as similes in booklet 2, and vice-versa for those items that had been written as similes in booklet 1. Each participant would be read either booklet 1 or 2, and then asked to provide their interpretation of each sentence.

Both the similarity judgments task and forward digit span task from the WAIS-IV were used. In the similarity judgments task, participants are asked what is similar between two objects (e.g., *horse-tiger*, *food-gasoline*) with different scores allocated based on the quality of the answer provided. The task itself can continue for a maximum of 18 object pairs, but is discontinued after three consecutive scores of 0. In the digit span task, participants are asked to repeat back a series of digits in increasing order. Two trials of each length, ranging from two to eight, are administered, with a score of one given for each correct trial. The task continues until a participant has two consecutive incorrect trials.

Both the MoCA and MMSE provide a general measure of a participant's cognitive capacity. The MoCA is a 30-point test that assesses several cognitive domains (e.g., perception, recall, abstraction). The test typically takes roughly 10 minutes to complete, has been validated in the setting of mild cognitive impairment (Nasreddine et al., 2005), and is frequently used in clinical settings when assessing the level of cognitive impairment present in a patient. Similar to the MoCA, the MMSE (Folstein et al., 1975) is also a 30-point questionnaire that is frequently used in clinical settings to access the degree of cognitive impairment in patients. Like the MoCA, the MMSE assesses different cognitive domains including recall, language, and complex commands. The MoCA, however, is typically better at capturing milder forms of cognitive impairment, whereas the MMSE is more suited for individuals with more severe conditions.

*Procedure*

A researcher first administered the MoCA and MMSE, if the participant was a person diagnosed with AD, or only the MOCA if the participant was an elderly control, followed by the digit span task and the similarity judgments task. Afterwards, each participant was read either the first sentence of booklet 1 or 2, and asked to provide their interpretation of the sentence. For example, the first time the metaphor *music is medicine* was read, the researcher asked the participant "*What is someone trying to say when he or she says that music is medicine?"* If the participant couldn't provide an answer, or failed to mention a particular property, the researcher then asked the participant *"if someone were to say that music is medicine, what would they be trying to say about music?"* This method helped prompt answers that reflected a particular property that could then be matched to the interpretation norms. After an interpretation had been given, or if the participant was still unable to provide an adequate answer, the next sentence was read, and so on, for all 20 items. Participants were given unlimited time to provide an interpretation, and told it was fine if they could not think of an interpretation. Most sessions lasted approximately 30 minutes.

## Results

Two items were dropped from analysis because participants (AD patients and elderly controls) repeatedly expressed difficulty providing an interpretation. Several participants expressed understanding the statement *life is a journey* but stated it was difficult to put into words a particular meaning. When interpretations were provided, most participants provided elaborate discussions about life in general rather than providing a particular property or adjective. The second item that caused confusion and was consequently dropped from analysis was *genes are blueprints*. For most participants, there was an initial period where the participant had to be told that the sentence meant genes "as in DNA" as opposed to *blue jeans.* Several participants (especially AD patients) expressed not understanding the concept *DNA.* Therefore, the metaphor interpretation scores for *life is (like) a journey*, an apt and familiar metaphor, and *genes are (like) blueprints,* a more apt than familiar metaphor, were both not included in any of the analyses involving metaphor interpretation scores.

### *Metaphor Interpretation Scores*

When allocating points for the interpretation provided, we used a procedure similar to that used by Papagno (2001), who assigned a score of 2 or 1 for correct answers. We gave a score of 2 if the interpretation mentioned a property found to be salient in the metaphor interpretation norms, and a score of 1 if a less-salient property was mentioned. Interpretations that included statements or properties not identical to the category label, but expressing the same meaning, were also recorded as correct responses (i.e., a match for either a salient or non-salient property). If the interpretation expressed a meaning completely different from the salient or less salient properties, or if the participant was unable to provide an answer, a score of 0 was given. One researcher first allocated a set of scores, while a second judge, who was blind to whether the interpretations came from a control or person diagnosed with AD, also provided scores as a reliability check. The interclass correlation was .85 ($p < .001$). Because this reliability score was high, the scores from the first researcher were used in all subsequent analyses.

We first present a comparison of the general means for metaphor and simile interpretation scores for both AD patients and elderly controls to check for an effect of linguistic structure. AD patients had a mean interpretation score of 1.28 for metaphor sentences (*SD = .48*), and 1.33 for simile sentences (*SD* = .18). The difference was not significant ($t$ (10) = -.30, $p$ = .77, $r$ = .09). For elderly controls, the mean interpretation score for metaphors was 1.48 (*SD* = .18), and 1.54 for similes (*SD* = .37), and found to not be significantly different ($t$ (9) = -.44, $p$ = .67, $r$ =-0.15). Because these comparisons were not significantly different, we averaged participants' metaphor and simile interpretation scores and used these scores in all further analyses.

The averaged figurative interpretation scores for AD patients was 1.31 (*SD* = .25), and 1.51 for elderly controls (*SD* = .17); this difference was significant by subjects and items ($t_1$ (19) = -2.14, $p < .05$, $r$ = .44; $t_2$ (17) = -2.17, $p < .05$, $r$ = .47). To isolate the source of this significant difference, we next compared participants' scores within the different item groups (i.e., apt and familiar; more apt than familiar; more familiar than apt; neither apt nor familiar). We did not run items analyses for these comparisons due to the decreased power from the reduced sample size in each category ($n < 8$). For apt and familiar items, AD patients had a mean interpretation score of 1.58 (*SD = .29*), while elderly controls had a mean interpretation score of 1.67 (*SD* = .19). These scores were not significantly different (*t* (19) = -.80, $p = .33$, $r = .18$). This result is consistent with Amanzio et al. (2008), who also failed to find significant interpretation differences between AD patients and controls for familiar items, which were also presumably apt.

The distributions for some of the three other item groups were found to be not normally distributed; thus, we used non-parametric tests in their analysis and report the Kolmogorov-Smirnov statistic. For more apt than familiar items, the mean interpretation scores was 1.42 (*SD* = .56, *mdn* = 1.33; *D* (11) = .25, $p < .05$) for AD patients, and 1.87 for elderly controls (*SD* = .23, *mdn* = 2.00, *D* (11) = .38, $p < .05$). The difference for this item group was marginally significantly (*U* = 28.50, $p = .06$, $r = -.45$). For the familiar, but less apt items, the mean interpretation scores for AD patients was 1.48 (*SD* = .56, *mdn* = 1.33), and for elderly controls was 1.93 (*SD* = .21, *mdn* = 2.00, *D* (11) = .53, $p < .05$). This comparison was significantly different (*U* = 25.00, $p < .05$, $r = -.53$). Finally, for the items that were neither apt nor familiar, AD patients had a mean interpretation score 0.74 (*SD* =.20, *mdn* = .80, *D* (11) = .29, $p < .05$), while elderly controls had a mean interpretation score of 0.82 (*SD* = .36, *mdn* = .80). This comparison was not significantly different (*U* = 46.50, $p = .56$, $r = -.14$). Therefore, the only item group where AD patients did significantly worse than elderly controls was for items categorized as more familiar than apt. These results are summarized and presented in Table 5C:

Table 5C: Interpretation Scores

*Mean Interpretation Scores (and SDs) for AD Patients and Elderly Controls*

| Item Group | AD Patients | Elderly Controls |
|---|---|---|
| Apt and Familiar | 1.58 (.29) | 1.67 (.19) |
| More Familiar than Apt* | 1.48 (.56) | 1.93 (.21) |
| More Apt than Familiar | 1.42 (.56) | 1.87 (.23) |
| Neither Familiar nor Apt | 0.74 (.20) | 0.82 (.36) |
| Average Score Across Item Groups* | 1.31 (.25) | 1.51 (.17) |

*$p < .05$

*Items Analysis*

For the metaphors used in the interpretation task, the mean familiarity rating was 4.76 (*SD* = 1.76), and the mean aptness rating was 4.75 (*SD* = 1.63). As predicted, the two sets of ratings were positively correlated ($r = .85$, $p < .05$). The average number of Internet production totals was 13.44 (*SD* = 13.86). When we then ran correlations with the metaphor interpretation task scores from AD patients, there was no significant correlation with the Internet production totals ($r = .33$, $p < .01$), but significant correlations were found with the aptness ratings ($r = .72$, $p < .05$), as well as with the familiarity ratings (*r* = .67, *p* < .05). We also found the aptness ratings correlated positively with the Google production totals (*r* =.54, *p* < .05), but the correlation between the production totals and familiarity ratings was not significant (*r* = .43, *p* = .07). This finding replicates the correlation pattern found by Thibodeau and Durgin (2011), and suggests that our familiarity ratings were affected by the item's aptness level.

*Participant Variables*

For the digit span task, the group means were comparable. AD patients had a mean digit span score of 10.64 (*SD* = 2.66), while controls had a mean digit span score of 11.45 (*SD* = 1.13), and this difference was not significant (*t* (13.50) = -.94, *p* = .36; Levene's test for equality of variances was significant (*F* (1,20) = 15.43, *p* < .01)). AD patients had an average similarity judgment score of 17.18 (*SD* = 10.12), while controls had an average similarity judgment score of 25.64 (*SD* = 2.54). This difference was significant (*t* (11.25) = -.269, *p* < .05, Levene's test for equality of variances was significant, *F* (1,20) = 13.35, *p* < .01).

We next ran correlations with the metaphor interpretation scores for AD patients to examine whether digit span or similarity judgments would be a better predictor of metaphor interpretation scores. Only similarity judgments were found to correlate with metaphor interpretation scores (*r* = .66, *p* < .05).

## Discussion

Elderly controls and AD patients were asked to provide interpretations for different metaphors and similes to examine whether elderly controls would provide better interpretations than AD patients, and whether interpretation scores would be better for simile statements. Interpretation scores for metaphors and similes were similar, but elderly controls were found to provide better interpretations than AD patients. Therefore, the comprehension problem faced by AD patients does not appear to be an inability to convert a metaphor statement into a comparison, as may have been predicted by Career of Metaphor theory (Bowdle & Gentner, 2008).

We further examined the interpretation score difference between AD patients and elderly controls by comparing scores for different item groups (apt and familiar, more apt than familiar, more familiar than apt, and neither apt nor familiar). Similar to Amanzio et al. (2008), AD patients and elderly controls provided equally accurate interpretations for items considered highly familiar, but only when the items were also highly apt. For items rated familiar and apt, as well as items rated more apt than familiar, interpretation scores for AD patients and elderly controls were comparable. In contrast, for items rated more familiar than apt, AD patients provided worse interpretations than elderly controls. Therefore, these results suggest that aptness is an important variable for good metaphor interpretation in AD patients, and could even be a more important variable than familiarity, because AD patients only provided worse interpretations when the items' aptness rating level decreased. When the familiarity level of the items decreased, but the aptness level remained constant (i.e., the items rated more apt than familiar), AD patients still provided interpretations that were as good as those provided by elderly controls.

Further support that aptness has a greater impact than familiarity for metaphor interpretation comes from the correlation results. The familiarity ratings did not significantly correlate with the collected Internet production counts, while aptness ratings correlated with both the familiarity ratings and the production counts. It is understandable that more apt statements would also be more frequent, but it is unclear why familiarity ratings, as a measure of general prevalence, would not correlate with the same production totals. This correlation pattern matches that found by Thibodeau and Durgin (2011), where the researchers had argued their familiarity ratings were more reflective of the item's aptness level because familiarity ratings significantly correlated with aptness ratings, but not the collected frequency totals from Google. Therefore, it could also be argued that the familiarity ratings in our study were not a valid measure of general prevalence because the Internet frequency totals correlated with aptness ratings, but not familiarity ratings, suggesting that our familiarity ratings were contaminated by the items' aptness level.

Adopting collected Internet production totals in the present study as a more accurate measure of familiarity, we still found no significant correlation with metaphor interpretation scores. Therefore, neither the collected familiarity ratings nor Internet frequency counts were a significant predictor of AD patients' metaphor interpretation scores. The only linguistic variable that predicted accurate metaphor interpretation was a metaphor's aptness level, which suggests that an item's aptness level is a more important variable than familiarity for metaphor comprehension in people diagnosed with AD.

It should also be noted that while our items did have high familiarity ratings, they were not the kind of conventional metaphors used in previous studies where the meaning could be obtained from the dictionary (e.g., Amanzio et al., 2008; Papagno, 2001, Winner & Gardner, 1977). Similar to the unfamiliar metaphors used by Amanzio, we determined the salient and less salient properties for our expressions by collecting interpretation norms. Amanzio found worse interpretation for such items in AD patients compared to elderly controls, whereas we found interpretation was equal to controls as long as the statement had a high aptness level.

*Beyond Aptness: The ability to infer a relationship between two objects*

The fourth best-interpreted metaphor by AD patients was *deserts are ovens*, where the salient property was *hot*; and a majority of AD patients correctly interpreted *hair is a rainbow* as meaning that hair is *colourful*. However, neither *deserts are ovens* nor *hair is a rainbow* had been rated apt or familiar, and both had low Internet production totals ($n < 5$). Therefore, metaphors may also be easily interpreted, despite not being very apt, when the abstraction level demanded is low, and the salient intended properties are concrete and sensory in nature (Aisenman, 1999). For example it is easier to determine the relationship between carrots and broccoli (both vegetables) than between music and tides (both have rhythms). Therefore, in the same way that different metaphors require constructing meanings that may reflect different abstraction levels, individuals who can best deal with these higher levels of abstractions may also have an easier time interpreting metaphors. Metaphors requiring more basic level abstractions, such as *deserts are ovens*, would be more easily interpreted because the salient property is concrete and sensory. In contrast, metaphors such as *families are fortresses* would be more difficult to interpret because the metaphor does not make reference to a specific literal property of fortresses (e.g., *made of stone*), rather it refers to more abstract concepts of *security* and *protection*.

Supporting the above argument, we found a significant positive correlation between AD patients' ability to infer a similarity between two concepts, as measured by similarity judgments scores, and their metaphor interpretation scores. Therefore, being able to infer the similarity between two concepts (e.g., *music-tides*) was a good predictor of whether AD patients could infer the intended relationship between the topic and vehicle terms in a metaphor (e.g., *music is medicine*). Amanzio et al. (2008) discussed how executive functions in AD patients could affect metaphor interpretation: they argued that the cognitive deficit impacted the patient's ability to create a new relationship between two objects. The positive correlation found between similarity judgments scores and metaphor interpretation scores supports the above argument.

Amanzio et al. (2008) also examined several additional cognitive tests (e.g., theory of mind tasks), which were ultimately found not to correlate with metaphor interpretation scores. In the present study, we similarly found that metaphors interpretation scores were *not* related to scores on tests of cognitive function such as the digit span task, or MoCA and MMSE scores. Therefore, the ability to infer a semantic relationship between two concepts seems somewhat cocooned from other cognitive abilities. In the present study, for example, participants' ability to infer a relationship was not related to either their general level of impairment or their working memory digit spans. Rather, AD patients' ability to correctly interpret a metaphor was best related to their ability to infer what property was shared between two presented objects.

*Conclusion*

Amanzio et al. (2008) had argued that unfamiliar metaphors cause interpretation difficulties for people diagnosed with AD because they require meaning construction rather than retrieval. Numerous metaphors, however, can be distinguished in terms of additional factors such as aptness, and whether the intended salient properties are concrete or abstract. These variables ultimately combine with participant variables, such as the capacity to infer the relationship between two objects, to determine whether one can construct the intended meaning of a metaphor. The present study shows that metaphor interpretation in mild to moderate AD patients is spared, even when metaphors are not familiar, if the statements are nevertheless apt.

# Chapter 6: Final Discussion

This thesis examined the comprehension of metaphor and simile expressions. Chapter 2 included two experiments investigating how metaphor and simile expressions are interpreted and used. Chapter 3 employed a self-paced reading paradigm to investigate how metaphor and simile expressions are processed, while Chapter 4 reported results from one experiment employing eye-tracking to examine how metaphors and similes are processed. Finally, Chapter 5 examined Alzheimer's Disease Patients' ability to interpret metaphor. Central questions included whether metaphor and simile expressions are processed and interpreted similarly, and whether aptness or conventionality are predictors of processing time and ease. Career of Metaphor theory (Bowdle & Gentner, 2005; Gentner & Bowdle, 2008) and Categorization theory (Glucksberg, 2008) make different predictions as to how these questions might be answered.

Career of Metaphor theory predicts that metaphors and similes can initiate distinct forms of processing, but produce similar interpretations, and that vehicle conventionality is the most important variable for metaphor comprehension. In contrast, Categorization theory predicts that metaphors and similes initiate similar forms of processing, convey different meanings, and that aptness is the most important variable for metaphor comprehension. In general, findings were inconsistent with both Categorization theory and Career of Metaphor theory. Metaphors and similes in Experiments 1 and 2 of Chapter 2 were found to produce occasionally different interpretations, while in Experiment 1 of Chapter 4, metaphor vehicles were read as fast as simile vehicles, but saccade lengths were shorter, which suggests metaphor vehicles were more difficult to process than simile vehicles. Finally, aptness was not a significant predictor of reading times.

*Pragmatic Variables*

Regarding the prediction that pragmatic variables such as aptness and conventionality would be significant predictors of reading times, we did not find support for Categorization theory's prediction that higher aptness ratings would correlate with faster reading times nor the prediction from Career of Metaphor theory that vehicles with higher conventionality ratings would have faster reading times were supported. These results differ from previous studies which found significant correlations between reading times and the collected aptness or conventionality ratings (e.g., Jones & Estes, 2006), but those studies relied on omnibus reading times (i.e., the time needed to read a full sentence) rather than restricting reading times to the vehicle region as done in Chapters 3 and 4. Therefore, it is possible that aptness or conventionality ratings do not predict faster reading times when those reading times are isolated to the vehicle term.

Reading times in studies such as Jones and Estes (2006) also measured the time when participants felt they understood the sentence; therefore, it is possible that these reading times were probably affected by non-linguistic variables, in addition to the time needed for lexical access. Consequently, omnibus reading times could be more susceptible to non-linguistic variables such as participants' perceived level of aptness for a given expression rather than the contribution of particular constituents (e.g., the vehicle term) to the sentence interpretation. This argument is supported by the finding in Chapter 3 that, despite *not* finding a significant correlation between aptness ratings and vehicle reading times, aptness ratings *were* able to predict to what extent participants agreed with a given sentence.

Regarding conventionality, it should be noted that these ratings were collected in a manner similar to past studies: we asked participants to what extent a vehicle term was associated with a particular meaning. More specifically, participants were asked how common it was to use a vehicle term such as *drug* in a sentence such as *x is a drug* to convey the notion that *x* is addictive. However, this method for determining conventionality may actually be the reason why conventionality has often been found to be a worse predictor than aptness. First, the concept of conventionality, as defined by Career of Metaphor theory, assumes that vehicle terms will be associated with a single property (e.g., *addiction*). However, as found in Chapter 2 and other studies (e.g., Chiappe and Kennedy, 2000; Thibodeau & Durgin, 2011), vehicles terms often bring to mind several properties rather than one. Therefore, notions of conventionality may be better suited for those instances where vehicles are associated with a single figurative property (e.g., *addiction* for the vehicle term *drug*, and *colourful* for *rainbow*).

The comprehension of a given topic-vehicle pair is also presumably affected by the topic term within that pair. For example, although *drug* may have the conventional figurative meaning of *addiction,* pairing this vehicle with a topic that is not considered addictive (e.g., *broccoli is a drug*) would cause more problems than pairing this vehicle with an object that is considered addictive (e.g., *chocolate is a drug*). Recall, for example, that Jones and Estes (2006) found faster reading times for more apt topic-vehicle pairs (e.g., *a goalie is a spider*) than less apt topic-vehicle pairs (*e.g., a fisherman is a spider*). In this comparison, the meaning of *being able to catch things* needed for interpretation was a more salient property of *goalies* than *fishermen*. Aptness ratings are able to capture such differences between pairs because participants are asked to rate to what extent a given vehicle term captures salient properties for a given topic term. In contrast, conventionality ratings are virtually “blind” to topic effects because participants are asked to consider only the vehicle term when providing their ratings. Therefore, it is perhaps not surprising that conventionality ratings are often a worse predictor than aptness ratings or are found to be null predictors because they fail to take into account the variability caused by the topic terms.

*Comprehension Times*

We found inconsistent results in Chapters 3 and 4. In Chapter 3, we compared metaphor and simile processing using a self-paced reading moving-window paradigm (hereafter referred to as SPR). Experiment 1 of Chapter 3 compared metaphors and similes in a declarative affirmative sentence (e.g., *lawyers are (like) sharks*), while Experiment 2 of Chapter 3 compared metaphors and similes in a negative sentence (e.g., *lawyers are not (like) sharks*). In both of these SPR experiments, vehicles had longer reading times when they were read in similes. By contrast, first-pass reading times in Chapter 4 (eye-tracking) for metaphor and simile vehicles were comparable—although total reading times were longer for metaphors-- and saccade length was shorter for metaphors. Therefore, while the results from Chapter 3 suggest simile vehicles take longer to comprehend, Chapter 4 suggests metaphors are more difficult. .

Why would the moving-window SPR paradigm yield longer reading times for simile vehicles? Witzel, Witzel, and Forster (2012) argue that SPR can often produce longer reading times than eye-tracking studies because SPR is less natural. Unlike eye-tracking, where participants are asked to simply read the sentences in a normal manner, participants in SPR must push a button to read the subsequent section, and this requirement could be unreflective of natural reading patterns. For example, participants may choose to press the button once they recognize a word, rather than fully integrating that word into their interpretation of the given sentence. This type of strategy would make comprehension appear faster than reality. On the other extreme, a participant may be extra cautious and take extra time to ensure they have fully understood and incorporated a word into their current interpretation of the sentence before reading the subsequent section. In these circumstances, reading times will appear longer than the time actually needed for normal reading. Finally, a participant could also adopt a rhythmic button-pressing pattern, simply tapping the button as fast as possible for each section, and fully interpreting the sentence only when all sections have been read. Witzel et al. note that SPR experiments often yield results for sentence sections subsequent to the word of interest. These "holdover" effects, as described by Witzel et al., suggest that reading times for a particular section could ″not reflect the processing associated with the words on which they are recorded" (p.108). More specifically, because participants might press the button before fully reading and integrating the given presented section, they subsequently do such processing after having already moved past the target section. In the present thesis, for example, the SPR experiment of Chapter 3 found longer vehicles and explanation times for similes, whereas explanation reading times in the eye-tracking experiment were similar. The longer reading times for simile explanations in our SPR study could indicate participants were still processing the vehicle section that had been previously read. Similarly, it is possible that longer reading times for simile vehicles in our SPR experiments reflect a "spill-over" effect (Rayner, 2009) from having read a longer verbal segment in similes (*is like*) than in metaphors (*is)*.

Because reading times in SPR are susceptible to "holdover effects" in addition to general reading processes, a better comparison between Chapter 3 and 4 could be reading times in the SPR study and *total times* in the eye-tracking study. Total time in eye tracking refers to the time participants spent first reading a particular section (e.g., the vehicle), as well as the time spent reading that section after participants have regressed back to that section from a later point in the sentence. Therefore, total time may reflect both general reading processes, as well as possible "holdover" effects that occur post-regression. In this manner, total times as opposed to first-pass times in eye-tracking are more analogous to SPR times. Interestingly, the eye-tracking total time results are actually opposite to that found in the SPR study: metaphor vehicles had longer total time than simile vehicles. It should be noted, however, that the explanations presented in the eye-tracking study were not the same explanations presented in the self-paced reading study. It is possible that participants found explanations in the eye-tracking study more acceptable for similes than metaphors, which led to a larger number of regressions for metaphors. In contrast, reading the explanation region in the SPR study would not have increased metaphor vehicle time because participants were unable to return to the metaphor vehicle for further processing.

Several additional differences also exist between the studies presented in Chapters 3 and 4: the set of topic-vehicle pairs was different; items were not categorized via familiarity in the SPR study; and the metaphor and simile items in the eye-tracking study were the minority sentence types among a large number of literal sentences (as part of another "filler" experiment), whereas participants in the SPR study saw only metaphors and similes. Therefore, further investigation is needed to fully understand why these two studies produced different results as there are multiple potential causes. A study that compares SPR and eye tracking results using the same metaphors and similes would be informative.

Perhaps the greatest advantage provided by eye tracking is that certain results (e.g., the location and duration of eye fixations) are relatively immune to non-linguistic variables. Unlike button presses which can be delayed, eye fixations and scan paths are relatively instant measures of reading behaviour (Rayner, 2009). For example, while first-pass times for metaphor and simile vehicles were similar, shorter saccade lengths were found for metaphor vehicles. Therefore, time may not be the best predictor of comprehension difficulty, nor whether processing a metaphor requires more stages than processing a simile, because this result indicates that equal processing times for different expressions is not necessarily an indication that the processes used to understand each expression were the same. This result is especially problematic for Categorization theory, as Gluckberg (2003, 2008) has previously argued that finding no significant time differences for metaphors and comparable literal statements supports the hypothesis that metaphors and literal statements do not trigger distinct comprehension processes. The eye-tracking results, however, demonstrate that equal time involvement is not necessarily evidence that the cognitive processes used for metaphors and similes is the same. In other words, the absence of evidence (null time differences) is not the evidence of absence (no distinct comprehension strategies for metaphors and similes).

De Almeida, Manouiliidou, Roncero, and Levin (2011), for example, have noted that comparable reading times could reflect figurative processing occurring faster and more efficiently, but not necessarily rely on the same process. This view of metaphor processing is similar to Ortony's (1979) interactionist theory, whereby contextual support rather than literality itself determines ease of processing. When a context can make either a literal or figurative interpretation readily available, than both sentence types should have comparable reading times (as found by Ortony, Schallert, Reynolds, & Antos, 1978, and described in the opening chapter). Unlike Ortony et al., however, de Almeida et al. assume an initial bias towards a literal interpretation because figurative meanings must be derived from initial literal interpretations. The results found in Chapter 4 support de Almeida et al.'s argument. Although vehicle first-pass times were similar, the vehicles appear to have been processed differently. Saccade lengths were shorter for metaphor vehicles and indicates metaphor vehicles took more effort (Rayner, 1998).

Similar results to those found in Chapter 4 come from researchers who use ERP studies to study the processing of metaphors. As noted in the Introduction, these researchers have found results suggesting that the cognitive processes for metaphors and comparable literal statements can be different, despite requiring equal amounts of processing time. Recall that Pynte et al. (1996) reported finding no time differences (wave onset was similar), which suggested that the processing of metaphors was not more delayed compared to literal statements; although a larger negative amplitude was found for metaphor vehicles around 400 ms (i.e., an N400 effect), suggesting metaphors had not been processed like the literal statements. One possible explanation for Pynte et al.'s results, and those found in Chapter 4, is that literal properties were readily activated when vehicles were first read, and the larger magnitudes and shorter saccade lengths found for metaphor vehicles reflects a need to activate figurative properties that are not initially activated. In this manner, the key difference between metaphors and literal statements would not be the type of processing that is triggered (*a qualitative difference*), but rather the amount of activation that properties first receive (*a quantitative difference*). In other words, N400 effects are larger when the appropriate interpretation is not the one initially activated by the words alone. Supporting this hypothesis, when Pynte et al. (1996) presented metaphors after supportive contexts, thus making a particular interpretation easier by priming those properties needed to interpret the statement as a metaphor, N400 amplitudes for metaphors were reduced.

Currently, I am developing an ERP study to investigate the processing of metaphors and similes. No ERP study to date has compared the processing of metaphors and similes; however, a study that found larger amplitudes for metaphors or similes, in comparison to more "literal" statements (e.g., *love is (like) a drug* versus *penicillin is a drug*) would inform us regarding which statement type is more difficult to process. For example, if similes are less difficult to process than metaphors, then we would expect metaphor vehicles to produce larger amplitudes around 400 ms; whereas larger amplitudes for simile vehicles would suggest that similes are more cognitively effortful. Finally, if the waveforms of metaphors and similes were similar, it would provide further support for the hypothesis that processes used for metaphors and similes are not inherently distinct, but may be more difficult to execute for a certain expression type. The planned study would also follow metaphors and similes with related properties to examine what properties are activated by metaphors and similes, and check whether the metaphor or simile context does make certain properties activate faster. For example, as soon will be discussed, if metaphors have the effect of making connotative properties more salient, then greater priming should be observed for connotative properties when they follow metaphors (i.e., smaller N400 amplitudes) than when they follow similes.

*The Interpretation of Metaphors and Similes*

When we asked participants in Chapter 5 to provide the meaning of metaphor and simile expressions, both elderly controls and people diagnosed with Alzheimer's Disease (AD) provided similar interpretations. For example, participants commonly interpreted both *music is medicine* and *music is like medicine* as meaning that *music* is *soothing*. Therefore, presenting a metaphor or simile did not produce a more literal or figurative answer; instead, interpretations were similar regardless the linguistic structure.

Similar results were found in Chapter 2. When participants were asked to produce property lists. The lists produced for metaphor and similes often included the same properties. Furthermore, participants rated metaphor and simile properties as reflecting comparable levels of connotativeness. Therefore, unlike the results found by Glucksberg and Haught (2006a), these results do not support the dual-reference hypothesis because the properties written for similes were not more literal, and were often the same properties as the ones written for metaphors. One significant difference we did observe for metaphor-simile property lists was a larger number of salient properties for metaphors. Specifically, certain properties seemed more accessible to participants when they read topic-vehicle pairs within a metaphor. Therefore, rather than arguing that metaphors and similes activate *different* properties, it is perhaps more accurate to state that metaphors and similes initially activate a similar set of properties, but certain properties receive more activation, thus making them more accessible for interpretation. For the remainder of this thesis, I will put forward the proposal that vehicles activate a set of salient properties.

The results reported in Chapter 2 support the argument that words activate related salient properties rather than a set of properties that is strictly literal or figurative. For example, compare the property lists given by participants for *bulldozer* when read in isolation versus within a metaphor. While we can observe certain salient properties related to so-called literal concept of *bulldozer* in Table 2C (e.g., *big*, *hardhats*, *construction*), we can also observe salient properties that might be considered more figurative/connotative of *bulldozer* such as *destructive* and *dangerous*. Crucially, when participants then interpreted the metaphor *salesmen are bulldozers*, the most frequent and salient property was *destructive*, which had also been written for the vehicle in isolation. This result is also quite common; for example, participants interpreted *health is a glass* as reflecting properties such as *breakable*—which was also written for *glass* in isolation. Interpreting *clouds* as *fluffy* may also seem inconsistent with the factual information related to clouds (i.e., clouds are not literally fluffy), but when participants listed properties related to *clouds*, *fluffy* was the most frequent and salient property. Therefore, the results are not consistent with the prediction words should activate literal or figurative properties only. Instead, consistent with the graded saliency hypothesis (Giora, 1997), a vehicle within a metaphor appears to activate related salient properties.

*Summary*

As previously mentioned, the results from the present series of experiments pose difficulty for both Categorization theory and Career of Metaphor theory. Against Career of Metaphor theory, conventionality ratings were not found to be significant predictors of reading times, and the interpretations for metaphors and similes were found to be distinct, with metaphors appearing to increase the activation levels of more connotative properties. Against Categorization theory, the results suggested that processing metaphors and similes is not completely analogous. Glucksberg (2008) predicts comprehension times to be similar when the statements are familiar, yet saccade lengths were shorter for metaphor vehicles in Chapter 4. Also, while interpretation differences between metaphors and similes were found, these differences are subtle, and do not support the hypothesis that a "literal shark" is activated in similes, but a "figurative shark" is activated in metaphors. In other words, the semantic difference appears to be relative rather than absolute. Therefore, because the results were not fully supportive for either of the main theories investigated in this thesis, it is worth examining whether a different framework could be adopted and allow a better understanding of the results found.

## A New Framework

The question to be answered in this new framework is how someone understands a metaphor such as *music is medicine*, and how understanding this metaphor is different from both understanding an equivalent simile (*music is like medicine*) and sentences such as *penicillin is medicine*. In the Introduction, I discussed theories of metaphor as being distinguishable by two stages of comprehension: an access stage where lexical access occurs based on the given word, followed by an interpretation stage. Similarly, I will discuss the proposed framework in terms of these stages, while also detailing key terms such as *meaning* and *properties*, and how the proposed framework is both similar and different to past theories discussed.

Access Stage

Theories typically discuss two sources of information during reading: the word and the context. In the proposed framework for comprehending a metaphor such as *music is medicine*, we will focus the discussion on what occurs when a person reaches the vehicle (i.e., *medicine*). The context in this case would be the preceding words in the sentence (i.e., *music is*). Theories of language comprehension agree that reading a word will activate a "meaning", but what specifically is *meaning*? What *meaning* do words activate? Presumably, it can be agreed that reading the word *cat* will activate the meaning CAT, but this answer merely forces a second question: what is the meaning of CAT? In the proposed framework, a meaning is defined as an index to a set of properties. Thus, reading the word *cat* activates a set of CAT properties. For most words, this activation is predicted to be relatively straight-forward, except for words where distinct meanings actually have distinct references in the world (e.g., homonyms). For example, the word *bank* can refer to the institution or the location beside a river; thus, it could be considered to have at least two meanings. In these situations, context would aide in selecting the correct meaning for the given context (Duffy, Morris, & Rayner, 1998). Note, however, that selecting a particular meaning entails selecting a particular set of properties that exist in one referent, but is absent in the other. For example, the properties generally associated with a *pitcher* in baseball (e.g., being a person) are quite different from those associated with *pitcher* the container (e.g., holds fluid). Thus, the different meanings activated reflect the different properties that have been activated. However, these cases are seen more as the "exception" than the "rule." Words such as *cat* and *bottle*, which are generally not considered homonyms and have only one referent, are predicted to activate one set of properties whenever lexical access occurs. Later, we will discuss how context could possibly affect this access stage.

Stating that a word such as *cat* activates a set of properties further forces a definition of which properties are activated. One possible answer is that CAT activates a set of literal properties. My hesitation with this answer, however, is that there is no clear definition of what a literal meaning entails. Consider the statement *John is a cold person*. Is this statement literal or metaphor? Rumelhart (1993) argues there are actually *three* possibilities: (1) Not literally true because John is not actually cold, and the word *cold* is being used metaphorically; (2) Literally true because the sense of *cold* activated is being unemotional, and in that sense, John is literally cold; (3) Neither literal nor metaphorical, the use of *cold* as unemotional was originally metaphorical, but has become conventional, such that *cold* now includes the sense of unemotional. Glucskberg similarly agrees that it can be difficult to determine whether a particular representation is literal or figurative, and that its classification as literal or figurative can change over time:

> with repeated encounters with a metaphor vehicle such as spider, it becomes polysemous to the extent that its meaning can be modulated in context in the same way that any other word meaning can be modulated in context—for example, by processes of pragmatic narrowing or broadening. At what point might ad hoc concepts lose their ad hoc status and become lexically encoded? To our knowledge, there are no clear criteria for distinguishing between ad hoc concepts and lexically encoded ones. Similarly, we have no clear criteria for distinguishing between metaphorical and literal uses of concepts, other than the distinction between linguistic and extra-linguistic meaning. As Carston put it, 'The use is a literal one if the logical/definitional properties of the linguistic encoding are preserved; it is nonliteral if they are not' (2002, p. 340). To identify any given instance of language use as literal or non-literal therefore requires identifying the logical/definitional properties of the lexical concepts employed. It is difficult enough to identify such properties at any specific point in a word's (or a metaphor's) career. Tracking changes in such properties over time would seem a hopeless task. Perhaps the literal/non-literal distinction should continue to be

drawn as a convenient fiction while we devote our energies to discovering the processes that people use to understand language use in context. (Glucksberg & Haught, 2006a, p. 377).

Therefore, although it can be difficult to distinguish meanings/senses as figurative or literal, Glucksberg argues that this "fiction" should be maintained while pursuing a better understanding of the processing mechanics. However, the maintenance of a literal-figurative distinction has perhaps actually been disadvantageous to our understanding of how metaphor is processed and interpreted. In the Introduction, it was noted that determining whether a sentence out of context (e.g., *My chiropractor is a magician*) should be interpreted literally or figuratively is rather difficult (Rumelhart, 1979). Similarly, results increasingly suggest that reading a given word or sentence can activate multiple properties, both literal and figurative, followed by an interpretation that is based on the properties activated.

When someone says *my chiropractor is a magician* in the "figurative" manner, for example, we attribute certain properties to the *chiropractor* (e.g., being very good at his profession), but different properties in the "literal" interpretation (e.g., actually performing a magic show as a *magician* would do). In this manner, the only difference between a literal and figurative interpretation would be the properties being attributed. Therefore, I disagree with Glucksberg that a literal-figurative distinction should be maintained, and similarly, disagree with the dual-reference hypothesis according to which there are two *sharks* within the lexicon (i.e., a literal one and a figurative one). Instead, I propose that it is more parsimonious to argue that that words activate multiple salient properties, and an interpretation is based on these properties. This proposal is consistent with the Giora's (2003) hypothesis that when words activate a given meaning, it entails activating a set of *salient* properties, which are a a reflection of *frequency,* *prototypicality, familiarity,* and *conventionality*. In this manner, *salient properties* can be seen as a reflection of personal experience, stereotype, be highly cultural, and potentially different between two individuals.

Consider the metaphor *lawyers are sharks*, which is repeatedly considered apt by participants and well understood even by patients with Alzheimer's Disease. The aptness of this statement seems unrelated to any "literal notion" as lawyers are not necessarily mean individuals and more typically people who strive to be proficient at their job, while attacks from sharks are relatively infrequent compared to other events (e.g., car accidents). Nevertheless, people generally consider *lawyers are sharks* to be an apt metaphor because properties such as *ruthlessness* and *viciousness* have become strongly associated with both lawyers and sharks (perhaps due to certain tv shows like *Boston Legal* and *Shark Week*). In other words, these properties have become salient properties for *lawyer* and *shark*.

It should be noted that none of the studies in the present thesis directly measured for saliency, but the pragmatic variables examined are indirectly related to saliency. When participants were asked to rate conventionality, for example, they rated how strongly certain properties (e.g., *addiction*) were associated with particular vehicle terms (e.g., *shark*). These ratings can be seen as a measure of saliency where participants are asked to to what degree a certain property is *salient* for that vehicle term. Similarly, the definition of aptness itself includes the notion of saliency: the extent to which the vehicle captures salient aspects of the topic. Thus, when people report that *lawyers are sharks* is an apt metaphor, they are reporting that the words *lawyers* and *sharks* activate similar salient properties.

The results found by Blasko and Connine (1993) can also be discussed in terms of saliency. In their study, priming for “literal” and “figurative” properties was similar for metaphors rated high for aptness and familiarity. Glucksberg (2003) has interpreted these results as the figurative meaning being activated whenever an apt and familiar metaphor is read. Instead, I would argue that the properties after metaphors that demonstrate priming do so not because they are figurative, but rather because these properties are salient for these apt and familiar metaphors. In other words, familiarity with a certain metaphor makes related properties more salient to the extent that properties which would be considered "literal" or "figurative" will both demonstrate priming due to their high levels of saliency. Similarly, in the case of apt metaphors, certain properties demonstrate priming because they are being activated by both the topic and the vehicle.

The Role of Context

Based on the saliency results obtained in Chapter 2, the explanation results found in Chapter 3, and the shorter saccade lengths found in Chapter 4, reading a vehicle within a categorical frame (*X is Y)* rather than a comparative frame (*X is like Y*) appears to affect which initially activated properties will receive extra attention. These distinct frames could have context effects. De Almeida et al. (2010), for example, have argued that the different structures of metaphors and similes impact how a vehicle is interpreted. More specifically, because metaphors have a predicative structure (*X is Y*), they are proposed to work like an algorithm (BE (e (<e,t>)), which is driven by the form of the sentence, and in this manner, metaphors can signal that a given interpretation should include more connotative, rather than denotative, properties:

> Our analysis relies on understanding that the univocal *be* projects an argument structure that specifies different semantic types for its internal and external arguments. The basic form is that of predication in which *e*, an entity (referent) is taken to be the topic to which the predicative type (<e,t>) applies (see Partee, 1986). It is possible that the arguments in BE (e <e,t>)) are subject to type-shifting operations-- e.g., shifting the internal argument from a basic entity type to a predicate (p. 186).

In contrast, in the case of similes, de Almeida et al. argue that the comparative structure causes the vehicle term to be treated as entity and makes more denotative properties receive greater attention:

> Our proposal for similes of the form *x is like y* (*lawyers are like sharks*) . . . the predicate *be-like* type shifts the internal argument for the purposes of comparison between two arguments of the same type (p. 186).

Therefore, consistent with arguments outlined by Glucksberg and Haught (2006), de Almeida et al. assume that a vehicle term is treated differently depending on whether a vehicle is read within a metaphor or simile: "It is because they have different structures that they yield different interpretations" (p.186). Metaphors can be seen as providing a context where connotative properties become more salient (because they are primed by the predicative frame).

The above prediction is consistent with the results found in Chapter 2 where certain properties appeared to become more salient when the word was read within a metaphor, as well as the results from Chapter 3, where explanations containing denotative properties were read faster after similes. Note, however, that these results could also be interpreted as consistent with Categorization theory’s claim that vehicles activate a literal representation in similes, but a figurative representation in metaphors. The initial activation difference would then cause priming effects, such that explanations with figurative properties are read faster after metaphors, while explanations with literal properties are read faster after similes. The problem with this interpretation of the results, as previously discussed, is needing to define certain properties as literal or figurative, and the related problems that such definitions entail. I propose instead that the distinction is connotative-denotative rather than literal-figurative, and that the same salient properties are initially activated whenever a word is read. The *X is Y* structure, however, has the effect of increasing the activation level of connotative properties.

Additional support also comes from the saccade length results found in Chapter 4. Metaphor vehicles were found to have shorter saccade lengths, which suggested the metaphor vehicles required additional processing compared to when they were read in a simile. Recall also the results found by Pynte et al. (1996), where larger amplitudes were found for metaphor vehicles, but this effect disappeared when the metaphors were placed after supportive contexts. It is possible the N400 effects found for metaphors in isolation reflects the need to give additional activation to certain connotative properties. When these statements are presented after a context that primes these same properties, however, then the additional activation needed for these properties is diminished. A future eye-tracking study could also compare the metaphor and simile sentences used in Chapter 4 in isolation and when proceeded after supportive contexts (similar to the study by Oronty et al. (1982)). I would predict shorter saccade lengths for metaphor vehicles when sentences are read out of context, but similar saccade lengths when these sentences are presented after contexts that prime a vehicle's connotative properties.

The difference between denotative and connotative properties being proposed is similar to the divide proposed between abstract and concrete nouns (Aisenman, 1999). Denotative properties refer to the physical manifestation of an object. In other words, the property is available to the senses and there is an obvious physical referent. In contrast, connotative properties would be ideas associated with that concept, with no obvious physical referent. For example, participants in Chapter 2 when answering the connotativeness quiz were required to respond that *rectangular* was a denotative property of painting, but *artistic* was a connotative property. The word *rectangular* refers to the physical make-up of a painting, whereas *artistic* refers our general opinion of paintings (i.e., that paintings are artistic productions), and has no specific referent. For example, if people were asked to demonstrate something *rectangular*, they would presumably present objects of similar shape. In contrast, asking someone to present something *artistic* could produce not only a wide array of objects of varying shape, but people may even disagree on whether a particular object is *artistic*. Therefore, we can use the physical realm and the presence of a referent available to the senses to distinguish connotative and denotative properties. Thus, properties can be ranked for connotativeness, as was done in Chapter 2, based on how much they reflect concrete observable aspects of a concept. In contrast, it seems more difficult to determine whether *artistic* should be considered a literal or figurative property of *painting*, as previously discussed, and noted by Rumelhart (1993). For this reason, the denotative-connotative distinction is preferred to a literal-figurative difference.

Post-Lexical Access: Interpretation Stage

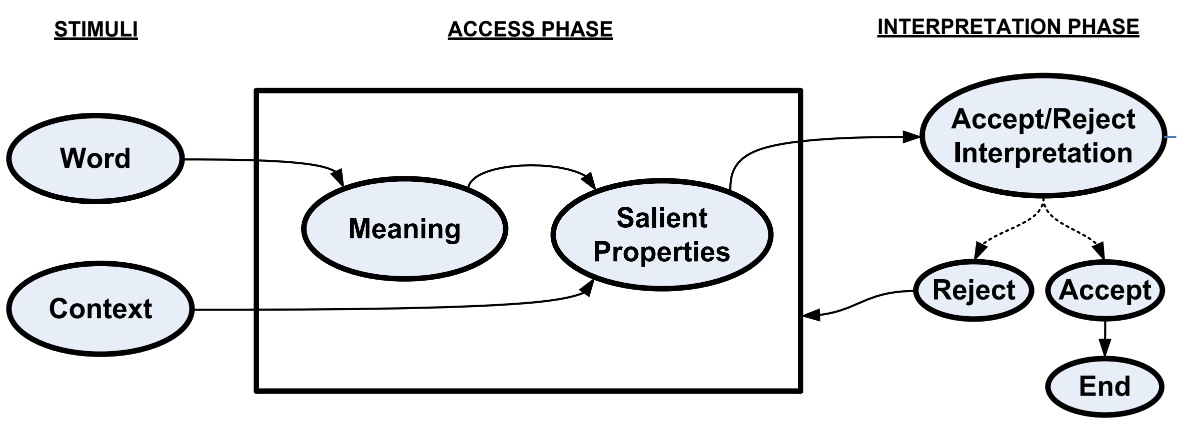
Although the distinct semantic frames of metaphors and similes can cause certain properties to receive increased activation, the initial set of properties for comparable metaphors and similes will initially be the same because the vehicles are the same. Therefore, in both cases, salient properties associated with the vehicle will be activated. For example, whether a person reads *lawyers are sharks* or *lawyers are like sharks*, when a word *shark* is first read, associated salient properties will also be activated. In the case of metaphors, however, certain connotative properties could receive greater activation, hence increasing their saliency for interpretation.

These activated properties are then used to infer the correct interpretation, with more salient properties being used to determine the appropriate interpretation of the sentence. Therefore, reading *shark* within a metaphor or simile would activate salient associated properties such as *dangerous*, as well as other possibly less salient properties (e.g., *sharp*), and people ultimately select which properties are most relevant for interpretation with a bias towards more salient properties. In other words, a set of possible interpretations is derived from the salient properties activated, and a person then infers which of these interpretations is most appropriate given the context and prior knowledge (Giora, 1997, 2003). In this manner, someone hearing the sentence *My chiropractor is a magician* would know whether the word *magician* referred to the chiropractor's second job or skill level. Similarly, if for a certain individual *dangerous* is a salient property of *shark*, then they would probably interpret the metaphor *lawyers are sharks* as meaning that lawyers are dangerous because the predicative frame makes *dangerous* a more salient property than *fish*. In contrast, when a word lacks salient associated connotative properties, then reading a metaphor such as *lawyers are gerbils* can be difficult because the connotative property needed for interpreting the metaphor is not a salient property of the vehicle.

In summary, replacing the notion of literal meaning with the framework that words activate salient properties allows us to better understand the results found within this thesis, as well as those found in previous studies by other researchers. First, a set of salient associated properties is initially activated when a vehicle is a read within a metaphor or simile, but the structure has the effect of making connotative properties more salient for metaphors, and denotative properties more salient for similes. These different activation levels for the activated properties can then cause metaphors to evoke interpretations that seem more figurative. The advantage of this framework is the elimination of issues related to whether meaning is initially literal or figurative, or whether context alone is sufficient for determining the correct interpretation. Instead, both the words within a sentence and the context itself are predicted to affect the salient properties that are activated. People then deduce from that set of salient properties the appropriate interpretation for a given sentence.

Ultimately, the framework presented within this thesis is perhaps most similar to two notable theories of metaphor: the Standard Pragmatic theory of metaphor (Searle, 1979) and Davidson's (1979) view of metaphor comprehension. Similar to Searle, I am arguing that a vehicle will activate a particular interpretation which is then considered within the present context and ultimately accepted or rejected. The key difference is the assumption that the initial meaning is *salient* (more specially, a set of salient properties) rather than a literal meaning. Once these salient properties are activated, however, I agree that comprehension can begin to proceed in the open-ended manner described by Davidson. From the set of salient properties activated, an interpretation is obtained. Unlike Davidson, however, I argue that this open-ended procedure has one key "rule": properties with the highest level of activation are considered first. When words are typically read in isolation, the properties that will receive the highest level of activation are those properties that can be considered *salient*. This result is especially true for apt metaphors where both the topic and vehicle will activate a similar set of salient properties. Furthermore, context and intra-lexical priming can increase the activation levels of certain vehicle properties, increasing the likelihood that an interpretation will be based on these properties. For example, when someone hears the metaphor *music is medicine*, both the topic and the vehicle will activate the salient property *soothing*, and in turn people will report their interpretation of the metaphor as meaning *music is soothing.* Figure 6 summarizes the proposed framework:

Figure 6: Proposed Framework for Metaphor Comprehension




The proposed framework differs in key ways from Categorization theory (Glucksberg, 2008) and Career of Metaphor theory (Gentner & Bowdle, 2008) theory. Within Categorization theory, I disagree with the dual-reference hypothesis, and instead argue that the same set of salient properties is activated whenever a particular vehicle is read. Within a categorical frame (i.e., *X is Y)*, connotative properties can received increased attention, but the same properties are initially activated when the vehicle is read within a metaphor or a simile. Similarly, the proposed framework diverges from Career of Metaphor's premise that topic-vehicle pairs (e.g., *music is medicine*) involve structure-mapping to select a particular property which is implied to be true of the topic. Rather, I view lexical access as exhaustive rather than selective. There is not one single property that is activated, but rather a large number of salient properties are activated whenever a vehicle is read. These properties, consistent with Giora (2003), can be ranked in terms of saliency, such that when these terms are read in isolation, more salient properties would be activated before less salient properties. However, the proposed framework differs from Giora's hypothesis by predicting that context (i.e., the semantic frame used to mention a vehicle) can affect the activation level of related salient properties. More specifically, context can increase the activation levels of less salient properties when such properties are connotative. In contrast, Giora argues that context is unable to increase the activation levels of less salient properties during lexical access. For example, when someone is asked to interpret the metaphor *music is medicine*, multiple salient properties are activated by both *music* and *medicine*, including the property *soothing*, which received more activation than other related properties.

## Conclusion

I put forward the argument that the results obtained in the present thesis suggest that lexical meaning may be neither literal nor figurative, and instead represent the activation of salient properties. Consistent with direct theories of metaphor processing and past researchers (e.g., Gibbs, 1999; Glucksberg, 2003; Giora, 1997), it is possible that the brain does not process, store, nor interpret language as literal or figurative when processing and interpreting sentences like metaphors. In other words, labelling a particular interpretation as literal or figurative is probably a separate cognitive process where we assess the sentence's merits based on our own knowledge of the world; and an interpretation, or set of interpretations, is probably produced without even a consideration for whether the sentence is figurative. Interpretations are based on salient activated properties which bias how a given sentence should be understood.

Therefore, the results obtained in this thesis add weight to the argument that the brain uses similar processes for both literal and figurative language, but only because there is no actual literal-figurative distinction, there is only salient properties. Moving forward, adopting the assumption that metaphor is not unique, there could perhaps be a greater push towards examining whether certain theories of language that do not reference metaphor could be extended to include metaphor. The Underspecification model (Frisson & Pickering, 2001), for example, originated as a theory for explaining lexical ambiguity which was later expanded to metaphor and other forms of figurative language (e.g., metonymy). Therefore, the next push in metaphor research should perhaps not be "new" theories of metaphor, or refinement of current "figurative language" theories, but rather an examination of how current theories regarding literal language could be expanded to include metaphor.

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# Appendices

## Table 2A:

## Collected Ratings

Legend

MetFam = Average Metaphor Familiairity Rating

SimFam = Average Simile Familiarity Ratings

MetCon = Average Metaphor Conventionality Rating

SimCon = Average Simile Conventionality Rating

MetEnt = Average Metaphor Entropy Rating

SimEnt = Average Simile Entropy Rating

MetApt = Average Metaphor Aptness Rating

SimApt = Average Simile Aptness Rating

| Topic-Vehicle Pair | MetFam | SimFam | MetCon | SimCon | MetEnt | SimEnt | MetApt | SimApt |
|---|---|---|---|---|---|---|---|---|
| alcohol-crutch | 5.20 | 4.16 | 7.95 | 8.00 | 4.86 | 4.93 | 7.35 | 6.83 |
| anger-fire | 4.75 | 7.68 | 7.15 | 8.80 | 4.44 | 4.30 | 8.48 | 7.87 |
| anger-heart | 1.20 | 1.40 | 4.75 | 7.56 | 4.91 | 4.56 | 1.91 | 2.04 |
| beauty-passport | 4.47 | 2.60 | 6.70 | 7.08 | 4.86 | 5.52 | 7.13 | 5.39 |
| bible-sword | 3.55 | 2.76 | 8.65 | 9.08 | 4.76 | 4.14 | 5.61 | 4.87 |
| billboards-warts | 1.05 | 1.12 | 7.00 | 8.52 | 4.20 | 5.21 | 4.04 | 4.48 |
| christ-door | 2.80 | 2.16 | 6.40 | 8.40 | 4.46 | 4.54 | 3.65 | 5.96 |
| christians-salt | 2.45 | 1.24 | 3.35 | 3.20 | 4.95 | 4.59 | 1.65 | 2.57 |
| cigarettes-time bombs | 4.10 | 6.20 | 8.25 | 9.00 | 4.04 | 4.46 | 9.13 | 6.39 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| cities-jungles | 6.60 | 8.04 | 3.85 | 5.12 | 4.65 | 5.12 | 8.61 | 8.61 |
| clouds-cotton | 5.95 | 8.24 | 8.70 | 9.60 | 3.10 | 2.89 | 5.22 | 6.74 |
| debt-disease | 5.05 | 6.36 | 8.45 | 9.28 | 5.41 | 5.06 | 6.30 | 5.14 |
| deserts-ovens | 4.75 | 4.40 | 9.15 | 8.92 | 3.57 | 4.06 | 6.26 | 6.30 |
| desks-junkyards | 2.10 | 3.20 | 8.20 | 8.60 | 3.98 | 4.02 | 4.65 | 3.74 |
| dreams-water | 2.60 | 1.76 | 5.30 | 8.48 | 5.01 | 4.92 | 3.65 | 4.09 |
| education-stairway | 5.90 | 6.84 | 7.40 | 8.56 | 5.01 | 4.86 | 8.96 | 7.65 |
| exams-hurdles | 6.10 | 6.16 | 7.00 | 7.56 | 4.68 | 4.76 | 7.87 | 8.00 |
| eyelids-curtains | 3.30 | 3.96 | 4.40 | 7.00 | 4.27 | 4.29 | 7.35 | 7.48 |
| faith-raft | 2.30 | 2.64 | 3.95 | 5.60 | 4.60 | 5.12 | 7.22 | 5.65 |
| families-fortresses | 3.25 | 5.28 | 8.35 | 8.80 | 4.48 | 4.73 | 7.78 | 6.22 |
| fingerprints-portraits | 5.05 | 5.28 | 1.70 | 2.12 | 4.79 | 4.74 | 6.13 | 6.35 |
| friendship-rainbow | 3.65 | 4.64 | 9.05 | 9.36 | 3.86 | 3.76 | 5.74 | 5.43 |
| genes-blueprints | 7.85 | 8.64 | 7.15 | 7.28 | 5.01 | 5.32 | 8.39 | 9.30 |
| giraffes-skyscrapers | 2.40 | 3.28 | 8.40 | 9.56 | 3.79 | 4.01 | 5.48 | 4.78 |
| god-fire | 2.05 | 2.40 | 5.25 | 5.96 | 4.42 | 5.08 | 3.39 | 5.22 |
| god-parent | 4.75 | 4.92 | 6.10 | 8.84 | 4.71 | 4.48 | 6.91 | 6.39 |
| greed-buzzard | 1.25 | 1.64 | 5.70 | 5.96 | 3.97 | 4.67 | 4.57 | 4.83 |
| health-glass | 1.20 | 1.48 | 8.70 | 8.60 | 4.02 | 3.78 | 3.61 | 4.70 |
| hearts-closets | 1.95 | 2.12 | 6.90 | 6.52 | 4.28 | 4.45 | 4.39 | 4.65 |
| heaven-treasure | 4.40 | 3.60 | 7.10 | 8.60 | 5.12 | 4.91 | 6.61 | 6.96 |
| highways-snakes | 2.55 | 3.08 | 4.90 | 5.76 | 4.21 | 4.08 | 3.18 | 4.74 |
| insults-daggers | 6.40 | 7.88 | 8.70 | 8.92 | 3.72 | 4.19 | 7.91 | 7.17 |
| jobs-jails | 3.15 | 5.00 | 4.00 | 3.28 | 5.07 | 5.09 | 5.00 | 4.17 |
| knowledge-light | 4.45 | 5.56 | 8.60 | 8.76 | 4.67 | 4.24 | 8.09 | 8.48 |
| knowledge-money | 6.00 | 5.40 | 8.20 | 9.16 | 4.81 | 4.67 | 6.35 | 5.83 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| knowledge-power | 9.80 | 9.60 | 8.75 | 9.24 | 4.98 | 5.26 | 8.52 | 8.04 |
| knowledge-river | 5.20 | 6.08 | 4.95 | 5.68 | 4.81 | 4.73 | 4.30 | 3.83 |
| lawyers-sharks | 7.70 | 6.17 | 9.05 | 4.75 | 4.85 | 5.15 | 8.61 | 7.35 |
| lawyers-snakes | 4.00 | 6.46 | 8.05 | 6.44 | 4.41 | 4.95 | 7.39 | 5.83 |
| life-beach | 6.00 | 3.62 | 8.80 | 9.69 | 4.31 | 4.52 | 5.17 | 5.26 |
| life-bottle | 2.00 | 2.37 | 4.40 | 9.88 | 4.78 | 4.60 | 2.43 | 2.39 |
| life-dream | 7.25 | 7.96 | 7.70 | 9.06 | 4.44 | 5.19 | 4.48 | 5.26 |
| life-joke | 5.60 | 4.32 | 8.85 | 9.94 | 4.13 | 4.48 | 6.17 | 4.00 |
| life-journey | 9.30 | 9.31 | 8.75 | 5.44 | 4.36 | 4.43 | 9.22 | 9.52 |
| life-river | 4.85 | 6.04 | 5.90 | 8.63 | 4.83 | 4.94 | 7.22 | 7.74 |
| love-child | 3.80 | 3.20 | 8.30 | 9.06 | 5.02 | 4.43 | 5.30 | 5.61 |
| love-drug | 8.60 | 9.69 | 9.80 | 8.88 | 4.27 | 4.69 | 8.26 | 9.09 |
| love-flower | 4.75 | 5.81 | 8.42 | 8.25 | 4.45 | 4.04 | 6.91 | 7.22 |
| love-gold | 4.75 | 4.22 | 8.75 | 8.38 | 3.48 | 4.22 | 6.91 | 6.26 |
| love-melody | 5.50 | 5.06 | 7.90 | 6.63 | 5.02 | 4.87 | 5.22 | 6.43 |
| love-rainbow | 4.90 | 4.08 | 8.95 | 7.25 | 4.07 | 3.91 | 5.39 | 6.00 |
| love-rose | 5.55 | 6.86 | 8.85 | 8.69 | 4.72 | 4.10 | 6.74 | 5.78 |
| memory-river | 2.60 | 2.60 | 7.40 | 4.50 | 4.44 | 3.53 | 4.78 | 4.35 |
| memory-sponge | 7.50 | 7.79 | 9.75 | 9.19 | 4.67 | 3.98 | 6.70 | 5.70 |
| men-fish | 3.35 | 3.65 | 6.70 | 8.44 | 5.52 | 5.18 | 1.74 | 2.57 |
| minds-computers | 7.65 | 7.62 | 6.90 | 7.56 | 4.79 | 5.22 | 7.48 | 8.17 |
| money-oxygen | 2.05 | 3.21 | 8.60 | 8.69 | 4.15 | 4.33 | 4.13 | 3.30 |
| music-medicine | 6.05 | 7.60 | 8.85 | 4.38 | 4.20 | 4.51 | 7.39 | 7.48 |
| obligations-shackles | 2.80 | 4.57 | 6.20 | 5.88 | 4.88 | 4.72 | 6.09 | 5.17 |
| peace-river | 2.30 | 2.24 | 6.10 | 6.50 | 4.24 | 4.60 | 5.65 | 4.83 |
| pets-kids | 4.05 | 4.90 | 6.65 | 7.06 | 4.90 | 4.98 | 6.74 | 6.13 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| rage-volcano | 5.10 | 7.62 | 9.50 | 8.00 | 3.94 | 4.08 | 8.09 | 7.65 |
| runners-torpedoes | 1.80 | 2.83 | 7.30 | 9.06 | 3.50 | 4.29 | 4.35 | 5.00 |
| salesmen-bulldozers | 2.45 | 2.99 | 8.10 | 8.94 | 4.83 | 4.95 | 5.35 | 4.00 |
| schools-zoos | 5.15 | 5.53 | 8.25 | 7.31 | 3.28 | 5.12 | 6.96 | 5.57 |
| science-politics | 3.30 | 1.42 | 6.20 | 4.31 | 5.09 | 4.98 | 4.32 | 3.17 |
| sermons-sleeping pills | 1.40 | 2.14 | 4.55 | 7.13 | 4.14 | 4.37 | 6.43 | 4.39 |
| skating-flying | 1.65 | 2.10 | 8.30 | 7.44 | 4.58 | 4.49 | 4.26 | 3.91 |
| smog-shroud | 1.75 | 1.83 | 4.25 | 6.19 | 4.35 | 4.57 | 5.09 | 6.81 |
| soldiers-pawns | 4.65 | 5.71 | 5.80 | 8.63 | 4.75 | 4.81 | 6.74 | 8.09 |
| stores-zoos | 5.55 | 5.33 | 9.25 | 3.88 | 4.76 | 4.49 | 5.26 | 5.09 |
| teachers-sculptors | 5.35 | 3.95 | 6.95 | 6.38 | 4.83 | 4.45 | 7.91 | 6.70 |
| television-candy | 1.70 | 1.84 | 8.40 | 4.94 | 4.34 | 4.40 | 5.74 | 5.91 |
| time-money | 9.95 | 8.25 | 8.35 | 3.06 | 4.86 | 4.89 | 8.43 | 5.91 |
| time-snail | 2.05 | 4.28 | 9.85 | 8.88 | 4.16 | 3.89 | 4.48 | 3.48 |
| time-thief | 3.30 | 4.25 | 3.90 | 9.00 | 4.87 | 4.48 | 6.91 | 4.87 |
| tongues-fire | 3.25 | 2.46 | 9.05 | 5.56 | 4.67 | 4.36 | 4.78 | 3.83 |
| tree trunks-straws | 1.50 | 1.38 | 2.15 | 7.69 | 4.16 | 4.21 | 2.65 | 4.00 |
| trees-umbrellas | 2.80 | 2.54 | 7.40 | 8.81 | 4.02 | 3.98 | 6.36 | 6.74 |
| trust-glue | 2.80 | 4.58 | 8.85 | 6.20 | 3.89 | 4.28 | 6.30 | 6.17 |
| typewriters-dinosaurs | 3.20 | 4.22 | 9.00 | 7.33 | 4.24 | 3.77 | 6.30 | 4.17 |
| winter-death | 5.35 | 4.50 | 6.05 | 7.27 | 4.46 | 4.31 | 5.17 | 4.35 |
| wisdom-ocean | 5.40 | 5.29 | 9.20 | 8.27 | 4.53 | 4.94 | 6.91 | 6.22 |
| women-cats | 4.20 | 3.56 | 6.05 | 3.53 | 5.23 | 5.11 | 3.87 | 4.22 |

Table 2B: Collected Properties for Metaphor and Simile Topic-Vehicle Pairs

Legend

*Conn = Average Connotativeness Rating*

*Sal = Average Saliency Rating*

*Freq = Frequency*

*TR = Total Responses*

*SR = Single Responses*

| **Topic-Vehicle** | **Properties as Metaphor** | | | | **Properties as Simile** | | | |
|---|---|---|---|---|---|---|---|---|
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **49** | | | **TR** | **49** | |
| **Alcohol-Crutch** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| | helpful | 1.80 | 5 | 3.50 | dependent | 1.20 | 5 | 3.81 |
| | dependable | 1.25 | 4 | | supportive | 1.25 | 4 | |
| | addictive | 1.67 | 3 | | bad | 1.50 | 2 | |
| | support | 2.33 | 3 | | addictive | 2.00 | 2 | |
| | disability | 1.50 | 2 | | dependable | 2.00 | 2 | |
| | aid | 2.50 | 2 | | hard | 2.00 | 2 | |
| | problem | 2.50 | 2 | | necessity | 2.00 | 2 | |
| | needed | 3.00 | 2 | | limiting | 2.50 | 2 | |
| | | **SR** | **26** | | help | 3.00 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | **SR** | **26** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **58** | | | **TR** | **55** | |
| **Anger-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Fire** | dangerous | 1.63 | 8 | 3.56 | red | 1.14 | 7 | 3.56 |
| | hot | 1.63 | 8 | 1.35 | dangerous | 1.86 | 7 | 1.35 |
| | red | 1.40 | 5 | 2.11 | hot | 1.86 | 7 | 1.40 |
| | scary | 2.20 | 5 | 4.52 | destructive | 2.17 | 6 | 3.54 |
| | burning | 1.67 | 3 | | raging | 1.33 | 3 | |
| | hurtful | 2.00 | 2 | | crazy | 2.00 | 2 | |
| | destructive | 2.50 | 2 | | | **SR** | **23** | |
| | deadly | 3.00 | 2 | | | | | |
| | | **SR** | **23** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **54** | | | **TR** | **47** | |
| **Anger-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Heart** | red | 1.20 | 5 | 2.11 | red | 1.67 | 9 | 2.11 |
| | beating | 1.75 | 4 | | passionate | 1.00 | 3 | |
| | pumping | 2.00 | 4 | | beating | 2.00 | 3 | |
| | bloody | 1.67 | 3 | | emotive | 2.33 | 3 | |
| | emotional | 1.67 | 3 | | bloody | 1.50 | 2 | |
| | loving | 2.00 | 3 | | strong | 1.50 | 2 | |
| | fragile | 1.50 | 2 | | | **SR** | **25** | |
| | hard | 2.50 | 2 | | | | | |
| | | **SR** | **28** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **45** | | | **TR** | **50** | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Beauty-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Passport** | freedom | 1.50 | 6 | 4.37 | accessible | 1.50 | 2 | |
| | gateway | 2.00 | 3 | | important | 2.50 | 2 | |
| | advantage | 1.00 | 2 | | useful | 2.50 | 2 | |
| | beneficial | 2.00 | 2 | | | **SR** | **44** | |
| | useful | 2.00 | 2 | | | | | |
| | informative | 3.00 | 2 | | | | | |
| | | **SR** | **28** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **51** | | | **TR** | **44** | |
| **Bible-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Sword** | sharp | 1.40 | 7 | 1.60 | sharp | 1.11 | 9 | 1.60 |
| | weapon | 1.86 | 5 | 1.70 | strong | 2.00 | 4 | |
| | powerful | 1.33 | 3 | | powerful | 2.25 | 4 | |
| | dangerous | 2.67 | 3 | | dangerous | 1.33 | 3 | |
| | life | 1.50 | 2 | | long | 2.33 | 3 | |
| | deadly | 2.50 | 2 | | weapon | 1.50 | 2 | |
| | silver | 2.50 | 2 | | useful | 2.00 | 2 | |
| | | **SR** | **27** | | | **SR** | **17** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **39** | | | **TR** | **53** | |
| **Billboards-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Warts** | ugly | 1.67 | 6 | 3.13 | annoying | 1.33 | 6 | 4.41 |
| | annoying | 2.25 | 4 | | round | 1.50 | 2 | |
| | big | 1.33 | 3 | | unwanted | 1.50 | 2 | |
| | unwanted | 1.00 | 2 | | big | 2.00 | 2 | |
| | disgusting | 1.50 | 2 | | painful | 2.00 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | dirty | 2.00 | 2 | | unsightly | 2.00 | 2 | |
| | everywhere | 2.00 | 2 | | removable | 2.50 | 2 | |
| | large | 2.00 | 2 | | | **SR** | **35** | |
| | noticeable | 2.50 | 2 | | | | | |
| | round | 2.50 | 2 | | | | | |
| | | **SR** | **12** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **48** | | | **TR** | **48** | |
| **Christ-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Door** | open/close | 1.20 | 14 | 1.79 | open/close | 1.27 | 15 | 1.79 |
| | obstructing | 2.33 | 3 | | inviting | 2.50 | 2 | |
| | opportunity | 1.00 | 2 | | entrance | 3.00 | 2 | |
| | wood | 1.50 | 2 | | | **SR** | **29** | |
| | gateway | 2.00 | 2 | | | | | |
| | locked | 2.00 | 2 | | | | | |
| | | **SR** | **23** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **40** | | | **TR** | **34** | |
| **Christians-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Salt** | bitter | 1.33 | 3 | | white | 1.75 | 4 | |
| | tasty | 1.00 | 2 | | small | 2.00 | 3 | |
| | white | 1.00 | 2 | | granular | 1.50 | 2 | |
| | salty | 1.50 | 2 | | tasty | 1.50 | 2 | |
| | small | 2.00 | 2 | | | **SR** | **23** | |
| | plenty | 2.50 | 2 | | | | | |
| | | **SR** | **27** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **TR** | **51** | | | **TR** | **55** | |
| **Cigarettes-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Time Bombs** | dangerous | 2.38 | 8 | 2.92 | death | 2.11 | 9 | 3.13 |
| | death | 1.29 | 7 | 3.13 | dangerous | 1.63 | 8 | 2.92 |
| | kills | 1.75 | 4 | | unhealthy | 1.00 | 3 | |
| | explosive | 1.00 | 3 | | destructive | 1.67 | 3 | |
| | smoky | 1.67 | 3 | | explosive | 2.33 | 3 | |
| | fatal | 2.00 | 3 | | killer | 1.50 | 2 | |
| | limiting | 1.50 | 2 | | fatal | 2.00 | 2 | |
| | scary | 1.50 | 2 | | hazardous | 2.50 | 2 | |
| | harmful | 2.00 | 2 | | | **SR** | **23** | |
| | bad | 2.50 | 2 | | | | | |
| | unpredictable | 2.50 | 2 | | | | | |
| | | **SR** | **13** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **56** | | | **TR** | **59** | |
| **Cities-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Jungles** | crazy | 1.71 | 7 | 4.20 | crowded | 1.50 | 4 | |
| | crowded | 1.67 | 6 | 3.28 | messy | 1.75 | 4 | |
| | noisy | 1.00 | 3 | | crazy | 2.00 | 4 | |
| | wild | 1.33 | 3 | | dangerous | 2.67 | 3 | |
| | busy | 1.67 | 3 | | big | 1.00 | 2 | |
| | dangerous | 2.00 | 3 | | busy | 1.00 | 2 | |
| | messy | 2.00 | 3 | | complicated | 2.00 | 2 | |
| | big | 1.00 | 2 | | huge | 2.00 | 2 | |
| | animals | 1.50 | 2 | | loud | 2.00 | 2 | |
| | disorganized | 2.50 | 2 | | wild | 2.00 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **SR** | **22** | | confusing | 2.50 | 2 | |
| | | | | | dirty | 3.00 | 2 | |
| | | | | | | **SR** | **28** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **58** | | | **TR** | **58** | |
| **Clouds-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Cotton** | soft | 1.43 | 15 | 2.05 | white | 1.89 | 18 | 1.72 |
| | white | 1.87 | 14 | 1.72 | soft | 2.08 | 13 | 2.05 |
| | fluffy | 2.00 | 11 | 2.33 | fluffy | 1.55 | 11 | 2.33 |
| | puffy | 1.50 | 2 | | puffy | 1.50 | 3 | |
| | bouncy | 2.00 | 2 | | comfortable | 2.00 | 2 | |
| | light-weight | 2.50 | 2 | | light | 3.00 | 2 | |
| | calming | 3.00 | 2 | | round | 3.00 | 2 | |
| | round | 3.00 | 2 | | | **SR** | **7** | |
| | | **SR** | **8** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **57** | | | **TR** | **55** | |
| **Debt-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Disease** | painful | 1.00 | 3 | | spreads | 1.50 | 4 | |
| | deadly | 1.67 | 3 | | painful | 1.33 | 3 | |
| | harmful | 2.33 | 3 | | avoidable | 1.67 | 3 | |
| | bad | 1.50 | 2 | | destructive | 1.67 | 3 | |
| | contagious | 2.00 | 2 | | unwanted | 1.67 | 3 | |
| | dibilitating | 2.00 | 2 | | dangerous | 2.00 | 3 | |
| | kills | 2.00 | 2 | | chronic | 1.50 | 2 | |
| | sad | 2.00 | 2 | | contagious | 2.00 | 2 | |
| | | **SR** | **38** | | depressing | 2.00 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | disabling | 3.00 | 2 | |
| | | | | | | **SR** | **28** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **52** | | | **TR** | **56** | |
| **Deserts-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Ovens** | hot | 1.00 | 20 | 1.63 | hot | 1.35 | 17 | 1.63 |
| | dry | 2.33 | 6 | 2.45 | dry | 1.50 | 6 | 2.45 |
| | burning | 2.20 | 5 | 2.69 | warm | 1.75 | 4 | |
| | cooked | 3.00 | 3 | | burning | 2.00 | 3 | |
| | baked | 1.50 | 2 | | | **SR** | **26** | |
| | | **SR** | **16** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **52** | | | **TR** | **56** | |
| **Desks-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Junkyards** | messy | 1.58 | 12 | 3.08 | messy | 1.46 | 13 | 3.08 |
| | dirty | 1.88 | 8 | 3.07 | dirty | 1.50 | 4 | |
| | junk or garbage | 1.40 | 5 | 1.67 | unorganized | 1.75 | 4 | |
| | disorganized | 1.33 | 3 | | full | 2.00 | 4 | |
| | unorganized | 2.00 | 2 | | disorganized | 2.14 | 4 | |
| | useless | 2.50 | 2 | | cluttered | 1.00 | 3 | |
| | ugly | 3.00 | 2 | | | **SR** | **24** | |
| | | **SR** | **18** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **56** | | | **TR** | **52** | |
| **Dreams-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Water** | fluid | 1.60 | 5 | 1.66 | fluid | 1.00 | 7 | 1.37 |
| | clear | 2.20 | 5 | 1.37 | clear | 2.25 | 4 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | liquid | 1.67 | 3 | | necessity | 1.33 | 3 | |
| | refreshing | 2.33 | 3 | | flowing | 1.00 | 2 | |
| | necessary | 1.50 | 2 | | evaporate | 2.00 | 2 | |
| | vital | 1.50 | 2 | | fresh | 2.00 | 2 | |
| | plentiful | 2.00 | 2 | | peaceful | 2.00 | 2 | |
| | pure | 2.00 | 2 | | | **SR** | **30** | |
| | essential | 2.50 | 2 | | | | | |
| | unclear | 2.50 | 2 | | | | | |
| | | **SR** | **28** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **50** | | | **TR** | **51** | |
| **Education-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Stairway** | higher | 1.50 | 4 | | steps | 1.40 | 5 | 1.14 |
| | steps | 1.33 | 3 | | hightens | 2.00 | 5 | 3.62 |
| | upward | 1.33 | 3 | | elevate | 1.00 | 2 | |
| | long | 1.00 | 2 | | passageway | 1.00 | 2 | |
| | passage | 1.00 | 2 | | long | 1.50 | 2 | |
| | ascension | 1.50 | 2 | | assending | 2.00 | 2 | |
| | climbing | 1.50 | 2 | | climbing | 2.00 | 2 | |
| | path | 1.50 | 2 | | tiring | 2.00 | 2 | |
| | success | 2.50 | 2 | | upwards | 2.00 | 2 | |
| | tiring | 2.50 | 2 | | complicated | 2.50 | 2 | |
| | | **SR** | **26** | | steady | 3.00 | 2 | |
| | | | | | | **SR** | **23** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **50** | | | **TR** | **45** | |
| **Exams-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Hurdles** | challenging | 1.17 | 6 | 3.84 | challenging | 2.33 | 6 | 3.84 |
| | obstacles | 1.50 | 4 | | difficult | 1.33 | 3 | |
| | difficult | 1.75 | 4 | | stressful | 1.67 | 3 | |
| | stressful | 2.50 | 4 | | frustrating | 1.00 | 2 | |
| | tough | 2.33 | 3 | | burdens | 1.50 | 2 | |
| | high | 1.50 | 2 | | obstacles | 1.50 | 2 | |
| | long | 2.00 | 2 | | passed | 3.00 | 2 | |
| | | **SR** | **25** | | | **SR** | **25** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **55** | | | **TR** | **54** | |
| **Eyelids-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Curtains** | open/close | 1.56 | 14 | 1.54 | open/close | 1.63 | 13 | 1.54 |
| | protective | 2.40 | 5 | 4.13 | darkness | 1.86 | 7 | 3.49 |
| | private | 1.33 | 3 | | protective | 1.75 | 4 | |
| | shut | 1.33 | 3 | | covers | 2.75 | 4 | |
| | shade | 1.50 | 2 | | private | 1.50 | 2 | |
| | barriers | 2.00 | 2 | | soft | 1.50 | 2 | |
| | moveable | 2.00 | 2 | | light | 2.00 | 2 | |
| | shields | 2.00 | 2 | | long | 2.50 | 2 | |
| | dark | 3.00 | 2 | | | **SR** | **18** | |
| | | **SR** | **20** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **43** | | | **TR** | **47** | |
| **Faith-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Raft** | unsteady | 1.40 | 5 | 3.29 | fragile | 2.00 | 3 | |
| | floating | 1.75 | 4 | | life-saving | 2.00 | 3 | |
| | protective | 2.25 | 4 | | unstable | 2.33 | 3 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | safety | 1.00 | 2 | | safety | 1.50 | 2 | |
| | saviour | 1.50 | 2 | | floating | 2.00 | 2 | |
| | small | 1.50 | 2 | | helpful | 2.00 | 2 | |
| | boat | 2.50 | 2 | | | **SR** | **32** | |
| | | **SR** | **22** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **56** | | | **TR** | **55** | |
| **Families-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Fortresses** | strong | 1.44 | 9 | 2.84 | strong | 1.38 | 8 | 2.84 |
| | protective | 1.63 | 8 | 3.24 | protective | 1.50 | 8 | 3.24 |
| | secure | 2.20 | 5 | 2.95 | solid | 1.00 | 2 | |
| | huge | 1.50 | 2 | | caring | 1.50 | 2 | |
| | supportive | 2.00 | 2 | | together | 2.00 | 2 | |
| | large | 2.50 | 2 | | loving | 2.50 | 2 | |
| | lasting | 2.50 | 2 | | secure | 3.00 | 2 | |
| | important | 3.00 | 2 | | | **SR** | **29** | |
| | | **SR** | **24** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **55** | | | **TR** | **54** | |
| **Fingerprints-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Portraits** | unique | 1.63 | 8 | 3.93 | unique | 1.50 | 9 | 3.93 |
| | individual | 2.25 | 4 | | individual | 1.75 | 4 | |
| | images | 1.00 | 3 | | identity | 1.33 | 3 | |
| | identity | 1.67 | 3 | | represent | 2.33 | 3 | |
| | revealing | 2.00 | 3 | | detailed | 2.67 | 3 | |
| | detailed | 2.00 | 2 | | identifiable | 1.50 | 2 | |
| | drawings | 2.00 | 2 | | people | 2.50 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | clues | 2.50 | 2 | | | **SR** | **28** | |
| | indentity | 2.50 | 2 | | | | | |
| | | **SR** | **26** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **58** | | | **TR** | **51** | |
| **Friendship-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Rainbow** | colourful | 1.25 | 16 | 1.43 | colourful | 1.85 | 13 | 1.43 |
| | beautiful | 1.82 | 11 | 4.25 | beauty | 2.00 | 7 | 4.25 |
| | rare | 2.20 | 5 | 3.75 | happy | 1.60 | 5 | 4.62 |
| | magical | 3.00 | 2 | | rare | 1.50 | 4 | |
| | | **SR** | **24** | | diversified | 1.00 | 2 | |
| | | | | | fun | 1.50 | 2 | |
| | | | | | wide | 1.50 | 2 | |
| | | | | | pleasing | 2.00 | 2 | |
| | | | | | shiny | 2.50 | 2 | |
| | | | | | | **SR** | **12** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **46** | | | **TR** | **53** | |
| **Genes-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Blueprints** | maps | 2.00 | 4 | | map | 1.33 | 3 | |
| | unique | 1.33 | 3 | | complicated | 1.67 | 3 | |
| | informative | 1.67 | 3 | | unique | 1.00 | 2 | |
| | designing | 2.00 | 2 | | orderly | 1.50 | 2 | |
| | identity | 2.00 | 2 | | unchangeable | 1.50 | 2 | |
| | personal | 2.50 | 2 | | stable | 2.00 | 2 | |
| | | **SR** | **30** | | foundation | 2.50 | 2 | |
| | | | | | hidden | 2.50 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | SR | 35 | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **56** | | | **TR** | **51** | |
| **Giraffes-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Skyscraper** | tall | 1.06 | 18 | 1.47 | tall | 1.12 | 17 | 1.47 |
| | high | 1.67 | 6 | 1.70 | noticeable | 2.00 | 3 | |
| | long | 2.40 | 5 | 2.30 | thin | 2.33 | 3 | |
| | imposing | 2.33 | 3 | | large | 2.00 | 2 | |
| | big | 2.50 | 2 | | long | 2.50 | 2 | |
| | huge | 2.50 | 2 | | strong | 2.50 | 2 | |
| | strong | 3.00 | 2 | | | **SR** | **22** | |
| | | **SR** | **18** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **55** | | | **TR** | **54** | |
| **God-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Fire** | powerful | 1.60 | 10 | 3.82 | warmth | 2.40 | 5 | 2.43 |
| | destructive | 2.83 | 6 | 3.54 | dangerous | 1.33 | 3 | |
| | dangerous | 1.80 | 5 | 3.56 | powerful | 1.33 | 3 | |
| | hot | 1.67 | 3 | | light | 2.00 | 3 | |
| | warm | 1.00 | 2 | | consuming | 2.33 | 3 | |
| | great | 1.50 | 2 | | strong | 1.00 | 2 | |
| | strong | 1.50 | 2 | | forceful | 2.00 | 2 | |
| | intimidating | 2.00 | 2 | | hot | 2.00 | 2 | |
| | engulfing | 2.50 | 2 | | | **SR** | **31** | |
| | | **SR** | **21** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **59** | | | **TR** | **58** | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **God-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Parent** | loving | 1.82 | 11 | 4.07 | caring | 1.90 | 10 | 4.04 |
| | caring | 1.20 | 5 | 4.04 | loving | 2.17 | 6 | 4.07 |
| | protective | 2.20 | 5 | 3.89 | protective | 1.50 | 6 | 3.89 |
| | authoritative | 1.50 | 2 | | guiding | 1.80 | 5 | 3.99 |
| | trustworthy | 1.50 | 2 | | nurturing | 2.50 | 2 | |
| | forgiving | 2.00 | 2 | | understanding | 3.00 | 2 | |
| | guiding | 2.00 | 2 | | | **SR** | **27** | |
| | | **SR** | **30** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **28** | | | **TR** | **31** | |
| **Greed-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Buzzard** | bad | 1.25 | 4 | | annoying | 1.33 | 3 | |
| | annoying | 1.33 | 4 | | selfish | 2.00 | 2 | |
| | | **SR** | **20** | | unwanted | 2.00 | 2 | |
| | | | | | | **SR** | **24** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **51** | | | **TR** | **49** | |
| **Health-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Glass** | fragile | 1.30 | 10 | 2.57 | fragile | 1.38 | 13 | 2.57 |
| | breakable | 1.89 | 9 | 2.31 | breakable | 1.75 | 8 | 2.31 |
| | transparent | 2.20 | 5 | 1.79 | transparent | 1.80 | 5 | 1.79 |
| | clear | 1.33 | 3 | | clear | 1.50 | 2 | |
| | full | 1.50 | 2 | | damageable | 2.50 | 2 | |
| | delicate | 2.00 | 2 | | empty | 3.00 | 2 | |
| | empty | 2.50 | 2 | | | **SR** | **17** | |
| | | **SR** | **18** | | | | | |

| | Metaphor | | | | Simile | | | |
|---|---|---|---|---|---|---|---|---|
| | | TR | 55 | | | TR | 52 | |
| Hearts- | Response | Sal | Freq | Conn | Response | Sal | Freq | Conn |
| Closests | closed/ope n | 1.27 | 11 | 2.10 | closed/open | 1.36 | 13 | 2.10 |
| | opened | 2.25 | 4 | | secrets | 1.75 | 4 | |
| | messy | 2.75 | 4 | | hidden | 1.33 | 3 | |
| | full | 1.67 | 3 | | full | 1.00 | 2 | |
| | hidden | 1.50 | 2 | | personal | 1.50 | 2 | |
| | fillable | 2.00 | 2 | | messy | 2.50 | 2 | |
| | private | 2.50 | 2 | | mysterious | 2.50 | 2 | |
| | protective | 2.50 | 2 | | dark | 3.00 | 2 | |
| | | SR | 25 | | deep | 3.00 | 2 | |
| | | | | | | SR | 20 | |
| | Metaphor | | | | Simile | | | |
| | | TR | 56 | | | TR | 54 | |
| Heaven- | Response | Sal | Freq | Conn | Response | Sal | Freq | Conn |
| Treasure | golden | 1.33 | 6 | 2.67 | precious | 1.80 | 5 | 3.64 |
| | richening | 2.33 | 3 | | valuable | 1.75 | 4 | |
| | pleasant | 1.00 | 2 | | secretive | 1.00 | 3 | |
| | beautiful | 1.50 | 2 | | hidden | 1.67 | 3 | |
| | nice | 1.50 | 2 | | exciting | 2.00 | 3 | |
| | value | 1.50 | 2 | | surprising | 1.00 | 2 | |
| | dream | 2.00 | 2 | | desirable | 1.50 | 2 | |
| | magical | 2.00 | 2 | | expensive | 1.50 | 2 | |
| | precious | 2.50 | 2 | | mystery | 2.00 | 2 | |
| | shiny | 2.50 | 2 | | rare | 2.00 | 2 | |
| | happiness | 3.00 | 2 | | sacred | 2.00 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | SR | 29 | | | SR | 24 | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **51** | | | **TR** | **54** | |
| **Highways-Snakes** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| | long | 1.11 | 9 | 1.87 | long | 1.36 | 14 | 1.87 |
| | slippery | 2.00 | 5 | 2.50 | dangerous | 2.80 | 5 | 3.44 |
| | dangerous | 2.20 | 5 | 3.44 | winding | 1.25 | 4 | |
| | curvy | 1.33 | 3 | | curvy | 1.80 | 4 | |
| | fast | 2.00 | 3 | | narrow | 1.50 | 2 | |
| | windy | 2.00 | 3 | | slippery | 2.00 | 2 | |
| | scary | 2.33 | 3 | | twisting | 3.00 | 2 | |
| | poisonous | 2.50 | 2 | | | **SR** | **21** | |
| | shapy | 2.50 | 2 | | | | | |
| | | **SR** | **16** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **49** | | | **TR** | **56** | |
| **Insults-Daggers** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| | hurtful | 1.38 | 19 | 4.07 | hurtful | 1.64 | 19 | 4.07 |
| | sharp | 2.00 | 6 | 1.40 | sharp | 2.00 | 8 | 2.74 |
| | dangerous | 2.00 | 3 | | dangerous | 1.67 | 3 | |
| | deadly | 2.67 | 3 | | | **SR** | **26** | |
| | harmful | 2.00 | 2 | | | | | |
| | bad | 2.50 | 2 | | | | | |
| | | **SR** | **14** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **55** | | | **TR** | **55** | |
| **Job-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Jail** | boring | 2.17 | 6 | 4.53 | limiting | 2.25 | 4 | |
| | prison | 1.00 | 3 | | boring | 1.00 | 3 | |
| | confining | 1.67 | 3 | | confining | 1.00 | 3 | |
| | restrictive | 1.00 | 2 | | obligation | 1.33 | 3 | |
| | controlling | 1.50 | 2 | | long-term | 1.00 | 2 | |
| | painful | 1.50 | 2 | | restricting | 1.50 | 2 | |
| | contract | 2.00 | 2 | | punishment | 3.00 | 2 | |
| | trapped | 2.00 | 2 | | | **SR** | **36** | |
| | long | 2.50 | 2 | | | | | |
| | ugly | 2.50 | 2 | | | | | |
| | | **SR** | **29** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **54** | | | **TR** | **53** | |
| **Knowledge-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Light** | bright | 1.36 | 11 | 1.97 | brightness | 1.27 | 15 | 1.97 |
| | illuminates | 1.33 | 3 | | enlighting | 2.00 | 4 | |
| | enlight | 2.00 | 3 | | illuminating | 1.50 | 2 | |
| | powerful | 2.33 | 3 | | shiny | 2.00 | 2 | |
| | needed | 1.50 | 2 | | useful | 2.00 | 2 | |
| | hope | 2.00 | 2 | | important | 2.50 | 2 | |
| | necessary | 2.50 | 2 | | needed | 2.50 | 2 | |
| | | **SR** | **28** | | wanted | 2.50 | 2 | |
| | | | | | | **SR** | **22** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **59** | | | **TR** | **54** | |
| **Knowledge-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Money** | powerful | 1.50 | 8 | 4.29 | valued | 1.80 | 5 | 3.28 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | important | 1.67 | 6 | 4.36 | powerful | 2.00 | 5 | 4.29 |
| | needful | 2.25 | 4 | | important | 2.40 | 5 | 4.36 |
| | expensive | 2.33 | 3 | | precious | 1.00 | 4 | |
| | useful | 2.33 | 3 | | useful | 1.00 | 2 | |
| | valuable | 1.00 | 2 | | acquired | 1.50 | 2 | |
| | necessary | 2.00 | 2 | | desirable | 1.50 | 2 | |
| | wanted | 2.00 | 2 | | necessity | 1.50 | 2 | |
| | | **SR** | **29** | | wanted | 1.50 | 2 | |
| | | | | | worthy | 1.50 | 2 | |
| | | | | | exchangeable | 2.50 | 2 | |
| | | | | | resourceful | 3.00 | 2 | |
| | | | | | | **SR** | **19** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **50** | | | **TR** | **53** | |
| **Knowledge-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Power** | important | 2.00 | 5 | 4.40 | strength | 1.25 | 4 | |
| | strength | 1.50 | 4 | | controlling | 2.33 | 3 | |
| | strong | 1.67 | 3 | | important | 1.00 | 2 | |
| | wanted | 2.00 | 3 | | manipulative | 1.50 | 2 | |
| | desired | 2.00 | 2 | | wanted | 1.50 | 2 | |
| | superior | 2.50 | 2 | | abusive | 2.00 | 2 | |
| | | **SR** | **31** | | necessary | 2.00 | 2 | |
| | | | | | desired | 2.50 | 2 | |
| | | | | | | **SR** | **34** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **50** | | | **TR** | **49** | |
| **Knowledge-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **River** | long | 1.71 | 7 | 2.85 | fluid | 1.63 | 8 | 2.16 |
| | flowing | 1.67 | 3 | | long | 1.33 | 3 | |
| | strong | 1.67 | 3 | | powerful | 1.67 | 3 | |
| | widening | 2.00 | 3 | | changing | 1.50 | 2 | |
| | deep | 1.00 | 2 | | constant | 1.50 | 2 | |
| | never-ending | 1.00 | 2 | | vast | 1.50 | 2 | |
| | dangerous | 1.50 | 2 | | wet | 2.00 | 2 | |
| | powerful | 1.50 | 2 | | transparent | 2.50 | 2 | |
| | | **SR** | **26** | | | **SR** | **25** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **58** | | | **TR** | **57** | |
| **Lawyers-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Sharks** | dangerous | 1.71 | 7 | 3.83 | sharp | 1.50 | 4 | |
| | mean | 1.50 | 4 | | sneaky | 1.50 | 3 | |
| | big | 2.25 | 4 | | dangerous | 1.67 | 3 | |
| | sneaky | 2.25 | 4 | | determined | 1.67 | 3 | |
| | scary | 1.50 | 3 | | predators | 2.00 | 3 | |
| | cruel | 1.50 | 2 | | attacks | 2.00 | 2 | |
| | sharp | 1.50 | 2 | | fierce | 2.00 | 2 | |
| | hungry | 2.00 | 2 | | fighters | 2.00 | 2 | |
| | powerful | 2.00 | 2 | | untrustworthy | 2.00 | 2 | |
| | eat | 3.00 | 2 | | quick | 2.50 | 2 | |
| | | **SR** | **26** | | scary | 2.50 | 2 | |
| | | | | | | **SR** | **29** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **56** | | | **TR** | **53** | |
| **Lawyers-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Snakes** | sneeky | 1.57 | 7 | 4.50 | sneaky | 2.17 | 6 | 4.50 |
| | liars | 1.40 | 5 | 4.68 | dangerous | 2.25 | 4 | |
| | slippery | 2.00 | 4 | | slimy | 1.33 | 3 | |
| | deceivable | 2.25 | 4 | | venemous | 1.33 | 3 | |
| | poisonous | 2.50 | 4 | | slippery | 1.00 | 2 | |
| | scary | 2.50 | 4 | | deceiving | 1.50 | 2 | |
| | dangerous | 1.33 | 3 | | vicious | 1.50 | 2 | |
| | slithery | 1.00 | 2 | | poisonous | 2.00 | 2 | |
| | evil | 1.50 | 2 | | | **SR** | **29** | |
| | ugly | 1.50 | 2 | | | | | |
| | mean | 2.00 | 2 | | | | | |
| | viscious | 2.50 | 2 | | | | | |
| | | **SR** | **15** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **57** | | | **TR** | **53** | |
| **Life-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Beach** | relaxing | 2.11 | 9 | 4.38 | relaxing | 2.00 | 8 | 4.38 |
| | fun | 2.00 | 7 | 4.55 | warm | 1.00 | 4 | |
| | sunny | 1.80 | 5 | 2.55 | fun | 1.25 | 4 | |
| | beautiful | 1.00 | 3 | | vast | 1.33 | 3 | |
| | calming | 1.33 | 3 | | sandy | 2.00 | 3 | |
| | warm | 1.33 | 3 | | sunny | 2.67 | 3 | |
| | enjoyable | 3.00 | 3 | | changing | 2.00 | 2 | |
| | soft | 2.00 | 2 | | hot | 2.00 | 2 | |
| | soothing | 2.00 | 2 | | pleasurable | 2.00 | 2 | |
| | happy | 2.50 | 2 | | beautiful | 2.50 | 2 | |
| | peaceful | 3.00 | 2 | | enjoyable | 2.50 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **SR** | **16** | | | **SR** | **18** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **49** | | | **TR** | **51** | |
| **Life-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Bottle** | full | 1.60 | 5 | 3.02 | full | 2.00 | 6 | 3.02 |
| | empty | 2.00 | 4 | | containment | 2.00 | 5 | 1.99 |
| | fragile | 1.33 | 3 | | breakable | 1.50 | 4 | |
| | clear | 2.00 | 3 | | fragile | 1.67 | 3 | |
| | closed | 1.00 | 2 | | empty | 2.00 | 3 | |
| | trapped | 1.50 | 2 | | clear | 1.00 | 2 | |
| | contained | 2.00 | 2 | | closed | 1.00 | 2 | |
| | short | 2.00 | 2 | | round | 1.00 | 2 | |
| | breakable | 2.50 | 2 | | filled | 1.50 | 2 | |
| | transparent | 3.00 | 2 | | cold | 2.00 | 2 | |
| | | **SR** | **22** | | | **SR** | **20** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **58** | | | **TR** | **53** | |
| **Life-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Dream** | unreal | 2.20 | 5 | 2.55 | personal | 1.67 | 3 | |
| | nice | 1.00 | 2 | | unrealistic | 1.67 | 3 | |
| | peaceful | 1.00 | 2 | | imaginative | 2.33 | 3 | |
| | quick | 1.00 | 2 | | surreal | 1.00 | 2 | |
| | good | 1.50 | 2 | | unclear | 1.50 | 2 | |
| | perfect | 1.50 | 2 | | unpredictable | 1.50 | 2 | |
| | happiness | 2.00 | 2 | | fun | 2.00 | 2 | |
| | personal | 2.00 | 2 | | beautiful | 2.50 | 2 | |
| | interpreting | 2.50 | 2 | | creative | 2.50 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | short | 2.50 | 2 | | scary | 2.50 | 2 | |
| | | **SR** | **35** | | | **SR** | **30** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **57** | | | **TR** | **56** | |
| **Life-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Joke** | funny | 1.22 | 18 | 2.71 | funny | 1.18 | 11 | 2.71 |
| | amusing | 2.25 | 4 | | humour | 1.50 | 4 | |
| | enjoyable | 2.50 | 4 | | ironic | 1.33 | 3 | |
| | short | 2.00 | 2 | | not serious | 2.67 | 3 | |
| | fun | 2.50 | 2 | | surprising | 3.00 | 3 | |
| | laughable | 3.00 | 2 | | laughter | 1.00 | 2 | |
| | | **SR** | **25** | | entertaining | 1.50 | 2 | |
| | | | | | happy | 2.00 | 2 | |
| | | | | | amusing | 2.50 | 2 | |
| | | | | | comical | 3.00 | 2 | |
| | | | | | enjoyable | 3.00 | 2 | |
| | | | | | short | 3.00 | 2 | |
| | | | | | | **SR** | **18** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **60** | | | **TR** | **55** | |
| **Life-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Journey** | long | 1.30 | 10 | 2.78 | long | 1.10 | 10 | 2.78 |
| | adventurous | 2.13 | 8 | 4.12 | adventurous | 1.83 | 6 | 4.12 |
| | fun | 2.17 | 6 | 4.51 | unpredictable | 1.75 | 4 | |
| | exciting | 2.20 | 5 | 4.47 | enjoyable | 2.00 | 3 | |
| | hard | 2.33 | 3 | | exciting | 2.33 | 3 | |
| | path | 1.00 | 2 | | surprising | 1.00 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | road | 2.00 | 2 | | unknown | 1.50 | 2 | |
| | | **SR** | **24** | | unexpected | 2.00 | 2 | |
| | | | | | challening | 2.50 | 2 | |
| | | | | | | **SR** | **21** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **55** | | | **TR** | **53** | |
| **Life-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **River** | long | 1.25 | 8 | 2.85 | fluid | 1.43 | 7 | 2.16 |
| | fluid | 1.83 | 6 | 2.16 | long | 1.50 | 4 | |
| | beautiful | 2.00 | 3 | | directional | 1.50 | 2 | |
| | water | 1.50 | 2 | | changing | 2.00 | 2 | |
| | changing | 2.00 | 2 | | continuous | 2.00 | 2 | |
| | mysterious | 2.00 | 2 | | fluid | 2.00 | 2 | |
| | deep | 2.50 | 2 | | relaxing | 2.00 | 2 | |
| | | **SR** | **30** | | moving | 2.50 | 2 | |
| | | | | | unpredictable | 2.50 | 2 | |
| | | | | | | **SR** | **28** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **59** | | | **TR** | **55** | |
| **Love-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Child** | young | 1.60 | 6 | 1.39 | innocent | 1.27 | 11 | 3.96 |
| | innocent | 1.17 | 5 | 3.96 | naïve | 2.50 | 4 | |
| | immature | 1.00 | 3 | | playfull | 2.75 | 4 | |
| | sweet | 2.67 | 3 | | sweet | 1.33 | 3 | |
| | happy | 2.00 | 2 | | caring | 2.67 | 3 | |
| | kind | 2.00 | 2 | | joyful | 2.67 | 3 | |
| | loving or lovable | 2.00 | 2 | | loving | 1.50 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | small | 2.00 | 2 | | young | 1.50 | 2 | |
| | playful | 2.50 | 2 | | adventurous | 2.50 | 2 | |
| | fun | 3.00 | 2 | | | **SR** | **21** | |
| | growing | 3.00 | 2 | | | | | |
| | | **SR** | **28** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **58** | | | **TR** | **59** | |
| **Love-Drug** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| | addictive | 1.29 | 17 | 2.93 | adictive | 1.13 | 15 | 2.93 |
| | dangerous | 2.25 | 4 | | bad | 1.67 | 3 | |
| | high | 1.33 | 3 | | dangerous | 2.67 | 3 | |
| | painful | 2.00 | 2 | | good | 2.00 | 2 | |
| | bad | 2.50 | 2 | | | **SR** | **36** | |
| | fun | 2.50 | 2 | | | | | |
| | healing | 2.50 | 2 | | | | | |
| | powerful | 2.50 | 2 | | | | | |
| | | **SR** | **24** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **58** | | | **TR** | **57** | |
| **Love-Flower** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| | beautiful | 1.67 | 9 | 4.14 | beautiful | 1.67 | 13 | 4.14 |
| | pretty | 1.50 | 4 | | pretty | 1.33 | 3 | |
| | colourful | 2.25 | 4 | | growth | 1.00 | 2 | |
| | soft | 1.50 | 2 | | red | 1.50 | 2 | |
| | | **SR** | **39** | | natural | 2.00 | 2 | |
| | | | | | dies | 2.50 | 2 | |
| | | | | | delicate | 3.00 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | SR | 31 | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **57** | | | **TR** | **54** | |
| **Love-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Gold** | precious | 1.50 | 8 | 3.90 | precious | 1.00 | 8 | 3.90 |
| | rare | 2.00 | 7 | 3.04 | rare | 2.00 | 7 | 3.04 |
| | shiny | 2.00 | 5 | 1.73 | valuable | 1.67 | 6 | 3.38 |
| | expensive | 1.00 | 3 | | shiny | 1.50 | 4 | |
| | worthy | 1.50 | 2 | | expensive | 2.33 | 3 | |
| | great | 2.00 | 2 | | wanted | 2.67 | 3 | |
| | hard | 2.00 | 2 | | desirable | 2.00 | 2 | |
| | heavy | 2.00 | 2 | | treasure | 2.00 | 2 | |
| | important | 2.00 | 2 | | wealth | 2.50 | 2 | |
| | treasure | 2.00 | 2 | | | **SR** | **17** | |
| | valuable | 2.00 | 2 | | | | | |
| | rich | 3.00 | 2 | | | | | |
| | | **SR** | **18** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **56** | | | **TR** | **54** | |
| **Love-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Melody** | soothing | 1.25 | 5 | | pleasing | 1.60 | 5 | 4.19 |
| | relaxing | 2.50 | 4 | 4.28 | beautiful | 1.50 | 4 | |
| | calming | 1.50 | 3 | | harmonious | 1.50 | 4 | |
| | happiness | 2.33 | 3 | | soothing | 1.00 | 3 | |
| | peaceful | 2.67 | 3 | | relaxing | 1.67 | 3 | |
| | musical | 1.00 | 2 | | rythmic | 2.00 | 3 | |
| | smooth | 1.00 | 2 | | uplifting | 1.50 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | song | 1.00 | 2 | | calming | 2.00 | 2 | |
| | sweet | 1.00 | 2 | | sweet | 2.00 | 2 | |
| | beautiful | 2.00 | 2 | | | **SR** | **26** | |
| | romantic | 2.00 | 2 | | | | | |
| | harmonious | 2.50 | 2 | | | | | |
| | | **SR** | **23** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **59** | | | **TR** | **49** | |
| **Love-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Rainbow** | colourful | 1.93 | 14 | 1.43 | colourful | 1.38 | 16 | 1.43 |
| | beautiful | 1.40 | 10 | 4.25 | rare | 2.20 | 5 | 3.75 |
| | bright | 2.00 | 3 | | beautiful | 1.50 | 2 | |
| | nice | 2.00 | 3 | | fun | 2.00 | 2 | |
| | rare | 2.00 | 3 | | pretty | 2.50 | 2 | |
| | sparkling | 1.50 | 2 | | bright | 3.00 | 2 | |
| | uplifting | 2.50 | 2 | | | **SR** | **20** | |
| | magical | 3.00 | 2 | | | | | |
| | | **SR** | **20** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **57** | | | **TR** | **53** | |
| **Love-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Rose** | beautiful | 2.00 | 9 | 4.29 | beautiful | 2.00 | 10 | 4.29 |
| | blooming | 1.25 | 4 | | red | 1.33 | 6 | 1.77 |
| | pretty | 1.00 | 3 | | delicate | 2.00 | 6 | 3.01 |
| | red | 1.33 | 3 | | pretty | 1.75 | 4 | |
| | flower | 1.67 | 3 | | thorny | 2.00 | 4 | |
| | pink | 2.00 | 3 | | fragrant | 1.00 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | delicate | 1.00 | 2 | | romantic | 1.00 | 2 | |
| | romantic | 1.50 | 2 | | fragile | 2.00 | 2 | |
| | prickly | 3.00 | 2 | | | **SR** | **17** | |
| | soft | 3.00 | 2 | | | | | |
| | | **SR** | **24** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **48** | | | **TR** | **49** | |
| **Memory-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **River** | fluid | 1.20 | 10 | 2.16 | fluid | 2.00 | 10 | 2.16 |
| | long | 1.17 | 6 | 2.69 | long | 1.25 | 4 | |
| | full | 2.00 | 2 | | continuous | 1.67 | 3 | |
| | narrow | 1.50 | 2 | | changing | 1.50 | 2 | |
| | stream | 2.00 | 2 | | current | 2.50 | 2 | |
| | | **SR** | **26** | | deep | 1.50 | 2 | |
| | | | | | transparent | 1.50 | 2 | |
| | | | | | | **SR** | **24** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **55** | | | **TR** | **50** | |
| **Memories-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Sponges** | absorbant | 1.15 | 13 | 2.51 | absorption | 1.21 | 14 | 2.51 |
| | expandable | 2.00 | 2 | | retentive | 1.71 | 7 | 1.81 |
| | flexible | 2.00 | 2 | | holes | 1.50 | 2 | |
| | full | 1.50 | 2 | | malleable | 1.50 | 2 | |
| | retainable | 2.50 | 2 | | squishy | 2.00 | 2 | |
| | soaking | 1.00 | 3 | | expandable | 2.50 | 2 | |
| | | **SR** | **31** | | wet | 3.00 | 2 | |
| | | | | | | **SR** | **19** | |

| | Metaphor | | | | Simile | | | |
|---|---|---|---|---|---|---|---|---|
| | | **TR** | **53** | | | **TR** | **45** | |
| **Men-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Fish** | slippery | 1.67 | 3 | | slippery | 1.00 | 2 | |
| | small | 1.80 | 3 | | survivors | 1.00 | 2 | |
| | smelly | 2.33 | 3 | | dumb | 1.50 | 2 | |
| | swimmers | 1.00 | 2 | | living | 2.00 | 2 | |
| | animal | 2.00 | 2 | | slimy | 2.00 | 2 | |
| | numerous | 2.00 | 2 | | smelly | 2.00 | 2 | |
| | nutritious | 2.50 | 2 | | quick | 2.50 | 2 | |
| | plentiful | 2.50 | 2 | | | **SR** | **31** | |
| | | **SR** | **34** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **59** | | | **TR** | **57** | |
| **Minds-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Computers** | complicated | 2.00 | 11 | 5.74 | processing | 2.33 | 6 | 1.42 |
| | intelligent | 1.33 | 3 | | information | 1.67 | 3 | |
| | memory | 1.33 | 3 | | useful | 2.00 | 3 | |
| | calculating | 1.67 | 3 | | smart | 1.00 | 2 | |
| | fast | 1.00 | 2 | | organized | 1.50 | 2 | |
| | mechanical | 1.00 | 2 | | learning | 2.00 | 2 | |
| | electrical | 2.00 | 2 | | programmable | 2.00 | 2 | |
| | smart | 2.00 | 2 | | analytical | 2.50 | 2 | |
| | technological | 2.00 | 2 | | | **SR** | **35** | |
| | useful | 3.00 | 2 | | | | | |
| | | **SR** | **27** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |

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|---|---|---|---|---|---|---|---|---|
| | | **TR** | **53** | | | **TR** | **54** | |
| **Money-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Oxygen** | needed | 1.00 | 10 | 2.77 | needed | 1.21 | 19 | 2.77 |
| | life | 1.43 | 7 | 3.26 | life | 1.50 | 2 | |
| | vital | 1.80 | 5 | 2.48 | important | 2.00 | 2 | |
| | essential | 2.00 | 4 | | sustains life | 2.00 | 2 | |
| | important | 2.25 | 4 | | universal | 2.00 | 2 | |
| | survival | 2.33 | 3 | | everywhere | 3.00 | 2 | |
| | useful | 1.50 | 2 | | survive | 3.00 | 2 | |
| | air | 2.00 | 2 | | | **SR** | **23** | |
| | everything | 2.50 | 2 | | | | | |
| | sought out | 2.50 | 2 | | | | | |
| | | **SR** | **12** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **59** | | | **TR** | **53** | |
| **Music-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Medicine** | healing | 1.38 | 10 | 2.55 | soothing | 1.33 | 6 | 4.04 |
| | helpful | 1.60 | 8 | 3.63 | curing | 1.40 | 5 | 2.59 |
| | cure | 2.17 | 6 | 2.59 | therapy | 1.75 | 4 | |
| | calming | 2.00 | 4 | | helpful | 2.25 | 4 | |
| | soothing | 2.25 | 4 | | heals | 1.33 | 3 | |
| | addictive | 1.67 | 3 | | needed | 2.00 | 3 | |
| | relief | 2.00 | 2 | | good | 1.00 | 2 | |
| | relaxing | 2.50 | 2 | | calming | 1.50 | 2 | |
| | drugs | 3.00 | 2 | | remedy | 1.50 | 2 | |
| | | **SR** | **18** | | relieving | 2.50 | 2 | |
| | | | | | comforting | 3.00 | 2 | |

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|---|---|---|---|---|---|---|---|---|
| | | | | | treatment | 3.00 | 2 | |
| | | | | | | **SR** | **16** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **47** | | | **TR** | **40** | |
| **Obligations-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Shackles** | annoying | 1.20 | 5 | 4.50 | annoying | 1.67 | 3 | |
| | restraining | 2.50 | 4 | | confining | 1.67 | 3 | |
| | metallic | 1.00 | 2 | | heavy | 1.67 | 3 | |
| | prison | 1.00 | 2 | | binding | 1.50 | 2 | |
| | duty | 1.50 | 2 | | limiting | 1.50 | 2 | |
| | restricting | 1.50 | 2 | | prisonner | 1.50 | 2 | |
| | trapped | 1.50 | 2 | | frustrating | 2.00 | 2 | |
| | uncomfotable | 2.00 | 2 | | restrictive | 2.00 | 2 | |
| | | **SR** | **26** | | | **SR** | **21** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **53** | | | **TR** | **50** | |
| **Peace-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **River** | calming | 1.33 | 15 | 4.37 | calming | 1.30 | 14 | 4.37 |
| | long | 1.60 | 5 | 2.85 | nature | 2.00 | 3 | |
| | relaxing | 2.00 | 4 | | beautiful | 2.00 | 2 | |
| | quiet | 1.67 | 3 | | quiet | 2.00 | 2 | |
| | flowing | 2.00 | 3 | | serenity | 2.50 | 2 | |
| | clear | 3.00 | 2 | | | **SR** | **27** | |
| | | **SR** | **21** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **59** | | | **TR** | **59** | |
| **Pets-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Kids** | loving or lovable | 1.80 | 5 | 4.44 | playful | 1.00 | 4 | |
| | cute | 2.00 | 5 | 3.69 | cute | 1.50 | 4 | |
| | annoying | 1.50 | 4 | | energetic | 1.75 | 4 | |
| | fun | 1.50 | 4 | | annoying | 1.67 | 3 | |
| | small | 1.50 | 4 | | attentive | 2.00 | 3 | |
| | loud | 2.33 | 3 | | loud | 2.00 | 3 | |
| | curious | 1.50 | 2 | | needy | 2.33 | 3 | |
| | innocent | 1.50 | 2 | | responsibility | 1.50 | 2 | |
| | playful | 2.00 | 2 | | care | 2.00 | 2 | |
| | | **SR** | **28** | | dependent | 2.00 | 2 | |
| | | | | | innocent | 2.00 | 2 | |
| | | | | | small | 3.00 | 2 | |
| | | | | | | **SR** | **25** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **58** | | | **TR** | **58** | |
| **Rage-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Volcano** | erupts | 1.70 | 10 | 1.85 | explosive | 1.50 | 10 | 2.26 |
| | explosive | 1.78 | 9 | 2.26 | erupts | 1.14 | 7 | 1.85 |
| | dangerous | 2.00 | 8 | 3.93 | dangerous | 1.80 | 7 | 3.93 |
| | hot | 1.83 | 6 | 2.03 | destructive | 2.40 | 5 | 3.72 |
| | deadly | 2.75 | 4 | | unpredictable | 2.00 | 4 | |
| | red | 1.00 | 2 | | red | 2.33 | 3 | |
| | | **SR** | **19** | | violent | 1.50 | 2 | |
| | | | | | heat | 2.00 | 2 | |
| | | | | | hot | 2.00 | 2 | |
| | | | | | | **SR** | **16** | |
| | **Metaphor** | | | | **Simile** | | | |

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|---|---|---|---|---|---|---|---|---|
| | | **TR** | **42** | | | **TR** | **47** | |
| **Runners-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Torpedoes** | fast | 1.13 | 16 | 2.43 | fast | 1.08 | 13 | 2.43 |
| | speedy | 2.00 | 3 | | quick | 1.33 | 3 | |
| | | **SR** | **23** | | speedy | 2.33 | 3 | |
| | | | | | aimed | 2.00 | 2 | |
| | | | | | | **SR** | **26** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **54** | | | **TR** | **52** | |
| **Salesmen-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Bulldozers** | destructive | 2.43 | 7 | 3.09 | loud | 2.50 | 6 | 2.57 |
| | annoying | 2.25 | 4 | | persistent | 2.00 | 4 | |
| | aggressive | 1.33 | 3 | | destructive | 2.00 | 3 | |
| | imposing | 1.67 | 3 | | forcefull | 2.00 | 3 | |
| | loud | 1.67 | 3 | | annoying | 1.50 | 2 | |
| | powerful | 1.00 | 2 | | determined | 1.50 | 2 | |
| | big | 2.00 | 2 | | pushy | 2.00 | 2 | |
| | tough | 2.00 | 2 | | | **SR** | **30** | |
| | noisy | 2.50 | 2 | | | | | |
| | | **SR** | **26** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **58** | | | **TR** | **56** | |
| **Schools-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Zoos** | busy | 1.20 | 5 | 3.70 | wild | 1.20 | 5 | 3.05 |
| | crowded | 1.60 | 5 | 3.38 | crowded | 1.33 | 3 | |
| | loud | 2.00 | 5 | 3.61 | chaos | 1.00 | 2 | |
| | wild | 2.20 | 5 | 3.05 | animals | 2.00 | 2 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | noisy | 1.50 | 4 | | crazy | 2.00 | 2 | |
| | full | 2.50 | 4 | | exciting | 2.00 | 2 | |
| | crazy | 1.33 | 3 | | loud | 2.00 | 2 | |
| | animals | 1.00 | 2 | | active | 2.50 | 2 | |
| | packed | 1.50 | 2 | | controlling | 3.00 | 2 | |
| | messy | 2.00 | 2 | | | **SR** | **34** | |
| | dirty | 2.50 | 2 | | | | | |
| | smelly | 3.00 | 2 | | | | | |
| | | **SR** | **17** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **51** | | | **TR** | **50** | |
| **Science-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Politics** | complicated | 1.00 | 4 | | complicated | 1.00 | 5 | 4.31 |
| | debatable | 1.67 | 3 | | debateful | 1.50 | 4 | |
| | arguments | 2.33 | 3 | | argumentative | 2.00 | 3 | |
| | biased | 1.50 | 2 | | challenging | 2.67 | 3 | |
| | confusing | 1.50 | 2 | | annoying | 2.00 | 2 | |
| | interesting | 1.50 | 2 | | difficult | 2.00 | 2 | |
| | conflicts | 2.00 | 2 | | | **SR** | **31** | |
| | theory | 2.00 | 2 | | | | | |
| | knowledge | 3.00 | 2 | | | | | |
| | | **SR** | **29** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **48** | | | **TR** | **53** | |
| **Sermons-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Sleeping Pills** | boring | 1.30 | 10 | 4.6 | boring | 1.50 | 8 | 4.60 |
| | tiring | 1.67 | 6 | 2.55 | tiring | 1.50 | 8 | 2.55 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | sleepy | 1.75 | 4 | | drowsy | 1.50 | 4 | |
| | drowsy | 1.67 | 3 | | sleepy | 2.50 | 4 | |
| | long | 2.00 | 2 | | annoying | 2.50 | 2 | |
| | small | 2.00 | 2 | | long | 2.50 | 2 | |
| | useful | 2.00 | 2 | | relaxing | 2.50 | 2 | |
| | uninteresting | 2.50 | 2 | | unhealthy | 3.00 | 2 | |
| | | **SR** | **17** | | | **SR** | **21** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **54** | | | **TR** | **59** | |
| **Skating-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Flying** | freedom | 1.29 | 7 | 4.24 | freedom | 1.82 | 11 | 4.24 |
| | fast | 1.80 | 5 | 3.29 | fun | 2.20 | 5 | 4.37 |
| | relaxing | 2.00 | 5 | 4.5 | gliding | 1.50 | 4 | |
| | fun | 2.00 | 3 | | fast | 2.00 | 3 | |
| | moving | 1.00 | 2 | | smooth | 2.33 | 3 | |
| | soaring | 1.00 | 2 | | airless | 3.00 | 3 | |
| | amazing | 1.50 | 2 | | exilirating | 1.50 | 2 | |
| | gliding | 1.50 | 2 | | liberating | 2.00 | 2 | |
| | lightweight | 2.00 | 2 | | sky | 2.00 | 2 | |
| | enjoying | 2.50 | 2 | | windy | 2.00 | 2 | |
| | exciting | 2.50 | 2 | | exciting | 2.50 | 2 | |
| | bird | 3.00 | 2 | | | **SR** | **20** | |
| | | **SR** | **18** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **29** | | | **TR** | **36** | |
| **Smog-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Shroud** | unclear | 1.67 | 3 | | covers | 1.33 | 6 | 2.22 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | blurry | 1.00 | 2 | | blinding | 1.00 | 2 | |
| | cloudy | 1.50 | 2 | | thick | 1.50 | 2 | |
| | dirty | 1.50 | 2 | | dark | 2.00 | 2 | |
| | engulfing | 1.50 | 2 | | | **SR** | **24** | |
| | thick | 1.50 | 2 | | | | | |
| | | **SR** | **16** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **32** | | | **TR** | **50** | |
| **Soldiers-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Pawns** | unimportant | 1.00 | 2 | | controlled | 1.17 | 6 | 3.18 |
| | followers | 1.50 | 2 | | useful | 2.20 | 5 | 3.93 |
| | moved or movable | 1.50 | 2 | | expendable | 1.00 | 3 | |
| | small | 1.50 | 2 | | puppets | 1.50 | 2 | |
| | | **SR** | **24** | | small | 1.50 | 2 | |
| | | | | | weak | 1.50 | 2 | |
| | | | | | played | 2.00 | 2 | |
| | | | | | orders | 3.00 | 2 | |
| | | | | | | **SR** | **26** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **54** | | | **TR** | **52** | |
| **Store-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Zoo** | crowded | 1.40 | 5 | 3.38 | busy | 1.83 | 6 | 3.70 |
| | loud | 1.25 | 4 | | crowded | 1.00 | 4 | |
| | noisy | 2.50 | 4 | | loud | 1.75 | 4 | |
| | messy | 1.00 | 3 | | messy | 1.75 | 4 | |
| | busy | 1.67 | 3 | | chaotic | 2.00 | 4 | |
| | wild | 2.33 | 3 | | wild | 1.67 | 3 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | crazy | 1.00 | 2 | | diversity | 2.67 | 3 | |
| | hectic | 1.00 | 2 | | packed | 1.50 | 2 | |
| | packed | 1.00 | 2 | | animals | 2.50 | 2 | |
| | animals | 1.50 | 2 | | nature | 2.50 | 2 | |
| | smelly | 2.00 | 2 | | | **SR** | **18** | |
| | confining | 2.50 | 2 | | | | | |
| | | **SR** | **20** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **50** | | | **TR** | **58** | |
| **Teachers-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Sculptors** | creators | 1.00 | 5 | 2.44 | creators | 1.69 | 13 | 2.44 |
| | artists | 1.25 | 5 | 2.51 | artists | 1.00 | 5 | 2.51 |
| | builders | 1.25 | 5 | 2.20 | molds | 1.75 | 4 | |
| | creative | 1.50 | 4 | | shaping | 1.33 | 3 | |
| | shaping | 1.33 | 3 | | inspiring | 2.00 | 3 | |
| | knowledge | 2.00 | 2 | | imaginative | 1.00 | 2 | |
| | Crafty | 2.50 | 2 | | educational | 2.00 | 2 | |
| | | **SR** | **24** | | influential | 2.00 | 2 | |
| | | | | | makers | 2.50 | 2 | |
| | | | | | | **SR** | **22** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **58** | | | **TR** | **56** | |
| **Television-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Candy** | sweet | 1.33 | 9 | 1.76 | addictive | 1.50 | 8 | 4.27 |
| | addictive | 1.57 | 7 | 4.27 | sweet | 1.33 | 6 | 1.76 |
| | good | 1.60 | 5 | 4.13 | unhealthy | 2.00 | 5 | 3.08 |
| | fun | 1.75 | 4 | | treat | 1.75 | 4 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | harmful | 2.33 | 3 | | good | 1.00 | 3 | |
| | treat | 2.33 | 3 | | colourful | 2.67 | 3 | |
| | tasty or tasting | 2.67 | 3 | | fun | 2.00 | 2 | |
| | yummy | 1.50 | 2 | | tasty | 2.00 | 2 | |
| | enjoyful or enjoyable | 2.00 | 2 | | tempting | 2.00 | 2 | |
| | entertaining | 2.50 | 2 | | enjoyable | 2.50 | 2 | |
| | | **SR** | **18** | | pleasurable | 2.50 | 2 | |
| | | | | | | **SR** | **17** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **58** | | | **TR** | **54** | |
| **Tv-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Drug** | addictive | 1.16 | 19 | 2.93 | addictive | 1.06 | 16 | 2.93 |
| | bad | 2.25 | 4 | | unhealthy | 2.00 | 3 | |
| | fun | 2.25 | 4 | | fun | 2.00 | 2 | |
| | good | 2.00 | 2 | | recreational | 2.50 | 2 | |
| | harmful | 2.00 | 2 | | time consuming | 2.50 | 2 | |
| | exciting | 2.50 | 2 | | unnecessary | 2.50 | 2 | |
| | unhealthy | 2.50 | 2 | | various | 2.50 | 2 | |
| | healing | 3.00 | 2 | | colours | 3.00 | 2 | |
| | | **SR** | **21** | | | **SR** | **23** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **53** | | | **TR** | **55** | |
| **Time-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Money** | important | 1.38 | 8 | 4.36 | precious | 1.67 | 6 | 4.16 |
| | powerful | 1.67 | 3 | | valuable | 1.60 | 5 | 3.28 |
| | value | 1.67 | 3 | | important | 2.25 | 4 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | precious | 2.00 | 3 | | necessity | 3.00 | 4 | |
| | expensive | 1.00 | 2 | | scarce | 1.50 | 2 | |
| | limited | 2.00 | 2 | | finite | 2.00 | 2 | |
| | spent or spending | 2.00 | 2 | | needed | 3.00 | 2 | |
| | needed | 2.50 | 2 | | | **SR** | **30** | |
| | | **SR** | **28** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **50** | | | **TR** | **47** | |
| **Time-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Snail** | slow | 1.00 | 15 | 2.53 | slow | 1.00 | 17 | 2.53 |
| | small | 1.33 | 3 | | steady | 2.33 | 3 | |
| | long | 2.33 | 3 | | ugly | 2.00 | 2 | |
| | steady | 2.00 | 2 | | slimy | 3.00 | 2 | |
| | slimy | 2.50 | 2 | | | **SR** | **23** | |
| | never-ending | 3.00 | 2 | | | | | |
| | | **SR** | **23** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **50** | | | **TR** | **49** | |
| **Time-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Thief** | steals | 1.50 | 5 | 1.72 | fast | 1.43 | 14 | 4.15 |
| | fast | 1.80 | 5 | 4.15 | steals | 1.00 | 3 | |
| | quick | 1.33 | 3 | | deceptive | 2.33 | 3 | |
| | short | 2.00 | 3 | | sneaky | 2.33 | 3 | |
| | bad | 2.00 | 2 | | mean | 2.50 | 2 | |
| | money | 2.50 | 2 | | | **SR** | **24** | |
| | taking | 2.50 | 2 | | | | | |
| | | **SR** | **28** | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **55** | | | **TR** | **52** | |
| **Tongues-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Fire** | hot | 1.33 | 9 | 1.35 | red | 1.71 | 7 | 2.11 |
| | red | 2.00 | 5 | 2.11 | dangerous | 2.00 | 7 | 3.56 |
| | burning | 1.50 | 4 | | hot | 1.67 | 6 | 1.35 |
| | spicy | 2.33 | 3 | | burning | 1.75 | 4 | |
| | warm | 1.50 | 2 | | hurtful | 2.00 | 3 | |
| | angry | 2.50 | 2 | | warm | 2.00 | 2 | |
| | hurtful | 2.50 | 2 | | | **SR** | **23** | |
| | damaging | 3.00 | 2 | | | | | |
| | | **SR** | **26** | | | | | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **43** | | | **TR** | **55** | |
| **Tree Trunks-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Straws** | long | 1.75 | 8 | 2.06 | long | 1.55 | 11 | 2.06 |
| | thin | 1.40 | 5 | 1.90 | cylindrical | 1.60 | 4 | |
| | tall | 1.25 | 4 | | straight | 1.80 | 4 | |
| | hollow | 2.33 | 3 | | round | 1.33 | 3 | |
| | drink | 1.00 | 2 | | narrow | 1.67 | 3 | |
| | colourful | 2.50 | 2 | | circular | 2.00 | 3 | |
| | weakening | 2.50 | 2 | | useful | 2.67 | 3 | |
| | | **SR** | **17** | | thn | 1.50 | 2 | |
| | | | | | tall | 2.00 | 2 | |
| | | | | | hollow | 2.50 | 2 | |
| | | | | | | **SR** | **18** | |
| | **Metaphor** | | | | **Simile** | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **TR** | **52** | | | **TR** | **52** | |
| **Trees-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Umbrellas** | protects | 1.64 | 14 | 3.23 | protects | 1.46 | 13 | 3.23 |
| | covers | 1.60 | 5 | 2.03 | covers | 1.60 | 5 | 2.03 |
| | big | 1.67 | 3 | | open | 1.00 | 3 | |
| | shading | 1.67 | 3 | | shelters | 2.00 | 3 | |
| | useful | 3.00 | 3 | | round | 2.33 | 3 | |
| | wide | 1.50 | 2 | | colourful | 2.67 | 3 | |
| | rainy | 2.00 | 2 | | useful | 2.67 | 3 | |
| | refuge | 2.50 | 2 | | branch-out | 1.00 | 2 | |
| | open | 3.00 | 2 | | water-resistant | 2.50 | 2 | |
| | | **SR** | **16** | | wide | 2.50 | 2 | |
| | | | | | | **SR** | **13** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **48** | | | **TR** | **50** | |
| **Trust-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Glue** | sticky | 1.38 | 13 | 1.79 | sticky | 1.40 | 10 | 1.79 |
| | binds | 1.00 | 5 | 2.72 | binds | 2.40 | 5 | 2.72 |
| | lasting | 2.67 | 3 | | strong | 1.75 | 4 | |
| | strong | 2.67 | 3 | | binding | 1.67 | 3 | |
| | holding | 1.50 | 2 | | useful | 2.33 | 3 | |
| | forever | 2.00 | 2 | | foundation | 1.50 | 2 | |
| | important | 2.00 | 2 | | stays | 2.00 | 2 | |
| | permanent | 2.00 | 2 | | cohesive | 2.50 | 2 | |
| | tough | 2.00 | 2 | | | **SR** | **19** | |
| | unifying | 2.00 | 2 | | | | | |
| | | **SR** | **12** | | | | | |

| | Metaphor | | | | Simile | | | |
|---|---|---|---|---|---|---|---|---|
| | | **TR** | **51** | | | **TR** | **51** | |
| **Typewriters-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Dinosaurs** | old | 1.36 | 11 | 2.84 | ancient | 1.36 | 11 | 2.79 |
| | ancient | 1.33 | 6 | 2.79 | old | 1.10 | 10 | 2.84 |
| | extinguished | 2.17 | 6 | 2.60 | extinct | 2.50 | 4 | |
| | big | 2.00 | 2 | | out-dated | 2.00 | 3 | |
| | antiques | 2.50 | 2 | | replaced | 2.33 | 3 | |
| | | **SR** | **24** | | huge | 1.50 | 2 | |
| | | | | | dead | 2.00 | 2 | |
| | | | | | obsolete | 2.00 | 2 | |
| | | | | | useful | 2.50 | 2 | |
| | | | | | | **SR** | **12** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **59** | | | **TR** | **57** | |
| **Winter-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Death** | cold | 1.13 | 15 | 3.61 | cold | 1.13 | 15 | 3.61 |
| | darkness | 2.00 | 4 | | lonely | 2.00 | 4 | |
| | end | 1.00 | 2 | | depressing | 2.00 | 3 | |
| | white | 2.50 | 2 | | lifeless | 2.33 | 3 | |
| | unwelcomed | 3.00 | 2 | | scary | 3.00 | 3 | |
| | | **SR** | **34** | | ending | 2.00 | 2 | |
| | | | | | dark | 2.50 | 2 | |
| | | | | | isolated | 3.00 | 2 | |
| | | | | | | **SR** | **23** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **52** | | | **TR** | **58** | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Wisdom-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Ocean** | vast | 1.38 | 9 | 2.07 | deep | 1.38 | 8 | 1.78 |
| | huge | 1.80 | 8 | 2.26 | vast | 1.75 | 4 | |
| | wide | 1.33 | 3 | | huge | 1.00 | 3 | |
| | deep | 2.00 | 3 | | old | 2.33 | 3 | |
| | infinite | 1.00 | 2 | | calm | 1.50 | 2 | |
| | flowing | 2.00 | 2 | | endless | 1.50 | 2 | |
| | mysterious | 2.00 | 2 | | infinite | 2.00 | 2 | |
| | powerful | 2.00 | 2 | | large | 2.50 | 2 | |
| | | **SR** | **21** | | serene | 2.50 | 2 | |
| | | | | | blue | 3.00 | 2 | |
| | | | | | | **SR** | **28** | |
| | **Metaphor** | | | | **Simile** | | | |
| | | **TR** | **60** | | | **TR** | **58** | |
| **Women-** | **Response** | **Sal** | **Freq** | **Conn** | **Response** | **Sal** | **Freq** | **Conn** |
| **Cats** | independent | 2.00 | 5 | 4.26 | independent | 2.29 | 7 | 4.26 |
| | soft | 1.75 | 4 | | affectionate | 1.00 | 2 | |
| | lovable | 2.33 | 3 | | elegant | 1.00 | 2 | |
| | playful | 1.00 | 2 | | beautiful | 1.50 | 2 | |
| | sneaky | 1.50 | 2 | | cute | 1.50 | 2 | |
| | beautiful | 2.00 | 2 | | graceful | 1.50 | 2 | |
| | sly | 2.00 | 2 | | sneaky | 1.50 | 2 | |
| | aggressive | 2.50 | 2 | | soft | 1.50 | 2 | |
| | smart | 2.50 | 2 | | warm | 1.50 | 2 | |
| | cuddling | 3.00 | 2 | | funny | 2.00 | 2 | |
| | intelligent | 3.00 | 2 | | smart | 2.00 | 2 | |
| | | **SR** | **32** | | friendly | 2.50 | 2 | |

| | | | | |
|---|---|---|---|---|
| | | loving | 3.00 | 2 |
| | | | **SR** | **27** |

Table 2C: Properties written for Topics and Vehicles in Isolation

Legend

*Conn = Average Connotativeness Rating*

*Sal = Average Saliency Rating*

*Freq = Frequency*

*TR = Total Responses*

*SR = Single Responses*

| **Topic-Vehicle** | **Properties for Topic** | | | **Properties for Vehicle** | | |
|---|---|---|---|---|---|---|
| **Alcohol-Crutch** | **Topic** | | | **Vehicle** | | |
| | | **TR** | **128** | | **TR** | **91** |
| | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | dangerous | 2.29 | 7 | helpful | 1.33 | 6 |
| | addictive | 2.00 | 6 | injured | 4.25 | 4 |
| | drunks | 2.00 | 5 | hard | 3.00 | 3 |
| | depressant | 1.00 | 2 | dependent | 1.50 | 2 |
| | death | 3.00 | 2 | annoying | 2.00 | 2 |
| | bitter | 4.50 | 2 | broken | 4.50 | 2 |
| | | **SR** | **104** | | **SR** | **72** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **117** | | **TR** | **114** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Anger-Fire** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | emotions | 3.40 | 5 | dangerous | 3.71 | 14 |
| | dangerous | 3.00 | 3 | burns | 4.13 | 8 |
| | fearful | 2.50 | 2 | destructive | 3.71 | 7 |
| | aggressive | 3.00 | 2 | death | 4.00 | 5 |
| | dark | 4.50 | 2 | flames | 2.00 | 3 |
| | controlled | 5.00 | 2 | bright | 4.00 | 3 |
| | | **SR** | **101** | | **SR** | **74** |
| **Anger-Heart** | **Topic** | | | **Vehicle** | | |
| | | **TR** | **117** | | **TR** | **111** |
| | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | emotions | 3.40 | 5 | beating | 3.13 | 8 |
| | dangerous | 3.00 | 3 | bloody | 3.00 | 6 |
| | fearful | 2.50 | 2 | big | 3.00 | 3 |
| | aggressive | 3.00 | 2 | broken | 3.33 | 3 |
| | dark | 4.50 | 2 | cards | 1.00 | 2 |
| | controlled | 5.00 | 2 | attack | 4.50 | 2 |
| | | **SR** | **101** | | **SR** | **87** |
| **Beauty-Passport** | **Topic** | | | **Vehicle** | | |
| | | **TR** | **111** | | **TR** | **104** |
| | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | nature | 1.75 | 4 | booklet | 4.33 | 3 |
| | desired | 2.00 | 3 | blue | 5.00 | 3 |
| | inner | 2.00 | 2 | customs | 2.50 | 2 |
| | good | 4.00 | 2 | descriptive | 2.50 | 2 |
| | peaceful | 4.00 | 2 | freedom | 2.50 | 2 |
| | happy | 4.50 | 2 | airport | 3.50 | 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | **SR** | **96** | | **SR** | **90** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **117** | | **TR** | **121** |
| **Bible-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Sword** | faithful | 2.83 | 6 | dangerous | 3.33 | 12 |
| | book | 2.75 | 4 | death | 4.67 | 6 |
| | black | 2.00 | 3 | hard | 2.50 | 2 |
| | christianity | 1.50 | 2 | fight | 3.00 | 2 |
| | educative | 2.50 | 2 | cutting | 4.00 | 2 |
| | hard cover | 5.00 | 2 | dectrotive | 5.50 | 2 |
| | | **SR** | **98** | | **SR** | **95** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **111** | | **TR** | **99** |
| **Billboards-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Warts** | big | 2.50 | 12 | big | 3.80 | 5 |
| | colourful | 3.43 | 7 | gross | 2.20 | 5 |
| | advertize | 2.00 | 5 | contagious | 3.00 | 4 |
| | catchy | 2.00 | 2 | disgusting | 1.00 | 3 |
| | black | 2.50 | 2 | bumpy | 3.00 | 2 |
| | attention | 4.00 | 2 | embarassing | 4.00 | 2 |
| | | **SR** | **81** | | **SR** | **78** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **109** | | **TR** | **115** |
| **Christ-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Door** | faithful | 2.00 | 4 | closed | 2.75 | 8 |
| | bible | 1.50 | 2 | hard | 1.75 | 4 |
| | godly | 2.00 | 2 | big | 1.67 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | believers | 2.50 | 2 | glass | 2.00 | 2 |
| | forgiving | 4.00 | 2 | entrance | 2.50 | 2 |
| | christianity | 4.50 | 2 | heavy | 5.00 | 2 |
| | | **SR** | **95** | | **SR** | **94** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **86** | | **TR** | **124** |
| **Christians-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Salt** | faithful | 1.29 | 7 | dry | 3.00 | 3 |
| | believing | 1.50 | 2 | crystallize | 3.33 | 3 |
| | friendly | 2.00 | 2 | edible | 4.67 | 3 |
| | church | 3.00 | 2 | cooking | 5.33 | 3 |
| | biblical | 4.00 | 2 | fattening | 2.50 | 2 |
| | biased | 4.50 | 2 | cubic | 3.00 | 2 |
| | | **SR** | **69** | | **SR** | **108** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **127** | | **TR** | **86** |
| **Cigarettes-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Time Bombs** | addictive | 2.91 | 11 | dangerous | 2.33 | 9 |
| | bad | 2.20 | 5 | destructive | 1.75 | 4 |
| | dangerous | 1.60 | 5 | death | 2.33 | 3 |
| | cancerous | 2.50 | 4 | black | 4.33 | 3 |
| | cylindrical | 3.00 | 3 | clocks | 2.00 | 2 |
| | burning | 2.50 | 2 | big | 2.50 | 2 |
| | | **SR** | **97** | | **SR** | **63** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **126** | | **TR** | **117** |
| **Cities-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Jungles** | crowded | 2.00 | 8 | dangerous | 4.57 | 7 |
| | big | 2.14 | 7 | animals | 3.50 | 6 |
| | busy | 2.14 | 7 | big | 1.25 | 4 |
| | dangerous | 3.00 | 3 | beautiful | 4.33 | 3 |
| | eventful | 3.50 | 2 | crowded | 1.50 | 2 |
| | cultural | 4.50 | 2 | dark | 3.50 | 2 |
| | | **SR** | **97** | | **SR** | **93** |
| **Clouds-Cotton** | **Topic** | | | **Vehicle** | | |
| | | **TR** | **125** | | **TR** | **119** |
| | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | fluffy | 2.50 | 10 | fluffy | 2.83 | 12 |
| | big | 3.50 | 6 | comfy | 4.17 | 6 |
| | beautiful | 2.00 | 2 | light | 3.67 | 3 |
| | blue | 2.00 | 2 | clean | 4.33 | 3 |
| | darkness | 3.00 | 2 | clothes | 4.67 | 3 |
| | cold | 4.50 | 2 | natural | 5.50 | 2 |
| | | **SR** | **101** | | **SR** | **90** |
| **Debt-Disease** | **Topic** | | | **Vehicle** | | |
| | | **TR** | **108** | | **TR** | **99** |
| | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | dangerous | 3.20 | 5 | death | 2.43 | 7 |
| | bad | 1.50 | 4 | contagious | 2.25 | 4 |
| | credit cards | 3.50 | 4 | dangerous | 2.00 | 3 |
| | annoying | 1.00 | 2 | inevitable | 3.00 | 3 |
| | banks | 2.50 | 2 | cures | 5.00 | 3 |
| | anxious | 5.00 | 2 | bad | 1.50 | 2 |
| | | **SR** | **89** | | **SR** | **77** |

| | Topic | | | Vehicle | | |
|---|---|---|---|---|---|---|
| | | **TR** | **125** | | **TR** | **111** |
| **Deserts-Ovens** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | dry | 2.20 | 10 | big | 2.33 | 6 |
| | delicous | 1.00 | 4 | dangerous | 2.00 | 4 |
| | fattening | 1.67 | 3 | dirty | 4.33 | 3 |
| | cold | 1.50 | 2 | burn | 2.00 | 2 |
| | chocolatey | 3.00 | 2 | black | 3.00 | 2 |
| | barren | 3.50 | 2 | bake | 4.00 | 2 |
| | | **SR** | **102** | | **SR** | **92** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **116** | | **TR** | **107** |
| **Desks-Junkyards** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | hard | 1.89 | 9 | dirty | 2.50 | 12 |
| | flat | 2.29 | 7 | big | 3.00 | 4 |
| | brown | 2.33 | 6 | cars | 2.00 | 3 |
| | big | 3.17 | 6 | crowded | 1.50 | 2 |
| | chairs | 4.00 | 3 | cluttered | 2.50 | 2 |
| | computer | 5.50 | 2 | dangerous | 4.00 | 2 |
| | | **SR** | **83** | | **SR** | **82** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **112** | | **TR** | **124** |
| **Dreams-Water** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | funny | 2.00 | 5 | cool | 3.38 | 8 |
| | confusing | 3.00 | 3 | clear | 1.80 | 5 |
| | imaginative | 3.00 | 3 | clean | 4.80 | 5 |
| | fantasy | 4.00 | 3 | blue | 2.25 | 4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | exciting | 3.50 | 2 | drinkable | 3.67 | 3 |
| | informative | 4.00 | 2 | dirty | 2.00 | 2 |
| | | **SR** | **94** | | **SR** | **97** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **124** | | **TR** | **106** |
| **Education-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Stairway** | good | 2.00 | 3 | dark | 3.33 | 3 |
| | expensive | 3.00 | 3 | exercising | 3.67 | 3 |
| | fun | 3.00 | 3 | descending | 2.00 | 2 |
| | helpful | 4.67 | 3 | height | 3.00 | 2 |
| | enlightening | 4.00 | 2 | hard | 3.50 | 2 |
| | growth | 4.50 | 2 | healthy | 5.50 | 2 |
| | | **SR** | **108** | | **SR** | **92** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **117** | | **TR** | **76** |
| **Exams-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Hurdles** | easy | 5.00 | 4 | hight | 1.50 | 6 |
| | difficult | 3.33 | 3 | hard | 3.50 | 4 |
| | boring | 4.33 | 3 | annoying | 1.33 | 3 |
| | grades | 4.33 | 3 | challenging | 3.00 | 3 |
| | challenging | 2.50 | 2 | important | 2.50 | 2 |
| | educative | 3.00 | 2 | difficult | 4.00 | 2 |
| | | **SR** | **100** | | **SR** | **56** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **106** | | **TR** | **114** |
| **Eyelids-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Curtains** | closed | 2.50 | 6 | colourful | 2.50 | 10 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | darkness | 3.50 | 4 | closure | 3.00 | 6 |
| | beautiful | 2.00 | 2 | darkness | 3.17 | 6 |
| | covering | 2.50 | 2 | decorative | 3.00 | 4 |
| | black | 3.00 | 2 | drapy | 3.33 | 3 |
| | colourful | 4.00 | 2 | blocking | 3.67 | 3 |
| | | **SR** | **88** | | **SR** | **82** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **99** | | **TR** | **90** |
| **Faith-Raft** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | hopeful | 3.17 | 6 | floats | 2.00 | 5 |
| | believing | 2.80 | 5 | dangerous | 3.50 | 4 |
| | important | 1.00 | 3 | big | 1.67 | 3 |
| | blinding | 1.00 | 2 | fun | 4.33 | 3 |
| | intangible | 2.50 | 2 | flat | 2.50 | 2 |
| | inspiring | 4.00 | 2 | buoyant | 3.50 | 2 |
| | | **SR** | **79** | | **SR** | **71** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **124** | | **TR** | **95** |
| **Families-Fortresses** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | caring | 3.33 | 6 | big | 2.50 | 6 |
| | big | 2.00 | 4 | defensive | 4.00 | 3 |
| | close | 2.33 | 3 | castle | 1.50 | 2 |
| | children | 2.67 | 3 | ancient | 3.50 | 2 |
| | divorced | 2.50 | 2 | gray | 3.50 | 2 |
| | annoying | 3.50 | 2 | cold | 4.00 | 2 |
| | | **SR** | **104** | | **SR** | **78** |
| | **Topic** | | | **Vehicle** | | |

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|---|---|---|---|---|---|---|
| | | TR | 92 | | TR | 104 |
| Fingerprints-Portraits | Response | Sal | Freq | Response | Sal | Freq |
| | different | 2.00 | 3 | beautiful | 3.25 | 8 |
| | black | 3.50 | 2 | colourful | 2.67 | 6 |
| | finger | 3.50 | 2 | artistic | 4.00 | 6 |
| | dirty | 4.00 | 2 | drawn | 3.00 | 3 |
| | distinction | 4.00 | 2 | familiar | 1.50 | 2 |
| | csi | 5.00 | 2 | family | 2.00 | 2 |
| | | SR | 79 | | SR | 77 |
| Friendship-Rainbow | Topic | | | Vehicle | | |
| | | TR | 113 | | TR | 109 |
| | Response | Sal | Freq | Response | Sal | Freq |
| | caring | 3.20 | 5 | colours | 1.25 | 20 |
| | helpful | 3.80 | 5 | curvy | 3.00 | 3 |
| | fun | 4.00 | 4 | beautiful | 2.50 | 2 |
| | comforting | 3.50 | 2 | bright | 3.00 | 2 |
| | happy | 4.00 | 2 | gay | 3.50 | 2 |
| | endearing | 4.50 | 2 | blue | 5.00 | 2 |
| | | SR | 93 | | SR | 78 |
| Genes-Blueprints | Topic | | | Vehicle | | |
| | | TR | 108 | | TR | 93 |
| | Response | Sal | Freq | Response | Sal | Freq |
| | biology | 2.33 | 3 | blue | 2.38 | 8 |
| | dna | 2.67 | 3 | big | 2.00 | 3 |
| | chromosomes | 3.33 | 3 | construction | 4.33 | 3 |
| | different | 2.50 | 2 | descriptive | 2.00 | 2 |
| | family | 3.00 | 2 | copy | 3.00 | 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | evolutionary | 3.50 | 2 | exact | 3.00 | 2 |
| | | **SR** | **93** | | **SR** | **73** |
| **Giraffes-Skyscrapers** | **Topic** | | | **Vehicle** | | |
| | | **TR** | **119** | | **TR** | **100** |
| | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | brown | 3.00 | 5 | glassy | 3.83 | 6 |
| | big | 1.00 | 3 | big | 1.50 | 4 |
| | animals | 2.00 | 2 | business | 5.00 | 3 |
| | colourful | 2.50 | 2 | expensive | 4.00 | 2 |
| | african | 4.00 | 2 | busy | 4.50 | 2 |
| | cute | 5.50 | 2 | beautiful | 5.50 | 2 |
| | | **SR** | **103** | | **SR** | **81** |
| **God-Fire** | **Topic** | | | **Vehicle** | | |
| | | **TR** | **102** | | **TR** | **114** |
| | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | almighty | 1.60 | 5 | dangerous | 3.71 | 14 |
| | beliefs | 3.33 | 3 | burns | 4.13 | 8 |
| | forgiving | 4.00 | 3 | destructive | 3.71 | 7 |
| | existant | 1.50 | 2 | death | 4.00 | 5 |
| | faithful | 2.50 | 2 | flames | 2.00 | 3 |
| | creator | 4.00 | 2 | bright | 4.00 | 3 |
| | | **SR** | **85** | | **SR** | **74** |
| **God-Parent** | **Topic** | | | **Vehicle** | | |
| | | **TR** | **102** | | **TR** | **135** |
| | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | almighty | 1.60 | 5 | caring | 3.20 | 10 |
| | beliefs | 3.33 | 3 | helpful | 2.40 | 5 |

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|---|---|---|---|---|---|---|
| | forgiving | 4.00 | 3 | authority | 2.67 | 3 |
| | existant | 1.50 | 2 | family | 2.50 | 2 |
| | faithful | 2.50 | 2 | home | 5.00 | 2 |
| | creator | 4.00 | 2 | believing | 5.50 | 2 |
| | | **SR** | **85** | | **SR** | **111** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **94** | | **TR** | **41** |
| **Greed-Buzzard** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | selfishness | 2.67 | 9 | loud | 2.20 | 5 |
| | bad | 2.00 | 5 | annoying | 2.00 | 3 |
| | money | 1.50 | 4 | flying | 4.33 | 3 |
| | powerful | 3.00 | 4 | birdy | 1.00 | 2 |
| | sinful | 1.67 | 3 | ominous | 5.50 | 2 |
| | mean | 2.50 | 2 | | **SR** | **26** |
| | | **SR** | **67** | | | |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **90** | | **TR** | **110** |
| **Health-Glass** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | important | 1.67 | 12 | breakable | 1.89 | 9 |
| | good | 1.57 | 7 | clear | 1.67 | 6 |
| | bad | 2.25 | 4 | colourless | 3.33 | 6 |
| | fragile | 3.00 | 2 | broken | 1.00 | 2 |
| | happy | 3.00 | 2 | big | 4.50 | 2 |
| | disease | 3.50 | 2 | bright | 4.50 | 2 |
| | | **SR** | **61** | | **SR** | **83** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **111** | | **TR** | **108** |

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| **Hearts-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Closests** | beating | 3.13 | 8 | closed | 1.67 | 6 |
| | bloody | 3.00 | 6 | clothes | 3.00 | 5 |
| | big | 3.00 | 3 | big | 2.00 | 4 |
| | broken | 3.33 | 3 | claustrophobic | 4.33 | 3 |
| | cards | 1.00 | 2 | cold | 4.50 | 2 |
| | attack | 4.50 | 2 | cluttered | 5.00 | 2 |
| | | **SR** | **87** | | **SR** | **86** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **112** | | **TR** | **105** |
| **Heaven-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Treasure** | angels | 3.14 | 7 | golden | 2.63 | 8 |
| | beautiful | 3.50 | 4 | expensive | 2.75 | 4 |
| | bright | 3.00 | 3 | burried | 3.00 | 3 |
| | blue | 1.50 | 2 | chest | 1.00 | 2 |
| | belief | 2.00 | 2 | box | 3.50 | 2 |
| | blissful | 3.50 | 2 | exciting | 4.00 | 2 |
| | | **SR** | **92** | | **SR** | **84** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **112** | | **TR** | **124** |
| **Highways-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Snakes** | dangerous | 2.43 | 7 | dangerous | 3.00 | 8 |
| | cars | 3.00 | 5 | death | 3.75 | 4 |
| | annoying | 2.50 | 2 | colourful | 5.00 | 2 |
| | busy | 2.50 | 2 | fast | 5.00 | 2 |
| | direction | 4.50 | 2 | big | 5.50 | 2 |
| | bumpy | 5.00 | 2 | frightening | 5.50 | 2 |

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|---|---|---|---|---|---|---|
| | | **SR** | **92** | | **SR** | **104** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **114** | | **TR** | **108** |
| **Insults-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Daggers** | hurtful | 1.33 | 15 | dangerous | 3.00 | 13 |
| | funny | 3.67 | 3 | death | 5.00 | 3 |
| | hateful | 3.67 | 3 | hurtful | 2.00 | 2 |
| | emotions | 4.00 | 3 | blade | 3.00 | 2 |
| | bad | 2.50 | 2 | cutting | 3.50 | 2 |
| | bullying | 5.00 | 2 | ancient | 5.00 | 2 |
| | | **SR** | **86** | | **SR** | **84** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **117** | | **TR** | **119** |
| **Job-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Jail** | boring | 3.38 | 8 | cold | 2.50 | 6 |
| | demanding | 1.67 | 3 | dangerous | 3.00 | 6 |
| | challenging | 2.50 | 2 | confining | 3.00 | 4 |
| | daily | 3.50 | 2 | criminals | 4.00 | 4 |
| | educative | 3.50 | 2 | cells | 3.00 | 3 |
| | benefit | 4.50 | 2 | bars | 2.50 | 2 |
| | | **SR** | **98** | | **SR** | **94** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **105** | | **TR** | **108** |
| **Knowledge-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Light** | important | 1.67 | 6 | bright | 1.41 | 17 |
| | educational | 3.83 | 6 | clear | 3.00 | 4 |
| | intelligent | 3.00 | 5 | necessity | 2.67 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | acquired | 1.67 | 3 | strong | 1.00 | 2 |
| | informative | 2.33 | 3 | electricity | 3.50 | 2 |
| | experience | 4.50 | 2 | low | 4.00 | 2 |
| | | **SR** | **80** | | **SR** | **78** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **105** | | **TR** | **109** |
| **Knowledge-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Money** | important | 1.67 | 6 | green | 2.25 | 8 |
| | educational | 3.83 | 6 | desired | 4.00 | 4 |
| | intelligent | 3.00 | 5 | good | 1.00 | 3 |
| | acquired | 1.67 | 3 | dirty | 1.67 | 3 |
| | informative | 2.33 | 3 | bills | 2.50 | 2 |
| | experience | 4.50 | 2 | death | 4.00 | 2 |
| | | **SR** | **80** | | **SR** | **87** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **105** | | **TR** | **101** |
| **Knowledge-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Power** | important | 1.67 | 6 | authority | 3.67 | 3 |
| | educational | 3.83 | 6 | bad | 2.00 | 2 |
| | intelligent | 3.00 | 5 | commandor | 2.00 | 2 |
| | acquired | 1.67 | 3 | big | 2.50 | 2 |
| | informative | 2.33 | 3 | abused | 4.50 | 2 |
| | experience | 4.50 | 2 | bossy | 4.50 | 2 |
| | | **SR** | **80** | | **SR** | **88** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **105** | | **TR** | **110** |
| **Knowledge-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |

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|---|---|---|---|---|---|---|
| **River** | important | 1.67 | 6 | blue | 3.00 | 5 |
| | educational | 3.83 | 6 | cold | 2.33 | 3 |
| | intelligent | 3.00 | 5 | deep | 3.33 | 3 |
| | acquired | 1.67 | 3 | fast | 3.00 | 2 |
| | informative | 2.33 | 3 | beautiful | 4.00 | 2 |
| | experience | 4.50 | 2 | dangerous | 5.50 | 2 |
| | | **SR** | **80** | | **SR** | **93** |
| **Lawyers-Sharks** | **Topic** | | | **Vehicle** | | |
| | | **TR** | **118** | | **TR** | **117** |
| | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | deceptive | 3.33 | 6 | dangerous | 2.50 | 16 |
| | argumentative | 2.25 | 4 | big | 3.14 | 7 |
| | determined | 2.67 | 3 | death | 3.75 | 4 |
| | convincing | 2.50 | 2 | blood | 4.00 | 3 |
| | clever | 3.00 | 2 | blue | 4.00 | 3 |
| | defense | 4.00 | 2 | black | 5.00 | 2 |
| | | **SR** | **99** | | **SR** | **82** |
| **Lawyers-Snakes** | **Topic** | | | **Vehicle** | | |
| | | **TR** | **118** | | **TR** | **124** |
| | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | deceptive | 3.33 | 6 | dangerous | 3.00 | 8 |
| | argumentative | 2.25 | 4 | death | 3.75 | 4 |
| | determined | 2.67 | 3 | colourful | 5.00 | 2 |
| | convincing | 2.50 | 2 | fast | 5.00 | 2 |
| | clever | 3.00 | 2 | big | 5.50 | 2 |
| | defense | 4.00 | 2 | frightening | 5.50 | 2 |
| | | **SR** | **99** | | **SR** | **104** |

| | Topic | | | Vehicle | | |
|---|---|---|---|---|---|---|
| | | **TR** | **114** | | **TR** | **123** |
| **Life-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Beach** | beautiful | 3.20 | 5 | fun | 3.29 | 7 |
| | entertaining | 3.00 | 3 | beautiful | 3.67 | 6 |
| | death | 3.67 | 3 | calming | 3.75 | 4 |
| | eventful | 2.00 | 2 | bright | 3.00 | 2 |
| | exciting | 2.00 | 2 | breezy | 4.50 | 2 |
| | adventurous | 3.00 | 2 | crowded | 5.00 | 2 |
| | | **SR** | **97** | | **SR** | **100** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **114** | | **TR** | **115** |
| **Life-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Bottle** | beautiful | 3.20 | 5 | big | 3.75 | 4 |
| | entertaining | 3.00 | 3 | broken | 3.00 | 3 |
| | death | 3.67 | 3 | alcohol | 3.00 | 2 |
| | eventful | 2.00 | 2 | clear | 3.00 | 2 |
| | exciting | 2.00 | 2 | container | 4.00 | 2 |
| | adventurous | 3.00 | 2 | breakable | 4.50 | 2 |
| | | **SR** | **97** | | **SR** | **100** |
| | **Topic** | | | **Vehicle** | | |
| **Life-** | | **TR** | **114** | | **TR** | **112** |
| **Dream** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | beautiful | 3.20 | 5 | funny | 2.00 | 5 |
| | entertaining | 3.00 | 3 | confusing | 3.00 | 3 |
| | death | 3.67 | 3 | imaginative | 3.00 | 3 |
| | eventful | 2.00 | 2 | fantasy | 4.00 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | exciting | 2.00 | 2 | exciting | 3.50 | 2 |
| | adventurous | 3.00 | 2 | informative | 4.00 | 2 |
| | | **SR** | **97** | | **SR** | **94** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **114** | | **TR** | **117** |
| **Life-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Joke** | beautiful | 3.20 | 5 | funny | 1.35 | 20 |
| | entertaining | 3.00 | 3 | entertains | 3.80 | 5 |
| | death | 3.67 | 3 | boring | 2.50 | 4 |
| | eventful | 2.00 | 2 | embarassing | 2.50 | 2 |
| | exciting | 2.00 | 2 | corny | 3.00 | 2 |
| | adventurous | 3.00 | 2 | creative | 3.00 | 2 |
| | | **SR** | **97** | | **SR** | **82** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **114** | | **TR** | **104** |
| **Life-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Journey** | beautiful | 3.20 | 5 | adventurous | 1.80 | 5 |
| | entertaining | 3.00 | 3 | eventful | 3.75 | 4 |
| | death | 3.67 | 3 | exciting | 4.25 | 4 |
| | eventful | 2.00 | 2 | endless | 3.50 | 2 |
| | exciting | 2.00 | 2 | destination | 4.00 | 2 |
| | adventurous | 3.00 | 2 | entertaining | 4.50 | 2 |
| | | **SR** | **97** | | **SR** | **85** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **114** | | **TR** | **110** |
| **Life-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **River** | beautiful | 3.20 | 5 | blue | 3.00 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | entertaining | 3.00 | 3 | cold | 2.33 | 3 |
| | death | 3.67 | 3 | deep | 3.33 | 3 |
| | eventful | 2.00 | 2 | fast | 3.00 | 2 |
| | exciting | 2.00 | 2 | beautiful | 4.00 | 2 |
| | adventurous | 3.00 | 2 | dangerous | 5.50 | 2 |
| | | **SR** | **97** | | **SR** | **93** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **119** | | **TR** | **126** |
| **Love-Child** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | beautiful | 2.67 | 6 | annoying | 2.75 | 4 |
| | happy | 1.33 | 3 | adorable | 3.25 | 4 |
| | caring | 3.00 | 3 | dependent | 3.33 | 3 |
| | feeling | 3.50 | 2 | cute | 4.33 | 3 |
| | giving | 3.50 | 2 | curious | 3.00 | 2 |
| | deep | 4.00 | 2 | energetic | 3.50 | 2 |
| | | **SR** | **101** | | **SR** | **108** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **119** | | **TR** | **112** |
| **Love-Drug** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | beautiful | 2.67 | 6 | addictive | 2.13 | 8 |
| | happy | 1.33 | 3 | dangerous | 2.50 | 8 |
| | caring | 3.00 | 3 | bad | 1.00 | 4 |
| | feeling | 3.50 | 2 | death | 2.75 | 4 |
| | giving | 3.50 | 2 | destruction | 2.50 | 2 |
| | deep | 4.00 | 2 | exciting | 5.00 | 2 |
| | | **SR** | **101** | | **SR** | **84** |
| | **Topic** | | | **Vehicle** | | |

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|---|---|---|---|---|---|---|
| | | **TR** | **119** | | **TR** | **120** |
| **Love-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Flower** | beautiful | 2.67 | 6 | colours | 2.85 | 13 |
| | happy | 1.33 | 3 | beauty | 2.56 | 9 |
| | caring | 3.00 | 3 | blossom | 1.00 | 2 |
| | feeling | 3.50 | 2 | dirt | 2.50 | 2 |
| | giving | 3.50 | 2 | bees | 5.50 | 2 |
| | deep | 4.00 | 2 | gift | 5.50 | 2 |
| | | **SR** | **101** | | **SR** | **90** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **119** | | **TR** | **121** |
| **Love-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Gold** | beautiful | 2.67 | 6 | expensive | 2.79 | 14 |
| | happy | 1.33 | 3 | heavy | 3.43 | 7 |
| | caring | 3.00 | 3 | jewlery | 3.75 | 4 |
| | feeling | 3.50 | 2 | beautiful | 2.50 | 2 |
| | giving | 3.50 | 2 | desired | 4.00 | 2 |
| | deep | 4.00 | 2 | discovery | 4.50 | 2 |
| | | **SR** | **101** | | **SR** | **90** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **119** | | **TR** | **103** |
| **Love-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Melody** | beautiful | 2.67 | 6 | harmony | 3.25 | 4 |
| | happy | 1.33 | 3 | beautiful | 1.67 | 3 |
| | caring | 3.00 | 3 | happy | 2.67 | 3 |
| | feeling | 3.50 | 2 | entertaining | 3.67 | 3 |
| | giving | 3.50 | 2 | annoying | 2.50 | 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | deep | 4.00 | 2 | beat | 3.50 | 2 |
| | | **SR** | **101** | | **SR** | **86** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **119** | | **TR** | **109** |
| **Love-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Rainbow** | beautiful | 2.67 | 6 | colours | 1.25 | 20 |
| | happy | 1.33 | 3 | curvy | 3.00 | 3 |
| | caring | 3.00 | 3 | beautiful | 2.50 | 2 |
| | feeling | 3.50 | 2 | bright | 3.00 | 2 |
| | giving | 3.50 | 2 | gay | 3.50 | 2 |
| | deep | 4.00 | 2 | blue | 5.00 | 2 |
| | | **SR** | **101** | | **SR** | **78** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **119** | | **TR** | **123** |
| **Love-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Rose** | beautiful | 2.67 | 6 | flowery | 2.20 | 5 |
| | happy | 1.33 | 3 | beauty | 2.75 | 4 |
| | caring | 3.00 | 3 | colourful | 2.75 | 4 |
| | feeling | 3.50 | 2 | blue | 3.00 | 2 |
| | giving | 3.50 | 2 | black | 4.00 | 2 |
| | deep | 4.00 | 2 | gifts | 4.50 | 2 |
| | | **SR** | **101** | | **SR** | **104** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **107** | | **TR** | **110** |
| **Memory-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **River** | forgetful | 3.67 | 3 | blue | 3.00 | 5 |
| | good | 4.00 | 3 | cold | 2.33 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | happy | 3.50 | 2 | deep | 3.33 | 3 |
| | cognitive | 4.00 | 2 | fast | 3.00 | 2 |
| | emotional | 4.00 | 2 | beautiful | 4.00 | 2 |
| | brain | 4.50 | 2 | dangerous | 5.50 | 2 |
| | | **SR** | **93** | | **SR** | **93** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **123** | | **TR** | **107** |
| **Memories-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Sponges** | forgottent | 3.25 | 4 | absorption | 1.82 | 11 |
| | emotions | 2.00 | 2 | cleaning | 2.67 | 6 |
| | far | 2.00 | 2 | porous | 2.33 | 3 |
| | bad | 2.50 | 2 | dirty | 4.33 | 3 |
| | fond | 3.50 | 2 | dishes | 3.00 | 2 |
| | fading | 4.00 | 2 | green | 4.00 | 2 |
| | | **SR** | **109** | | **SR** | **80** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **117** | | **TR** | **119** |
| **Men-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Fish** | hairy | 2.00 | 3 | big | 3.60 | 5 |
| | friendly | 2.00 | 2 | colourful | 3.75 | 4 |
| | handsome | 2.50 | 2 | cold blooded | 4.67 | 3 |
| | big | 4.00 | 2 | blue | 2.00 | 2 |
| | hard working | 4.00 | 2 | cute | 4.50 | 2 |
| | attractive | 5.00 | 2 | animal | 5.00 | 2 |
| | | **SR** | **104** | | **SR** | **101** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **102** | | **TR** | **119** |

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|---|---|---|---|---|---|---|
| **Minds-Computers** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | brainy | 4.60 | 5 | fast | 3.17 | 6 |
| | different | 2.33 | 3 | expensive | 4.50 | 4 |
| | beautiful | 3.50 | 2 | complex | 2.00 | 2 |
| | complex | 3.50 | 2 | entertaining | 4.00 | 2 |
| | emotions | 3.50 | 2 | black | 5.00 | 2 |
| | believes | 4.00 | 2 | frustrating | 5.00 | 2 |
| | | **SR** | **86** | | **SR** | **101** |
| **Money-Oxygen** | **Topic** | | | **Vehicle** | | |
| | | **TR** | **109** | | **TR** | **100** |
| | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | green | 2.25 | 8 | air | 1.83 | 6 |
| | desired | 4.00 | 4 | breathing | 2.67 | 6 |
| | good | 1.00 | 3 | gaseous | 2.25 | 4 |
| | dirty | 1.67 | 3 | essential | 2.00 | 3 |
| | bills | 2.50 | 2 | carbon dioxide | 2.33 | 3 |
| | death | 4.00 | 2 | available | 1.50 | 2 |
| | | **SR** | **87** | | **SR** | **76** |
| **Music-Medicine** | **Topic** | | | **Vehicle** | | |
| | | **TR** | **118** | | **TR** | **113** |
| | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | artists | 4.00 | 4 | good | 1.33 | 3 |
| | beautiful | 2.25 | 4 | heals | 1.00 | 2 |
| | creative | 3.67 | 3 | cure | 1.50 | 2 |
| | beat | 2.50 | 2 | bitter | 2.00 | 2 |
| | boring | 4.50 | 2 | doctor | 3.00 | 2 |
| | dance | 4.50 | 2 | expensive | 3.00 | 2 |

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|---|---|---|---|---|---|---|
| | | **SR** | **101** | | **SR** | **100** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **89** | | **TR** | **83** |
| **Obligations-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Shackles** | dutiful | 1.33 | 3 | heavy | 3.00 | 7 |
| | boring | 4.33 | 3 | chains | 1.00 | 3 |
| | frustrating | 1.00 | 2 | cold | 3.00 | 3 |
| | annoying | 1.50 | 2 | confined | 1.50 | 2 |
| | fulfilled | 2.50 | 2 | dark | 3.50 | 2 |
| | family | 3.50 | 2 | jails | 4.50 | 2 |
| | | **SR** | **75** | | **SR** | **64** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **107** | | **TR** | **110** |
| **Peace-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **River** | calmness | 2.13 | 8 | blue | 3.00 | 5 |
| | friendship | 4.25 | 4 | cold | 2.33 | 3 |
| | desired | 2.67 | 3 | deep | 3.33 | 3 |
| | hippies | 3.00 | 2 | fast | 3.00 | 2 |
| | beautiful | 3.50 | 2 | beautiful | 4.00 | 2 |
| | happy | 3.50 | 2 | dangerous | 5.50 | 2 |
| | | **SR** | **86** | | **SR** | **93** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **126** | | **TR** | **124** |
| **Pets-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Kids** | cute | 2.80 | 5 | annoying | 1.67 | 6 |
| | company | 3.33 | 3 | cute | 3.25 | 4 |
| | caring | 4.67 | 3 | adorable | 2.67 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | animals | 2.00 | 2 | curious | 3.00 | 3 |
| | cats | 2.00 | 2 | friendly | 2.50 | 2 |
| | comforting | 3.50 | 2 | caring | 5.00 | 2 |
| | | **SR** | **109** | | **SR** | **104** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **103** | | **TR** | **110** |
| **Rage-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Volcano** | angry | 2.00 | 12 | dangerous | 3.18 | 11 |
| | dangerous | 2.00 | 4 | big | 1.50 | 4 |
| | destructive | 2.33 | 3 | destructive | 3.33 | 3 |
| | emotional | 5.33 | 3 | active | 4.00 | 3 |
| | aggressive | 3.00 | 2 | death | 4.67 | 3 |
| | harmful | 4.50 | 2 | ashy | 5.50 | 2 |
| | | **SR** | **77** | | **SR** | **84** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **114** | | **TR** | **86** |
| **Runners-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Torpedoes** | fast | 1.10 | 10 | dangerous | 2.43 | 14 |
| | athletic | 2.57 | 7 | fast | 2.63 | 8 |
| | energized | 2.75 | 4 | explosive | 3.29 | 7 |
| | determined | 4.00 | 3 | destructive | 3.43 | 7 |
| | dedicated | 3.50 | 2 | black | 3.50 | 2 |
| | fit | 3.50 | 2 | death | 5.00 | 2 |
| | | **SR** | **86** | | **SR** | **46** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **115** | | **TR** | **101** |
| **Salesmen-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |

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|---|---|---|---|---|---|---|
| **Bulldozers** | annoying | 2.00 | 10 | big | 2.63 | 8 |
| | convincing | 2.00 | 4 | destructive | 2.43 | 7 |
| | conniving | 1.00 | 2 | dangerous | 2.80 | 5 |
| | friendly | 1.50 | 2 | constructive | 3.50 | 4 |
| | helpful | 2.00 | 2 | expensive | 5.67 | 3 |
| | dishonest | 2.50 | 2 | hardhats | 5.00 | 2 |
| | | **SR** | **93** | | **SR** | **72** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **122** | | **TR** | 112 |
| **Schools-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Zoos** | big | 1.75 | 8 | big | 2.86 | 7 |
| | bright | 3.67 | 3 | animals | 1.00 | 6 |
| | children | 2.00 | 2 | crowded | 3.00 | 4 |
| | books | 3.00 | 2 | colourful | 3.00 | 3 |
| | crowded | 3.50 | 2 | children | 4.50 | 2 |
| | discipline | 4.00 | 2 | beautiful | 5.50 | 2 |
| | | **SR** | **103** | | **SR** | **88** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **109** | | **TR** | **113** |
| **Science-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Politics** | complicated | 2.20 | 5 | boring | 1.00 | 3 |
| | educational | 2.00 | 4 | democratic | 1.67 | 3 |
| | experimental | 4.25 | 4 | corrupted | 2.67 | 3 |
| | biology | 2.00 | 3 | complicated | 3.00 | 3 |
| | chemistry | 3.00 | 2 | confusing | 5.67 | 3 |
| | difficult | 3.00 | 2 | annoying | 3.50 | 2 |
| | | **SR** | **89** | | **SR** | **96** |

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| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **80** | | **TR** | **110** |
| **Sermons-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Sleeping Pills** | long | 1.78 | 14 | addictive | 2.22 | 9 |
| | boring | 2 | 11 | dangerous | 2.67 | 6 |
| | religious | 3 | 5 | hard | 2 | 2 |
| | priestly | 3 | 2 | drugs | 2.5 | 2 |
| | preechy | 3.5 | 2 | colourful | 4 | 2 |
| | faithful | 4 | 2 | death | 5 | 2 |
| | | **SR** | **44** | | **SR** | **87** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **117** | | **TR** | **114** |
| **Skating-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Flying** | cold | 3.22 | 9 | birds | 2.40 | 5 |
| | dangerous | 3.40 | 5 | cold | 3.75 | 4 |
| | fast | 2.25 | 4 | dangerous | 1.33 | 3 |
| | challenging | 4.00 | 2 | exciting | 2.00 | 3 |
| | exciting | 4.50 | 2 | adventurous | 3.00 | 2 |
| | blades | 5.50 | 2 | beautiful | 4.00 | 2 |
| | | **SR** | **93** | | **SR** | **95** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **99** | | **TR** | **40** |
| **Smog-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Shroud** | cloudy | 2.17 | 6 | dark | 2.50 | 4 |
| | dark | 2.25 | 4 | cloudy | 3.00 | 3 |
| | black | 2.75 | 4 | mysterious | 1.00 | 2 |
| | dangerous | 4.25 | 4 | unclear | 2.00 | 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | city | 1.50 | 2 | | **SR** | **29** |
| | annoying | 3.50 | 2 | | | |
| | | **SR** | **77** | | | |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **132** | | **TR** | **64** |
| **Soldiers-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Pawns** | brave | 2.14 | 7 | small | 1.36 | 11 |
| | courageous | 3.20 | 5 | chess | 1.00 | 3 |
| | army | 2.33 | 3 | used | 2.00 | 2 |
| | armed | 3.00 | 2 | blakc | 2.50 | 2 |
| | brainwashed | 3.00 | 2 | dirty | 3.00 | 2 |
| | athletic | 4.00 | 2 | strategy | 3.00 | 2 |
| | | **SR** | **111** | | **SR** | **42** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **122** | | **TR** | **112** |
| **Store-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Zoo** | big | 1.67 | 9 | big | 2.86 | 7 |
| | clothes | 3.33 | 3 | animals | 1.00 | 6 |
| | buy | 3.00 | 2 | crowded | 3.00 | 4 |
| | cheap | 3.50 | 2 | colourful | 3.00 | 3 |
| | clean | 3.50 | 2 | children | 4.50 | 2 |
| | charming | 5.50 | 2 | beautiful | 5.50 | 2 |
| | | **SR** | **102** | | **SR** | **88** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **132** | | **TR** | **104** |
| **Teachers-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Sculptors** | educative | 2.38 | 8 | artistic | 2.33 | 12 |

294

| | | | | | | |
|---|---|---|---|---|---|---|
| | caring | 3.40 | 5 | creative | 2.00 | 9 |
| | boring | 3.75 | 4 | clay | 1.50 | 2 |
| | demanding | 2.50 | 2 | crafty | 1.50 | 2 |
| | dedicated | 3.00 | 2 | dedicated | 2.50 | 2 |
| | friendly | 3.50 | 2 | creators | 5.00 | 2 |
| | | **SR** | **109** | | **SR** | **75** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **127** | | **TR** | **128** |
| **Television-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Candy** | colourful | 3.33 | 6 | colourful | 3.00 | 9 |
| | big | 3.60 | 5 | edible | 4.33 | 3 |
| | boring | 3.60 | 5 | crunchy | 2.50 | 2 |
| | black | 3.75 | 4 | delicious | 2.50 | 2 |
| | addictive | 1.50 | 2 | fattening | 4.50 | 2 |
| | box | 2.50 | 2 | fruity | 4.50 | 2 |
| | | **SR** | **103** | | **SR** | **108** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **127** | | **TR** | **112** |
| **Tv-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Drug** | colourful | 3.33 | 6 | addictive | 2.13 | 8 |
| | big | 3.60 | 5 | dangerous | 2.50 | 8 |
| | boring | 3.60 | 5 | bad | 1.00 | 4 |
| | black | 3.75 | 4 | death | 2.75 | 4 |
| | addictive | 1.50 | 2 | destruction | 2.50 | 2 |
| | box | 2.50 | 2 | exciting | 5.00 | 2 |
| | | **SR** | **103** | | **SR** | **84** |
| | **Topic** | | | **Vehicle** | | |

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|---|---|---|---|---|---|---|
| | | **TR** | **105** | | **TR** | 109 |
| **Time-Money** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | fast | 2.56 | 9 | green | 2.25 | 8 |
| | fleeting | 1.33 | 3 | desired | 4.00 | 4 |
| | clocks | 1.00 | 2 | good | 1.00 | 3 |
| | inescapable | 1.50 | 2 | dirty | 1.67 | 3 |
| | life | 2.00 | 2 | bills | 2.50 | 2 |
| | late | 2.50 | 2 | death | 4.00 | 2 |
| | | **SR** | **85** | | **SR** | **87** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **105** | | **TR** | **103** |
| **Time-Snail** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | fast | 2.56 | 9 | cute | 3.67 | 3 |
| | fleeting | 1.33 | 3 | boring | 4.33 | 3 |
| | clocks | 1.00 | 2 | funny | 5.00 | 3 |
| | inescapable | 1.50 | 2 | brown | 3.00 | 2 |
| | life | 2.00 | 2 | edible | 4.00 | 2 |
| | late | 2.50 | 2 | gooey | 4.50 | 2 |
| | | **SR** | **85** | | **SR** | **88** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **105** | | **TR** | **112** |
| **Time-Thief** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| | fast | 2.56 | 9 | dangerous | 4.57 | 7 |
| | fleeting | 1.33 | 3 | bad | 2.00 | 5 |
| | clocks | 1.00 | 2 | criminal | 2.20 | 5 |
| | inescapable | 1.50 | 2 | dishonest | 1.50 | 2 |
| | life | 2.00 | 2 | destruction | 2.50 | 2 |

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|---|---|---|---|---|---|---|
| | late | 2.50 | 2 | fast | 3.50 | 2 |
| | | **SR** | **85** | | **SR** | **89** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **103** | | **TR** | **114** |
| **Tongues-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Fire** | long | 2.33 | 6 | dangerous | 3.71 | 14 |
| | pierce | 2.33 | 3 | burns | 4.13 | 8 |
| | bumpy | 2.00 | 2 | destructive | 3.71 | 7 |
| | fleshy | 2.50 | 2 | death | 4.00 | 5 |
| | organic | 3.50 | 2 | flames | 2.00 | 3 |
| | lick | 6.00 | 2 | bright | 4.00 | 3 |
| | | **SR** | **86** | | **SR** | **74** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **114** | | **TR** | **112** |
| **Tree Trunks-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Straws** | brown | 2.17 | 12 | funny | 2.17 | 6 |
| | big | 2.29 | 7 | colourful | 3.60 | 6 |
| | barky | 2.25 | 4 | cylindrical | 1.67 | 3 |
| | dark | 3.00 | 2 | bendy | 4.00 | 3 |
| | circular | 4.00 | 2 | drinking | 2.50 | 2 |
| | age | 5.00 | 2 | empty | 3.00 | 2 |
| | | **SR** | **85** | | **SR** | **90** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **124** | | **TR** | **107** |
| **Trees-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Umbrellas** | big | 2.13 | 8 | colourful | 1.60 | 5 |
| | brown | 3.14 | 7 | broken | 3.25 | 4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | beautiful | 1.00 | 3 | big | 2.00 | 3 |
| | environmental | 2.00 | 2 | dry | 3.00 | 3 |
| | colourful | 2.50 | 2 | black | 3.00 | 2 |
| | branchy | 4.50 | 2 | annoying | 5.00 | 2 |
| | | **SR** | **100** | | **SR** | **88** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **98** | | **TR** | **113** |
| **Trust-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Glue** | important | 1.80 | 10 | liquid | 2.80 | 5 |
| | friendship | 1.86 | 7 | artsy | 4.40 | 5 |
| | honesty | 3.33 | 3 | crafty | 3.67 | 3 |
| | hard | 4.33 | 3 | annoying | 5.33 | 3 |
| | broken | 1.00 | 2 | hard | 3.50 | 2 |
| | fragile | 3.00 | 2 | gooey | 4.00 | 2 |
| | | **SR** | **71** | | **SR** | **93** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **107** | | **TR** | **118** |
| **Typewriters-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Dinosaurs** | fast | 2.00 | 3 | ancient | 1.36 | 11 |
| | clicking noise | 1.50 | 2 | extinct | 1.75 | 8 |
| | heavy | 2.50 | 2 | big | 2.43 | 7 |
| | ink | 2.50 | 2 | dangerous | 3.83 | 6 |
| | fun | 3.50 | 2 | carnivorous | 5.33 | 3 |
| | black | 4.50 | 2 | dead | 3.50 | 2 |
| | | **SR** | **94** | | **SR** | **81** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **122** | **TR** | | **104** |

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|---|---|---|---|---|---|---|
| **Winter-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Death** | cold | 1.38 | 20 | dark | 4.00 | 4 |
| | dark | 3.60 | 5 | final | 3.67 | 3 |
| | depressing | 4.40 | 5 | cold | 2.00 | 2 |
| | freezing | 4.67 | 3 | heaven | 2.00 | 2 |
| | christmas | 5.00 | 3 | impending | 2.50 | 2 |
| | boring | 4.50 | 2 | endings | 3.00 | 2 |
| | | **SR** | **84** | | **SR** | **89** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **104** | | **TR** | **114** |
| **Wisdom-** | **Response** | **Sal** | **Freq** | | **Sal** | **Freq** |
| **Ocean** | educative | 3.00 | 4 | blue | 2.00 | 15 |
| | experienced | 3.00 | 3 | big | 2.25 | 4 |
| | beautiful | 2.50 | 2 | beautiful | 3.50 | 4 |
| | acquired | 3.00 | 2 | calm | 4.33 | 3 |
| | deep | 3.50 | 2 | boats | 4.50 | 2 |
| | advice | 5.00 | 2 | clean | 4.50 | 2 |
| | | **SR** | **89** | | **SR** | **84** |
| | **Topic** | | | **Vehicle** | | |
| | | **TR** | **123** | | **TR** | **123** |
| **Women-** | **Response** | **Sal** | **Freq** | **Response** | **Sal** | **Freq** |
| **Cats** | caring | 4.09 | 11 | fat | 4.00 | 4 |
| | beautiful | 2.83 | 6 | black | 3.67 | 3 |
| | curvy | 3.20 | 5 | cuddly | 4.00 | 3 |
| | complicated | 1.67 | 3 | friendly | 4.33 | 3 |
| | emotional | 2.33 | 3 | fluffy | 2.00 | 2 |
| | confusing | 4.50 | 2 | cute | 2.50 | 2 |

| | | |
|---|---|---|
| | **SR 93** | **SR 106** |

Table 3B: Topic-Vehicle pairs and Words Used in Explanation

| Topic-Vehicle Pair | Figurative Property | Literal Property |
|---|---|---|
| Anger-Heart | Red | Organ |
| Bible-Sword | Sharp | Weapon |
| Clouds-Cotton | Soft | Fibers |
| Dreams-Water | Fluid | Liquid |
| Education-Tree | Grows | Plant |
| Hair-Rainbow | Colourful | Visionary Creation |
| Heaven-Treasure | Golden | Precious Thing |
| Lawyers-Sharks | Dangerous | Fish |
| Life-Beach | Relaxing | Full of Sand |
| Love-Child | Young | Person |
| Love-Melody | Soothing | Song |
| Memory-River | Fluid | Water |
| Men-Fish | Slippery | Aquatic Animals |
| Music-Medicine | Healing | Drug |
| Perjury-Boomerang | Returns | Weapon |
| Television-Candy | Sweet | Sugar |
| Tongues-Fire | Hot | Flames |
| Typewriters-Dinosaurs | Old | Reptiles |
| Wisdom-Ocean | Vast | Water |
| Women-Cats | Independent | Felines |

Table 5B: Senior Interpretation Norms for Metaphors

| | Salient Properties | Less Salient Properties |
|---|---|---|
| *Apt and Familiar* | | |
| Alcohol is a crutch | relied upon, addictive | numbing |
| Cigarettes are time-bombs | cause death, dangerous | |
| Education is a stairway | Leads to better things | eternal |
| Exams are hurdle | Challenging, allows progress | |
| Knowledge is power | empowering | |
| Life is a journey | unpredictable, enjoyable | short, goes from life to death |
| Mall is a zoo | chaotic, dangerous people | crowded |
| Time is money | valuable | limited, wasted |
| *More Apt than Familiar* | | |
| Anger is fire | uncontrollable, destructive | |
| Genes are blueprints | defines your identity | |
| Knowledge is light | enlightening | bright |
| Music is medicine | soothing, enjoyable | healing |

*More Familiar than Apt*

| | | |
|---|---|---|
| Cities are jungles | crowded | dangerous |
| Families are Fortresses | strong, protective | Safe, united |
| Lawyers are sharks | ruthless | sharp |

*Neither Apt nor Familiar*

| | | |
|---|---|---|
| Anger is a heart | very emotional | dangerous |
| Deserts are ovens | hot | |
| Hair is a rainbow | colourful | a crown, beautiful |
| Life is a bottle | Encased | can be empty or full |
| Men are fish | catchable | slippery, gullible |