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The Effects of Reading Metaphor on Perceptual Distance Judgments

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Graduate Program in Psychology
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Abstract

The present research examined the effects of reading metaphor on judgments of distance between people. In two experiments, we found that reading metaphor induced participants to perceive pairs of models shown in pictures as physically farther apart compared to reading either literal language, or nothing aside from instructions. A third experiment ruled out that this effect was due to participants feeling closer themselves to the models and a fourth experiment ruled out that this effect was related to perceived social distance. Construal level theory posits that there are multiple dimensions of psychological distance and that these dimensions are cognitively related. We propose that semantic distance might be another cognitively related dimension of psychological distance. Reading metaphor may highlight semantic distance as metaphor is a comparison of two unlike things. We suggest that the participants who read metaphor might have projected this semantic distance onto their spatial distance judgments.

Keywords

Metaphor, Construal Level Theory, Perception, Conceptual Metaphor Theory, Embodied Cognition, Language.

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Chapter 1

1 Introduction

This thesis will examine one role that embodied cognition might play in the processing of metaphor. I will discuss metaphor and some studies relevant to the current thesis first, followed by a discussion of embodied cognition and the proposed studies.

Metaphor, as typically defined, is “a figure of speech in which a word or phrase is applied to an object or action to which it is not literally applicable” (*Dictionary.com*, 2016). The study of metaphor dates back to at least Aristotle (335 B.C./1980), who defined metaphor as giving to something “a name that belongs to something else” (p. 63). For example, consider the classic metaphor from William Shakespeare’s (1599/1905) *As You Like It*: “All the world’s a stage, / And all the men and women merely players” (2.7.138-139). In this example, the world is described as a theatre stage and people are described as actors. The statement is not meant to be a literal description of the “world” but rather provides a way of highlighting that as one goes through life, he or she may act differently in different situations and contexts, similar to how an actor will play different roles in different plays. Metaphor in fact is a pervasive and commonly used linguistic device. Cameron (2003, p. 57) estimates that out of every 1000 words a person says, on average 50 are related to metaphor. This proportion may be even greater if metaphor is defined more broadly as a cross-domain mapping. Steen, Dorst, Herrmann, Kaal, and Krennmayr (2010) found that about 77 words per 1000 of conversation are related to metaphor when metaphor is defined in this way.

1.1 Current psychological research on metaphor

Most current psychological research into the processing of metaphor has emphasized two questions. Firstly, why do we use metaphor in the first place? Secondly, how do we derive meaning from metaphor, seeing as the literal meaning of the words differs from the intended meaning? With respect to the first question, Ortony (1975) provided some initial reasons, arguing that because language is a “discrete symbol system” whereas

experience is continuous, it is nearly impossible to convey all the details of an event or experience using only literal language. Metaphor however, helps to convey the continuity of experience in three ways. Firstly, metaphor allows for many characteristics to be ascribed to an object in a concise and compact manner. Secondly, there are some things in language that we only talk about in metaphorical terms (e.g., “the thought slipped my mind”); for these cases, there is not an easy way to literally express these ideas. Lastly, related to the first two points, metaphor allows ideas to be expressed more vividly compared to literal language because metaphor is closely tied to perceived experience. Thus, according to Ortony, we use metaphors because they allow things to be expressed concisely, vividly, and because some things can only be expressed metaphorically. In essence, Ortony was approaching metaphor from the perspective of the pragmatic effects served by metaphor that gives it force beyond that found with literal translations.

Other more recent pragmatic aspects to metaphor can be found in Katz (1996). For instance, one question is, how do people recognize that a statement is metaphorical versus ironic? There are multiple types of irony, but one type commonly used in conversation is sarcastic irony, which is when the speaker says something but means the opposite. Katz argues that recognition of metaphor and irony is based on inferring the speaker’s intent, and that this is based on a set of heuristics. The first heuristic is whether the goal of the speaker is to convey information or to convey attitude. Typically (but not always) metaphor is used for the former and irony used for the latter. The second heuristic is whether there is a human referent, as irony often involves a victim or target of criticism. The third heuristic is the nature of the speaker. Katz and Pexman (1997) found that participants rated ambiguous statements to be more ironic if uttered by a member of a high-irony occupation (e.g., comedian) versus a high-metaphor occupation (e.g.,

clergyman)¹. This suggests that characteristics of the speaker act as a heuristic that guides metaphor and irony processing. The last heuristic is the nature of the statement itself. Katz and Pexman (1997) found that participants showed high agreement on the degree to which sentences were good examples of either metaphor or irony even when these sentences were presented without context. Katz (1996) argues that culturally some statements are more associated with metaphor or irony than others, and that people draw upon this cultural knowledge when processing those tropes. For example, the statement “cry me a river” could hypothetically be metaphorical; however, it is almost always used as a sarcastic remark.

The second question that has motivated most psychological investigations of metaphor is in determining the nature of the processing mechanism that permits one to derive meaning from statements in which what is expressed (e.g., the world is a stage) differs from the intended meaning (e.g., people serve different roles in different contexts). There are several well-developed models that have emerged in the last few years. Two prominent comprehension models are Glucksberg’s attributive category model (Glucksberg and Keysar, 1990; Glucksberg, 2008) and Gentner’s structure-mapping model (Gentner, 1983; Wolff and Gentner, 2011). Glucksberg argues that metaphors are processed as class-inclusion statements. Consider the metaphor “my lawyer is a shark.” In this case, the vehicle of the metaphor, “shark,” is a label for an ad-hoc category that it exemplifies, namely, “vicious things.” Thus, processing the metaphor “my lawyer is a shark” is equivalent to categorizing the topic “my lawyer” into this category. It is important to note that the vehicle of the metaphor is both an exemplar and a label of the superordinate, ad-hoc category. For instance, consider the word “Kleenex.” People often use this word to mean any type of facial tissue. However, Kleenex is also a specific brand of tissue; thus, it is both an exemplar of facial tissues and a label for the

¹ Intonation of voice is also important for perceiving sarcastic irony (Woodland & Voyer, 2011). It is possible that some participants imagined a tone of voice for the occupations and used this as a heuristic for judging the statements to be either metaphorical or ironic.

superordinate category. Similarly, in the above mentioned metaphor, “shark” acts as a label for the ad-hoc category “vicious things,” but at the same time is a member of that category.

Similar to how literal class-inclusion statements are directional, Glucksberg’s model also posits that metaphors are processed directionally. In contrast, Wolff and Gentner (2011) argue that metaphors are processed in two stages. In the first stage of metaphor processing, similarity is computed between the metaphor topic and the metaphor vehicle. This is similar to literal comparison except that with metaphor (and analogy), the comparisons are between relations rather than attributes. Gentner (1983) defines a relation as involving more than a single component. For instance, “collide” would be a relation because it involves the interaction between two objects (as opposed to an attribute such as “large” which does not involve an interaction). Typically metaphors involve similarities in relational structures between the domains being compared. For example, consider once again the metaphor “my lawyer is a shark.” Lawyers and sharks share few attributes, and even the ones they do share (e.g., both are animate) are unimportant for understanding the metaphor. However, the relations (e.g., vicious towards prey) are important.

After similarity is computed, in the second stage inferences are projected from the vehicle to the topic, much like Glucksberg’s model. The key distinction is that in Gentner’s model, this directional stage occurs later in processing. Wolff and Gentner (2011) found partial support for this. They had participants rate forward and reversed metaphors after a 1,200 ms deadline and a 1,800 ms deadline. An example of a forward metaphor they used was “some lies are boomerangs,” and the reversed version of this was “some boomerangs are lies.” They found a significant interaction -- forward metaphors increased in comprehensibility with the later deadline, but reversed metaphors did not. This partially supports the theory that directional inferences occur later in processing, following a non-directional comparison stage.

1.2 Social aspects of metaphor

The two major themes in metaphor research described above dominate the metaphor literature in psychology. Nonetheless there is a third, much less studied area of metaphor which will be the focus of the studies presented in this thesis. Whereas Ortony (1975) and Katz (1996) focus on the pragmatic aspects of metaphor and Glucksberg (2008) and Wolff and Gentner (2011) focus on the internal comprehension mechanisms that are engaged while processing metaphor, the third much smaller literature examines social aspects of metaphor. Social effects in metaphor use have been found when people infer social information from metaphor use, such as interlocutor gender (Hussey and Katz, 2009) and occupation (Katz, 2005). People also use metaphor to reinforce social bonds and build intimacy with one another (Cohen, 1978). Because a metaphor requires shared knowledge, or “common ground,” between people to be understood, Cohen (1978, p.8) argues that it acts as a “concealed invitation” from the speaker to the hearer to draw upon this common ground. This process acknowledges that the speaker and hearer share a community, which cultivates intimacy between them. However, the nature of this invitation is unclear. For instance, if the speaker uses a metaphor, does only the person the speaker was addressing receive this invitation, or is everyone who hears the metaphor drawn closer to the speaker? Would a third-party observer sense that the speaker and hearer are close friends, or would this observer him- or herself feel closer to both of these individuals? The former possibility would suggest that observers use metaphor as a cue to make social inferences whereas the latter possibility would suggest that metaphors create intimacy between individuals in a more general sense.

Regarding the above possibilities, the empirical evidence is mixed. Findings from Horton (2007; 2013) suggest the former, namely that a third-party observer will infer that two interlocutors are more intimate when one of them uses a metaphor. Horton (2007) had participants read short stories that contained dialogues between two characters. In one version of the dialogues, one of the characters would use a metaphor whereas in the other version, the same character would use literal language (e.g. “I saw my old *icebox/boyfriend* the other day”). The stories were identical otherwise and the relationship between the characters was always ambiguous. When a metaphor was used,

participants judged that the characters were closer friends than when literal language was used. To use Cohen's terminology, noting that a person who used metaphor was offering an "invitation" permitted the participants in the study (basically third-party observers) to make the inference that the interlocutors were close to one another

Horton (2013) followed up his original study by explicitly manipulating the relationships between interlocutors and measuring the speed with which texts were read. Horton observed that when dialogues contained metaphors and characters were said to be friends, participants read metaphorical words as fast as they did the literal counterparts. However, when dialogues contain metaphors and the characters are said to be unfamiliar, participants are significantly slower at reading metaphorical words compared to literal counterparts. This indicates that knowing interlocutors are friends facilitates metaphor processing. Both of Horton's studies suggest that when metaphor is used in a dialogue, a third-party observer will infer that the individuals in the conversation are socially closer to each other than when only literal language is used.

On the other hand, one can question whether the effect described above requires metaphor to be placed in a social context involving interlocutors or whether the mere act of processing metaphor engages Cohen's "concealed invitation." Consider again the example from Shakespeare used earlier. On reading "all the world's a stage," the reader is not in a conversation with someone who has uttered those words, nonetheless one is engaged in an act that can prompt an "invitation," namely questioning what can someone mean by those words, looking for commonalities shared by people or orienting one's attention towards social information in general in order to infer a plausible context. Bowes and Katz (2015) demonstrated that simply reading metaphors draws one closer to other people. Two studies involved either creating a context or having participants read short passages similar to those used in Horton (2007). After processing metaphor they found that, relative to a literal language comparison group, participants performed better on an ostensibly unrelated task, "The Reading the Mind in the Eyes Test" (RMET; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). The RMET is an instrument that measures first order "Theory of Mind," specifically the ability to identify another

person's emotional state. In this task, participants only see the eyes (and surrounding area) of a person and they are asked to judge the emotion that person is feeling.

Of critical importance to the studies to be reported here, participants actually score higher on the RMET after reading a series of metaphorical sentences compared to participants who read a series of literal sentences, even when the sentences are presented without any contextual information (Bowes and Katz, 2015, Study 3, emphasis added). These data suggest the mere act of reading metaphors orients a person towards interpersonal social information, even in the absence of supporting contextual information, in this case, the inference of others' internal emotional states. This orientation may be one of the mechanisms by which metaphors cultivate intimacy.

Bowes and Katz (2015) speculate that, as suggested by simulation-theory (Barsalou 1999; Gallese, 2005; 2007), processing metaphor might involve simulating past experiences that go beyond the linguistic context. There is empirical data to support this speculation. Wilson and Gibbs (2007) found that physically performing or imagining an action (e.g., a grasping motion) facilitated the processing of metaphors congruent with this action (e.g., "grasp a concept"). Another study by Gibbs (2013) also suggests that people may simulate actions while processing metaphor. In this study, participants were instructed to read one of two short paragraphs about a romantic relationship and then walk towards a tennis ball with their eyes blindfolded. This experiment took place on a field, and the tennis ball was about forty yards from where the participants began reading the story. In one of the paragraphs the romantic relationship continued happily, and in the other the romantic relationship ended disappointingly. Importantly, both paragraphs framed the relationship metaphorically in terms of a journey. After the participants read the assigned paragraph, they were told to think about the story as they walked towards the tennis ball blindfolded. The results indicated that participants who read the happy paragraph actually walked farther and overshot the tennis ball, whereas the participants who read the disappointing paragraph undershot it. Gibbs argues that these participants were simulating the "RELATIONSHIPS ARE JOURNEYS" metaphor. Because in the happy paragraph the relationship lasted longer, the participants walked farther, in other words, it was a longer journey. Conversely, participants who read the disappointing paragraph

walked a shorter distance because the relationship ended early, therefore, the journey was not as long. Slepian and Ambady (2014) found that processing novel metaphors involve embodied simulations as well. In their study, one group of participants were exposed to the novel metaphor that the past, relative to the present, is heavy, and another group were exposed to the converse – that the present, relative to the past, is heavy. Following exposure to these metaphors, the participants were given a book that either looked old or new depending on the condition. Participants in the heavy-past condition judged the old book to be heavier than participants in the heavy-present condition, while participants in the heavy-present condition judged the new book to be heavier than participants in the heavy-past condition. These results suggest that processing metaphor involves embodied simulations even when the metaphors are novel.

Gallese (2007) argues that simulation is also involved in Theory of Mind, and this may be especially true of the RMET. When the participant looks at a pair of eyes, he or she may simulate that bodily state in order to determine the emotion that the person in the picture is feeling. Because metaphor also involves the simulation of bodily states, reading metaphor may sensitize the participant to the kind of simulation that leads to accurate performance on the RMET.

It is interesting to note that reading metaphors facilitated inferring others' emotions, even though the metaphors had no direct connection to the people pictured in the RMET. This suggests that experiencing metaphors elicits one to see greater intimacy with others in general. Perhaps when a third-party observes a metaphor being used in a conversation, not only does the observer sense intimacy between the interlocutors, but he or she may also feel personally closer to the interlocutors. We will discuss studies presently to address this question.

1.3 Embodied cognition

The received wisdom for most of the 20th century held that cognition was amodal (Barsalou, 1999; but see Paivio, 1971). According to amodal theories, thought is non-perceptual and our brains transduce subsets of percepts into symbols that are completely detached from perception. That is, our knowledge about, representation of, and the

meaning given to concepts are stored in a propositional or connectionist structure. In recent years that conception has been challenged by theories of embodied cognition. The embodied cognition perspective posits that higher cognitive functions such as language, reasoning, and memory are rooted in our bodily experiences based on, and activated by our movements through and interactions with the environment (Barsalou, 1999; Wilson, 2002). Although there are many variations of embodied cognition theories, most emphasize the central role of simulation (Barsalou, 1999; Chatterjee, 2010). Simulation is the idea that a subset of neurons that are active during perception or action are reactivated when one thinks about a concept. For example, consider the concept “mug.” Some of the motor neurons associated with the act of grasping a mug may reactivate when one thinks about mugs. Contrary to amodal theories, embodied cognition theories propose that thought is modal and is intimately linked with perception and action.

A similar, but initially unrelated, line of theorizing was proposed by Lakoff and Johnson (1980). In their seminal book, *Metaphors we live by*, they argued that the human conceptual system is based on broad metaphorical mappings that ground abstract concepts in concrete, embodied experiences. For instance, one of the common metaphors in the English language is AFFECTION IS WARMTH (Lakoff & Johnson, 1980). One could argue that this metaphor is rooted in our embodied experience with our caretakers in the early years of life. When a caretaker holds a child, he or she simultaneously provides that child with affection and warmth via body heat, and as a result, these two events become linked in the mind of the child. Warmth then becomes a natural way of conceptualizing the more abstract topic of affection.

There is empirical evidence to suggest that our bodily states do inform our conceptual systems. For instance, Williams and Bargh (2008) had participants hold a cup of either hot or iced coffee and then rate a written description of a person on various personality traits. Participants who held the hot coffee cup, and thus experienced physical warmth, provided higher ratings on personality traits associated with social warmth (affection, kindness, etc.). This parallel between physical warmth and social warmth suggests that warmth is not an arbitrary way of conceptualizing affection, but that this conceptualization is rooted in the experiential correlation of warmth and affection.

Furthermore, this research suggests that input from a sensory domain can influence reasoning in an abstract domain that is superficially dissimilar.

Just as input from a sensory domain can influence cognition in an abstract domain, input from an abstract domain can influence sensory perceptions. Zhong and Leonardelli (2008) had one group of participants recall a time they felt socially excluded, and another group recall a time they felt socially included. The group who recalled social exclusion rated the room temperature to be significantly lower on average than those who recalled social inclusion. In a second experiment, they had subjects participate in a virtual ball throwing simulation. The participants were told they were playing online with other humans, but the other players were actually controlled by a computer program. One group of participants was thrown the ball frequently (i.e., social inclusion) and the other group was thrown the ball infrequently (i.e., social exclusion). Following this simulation, participants were asked to rate various hot and cold drinks and foods. The socially excluded group rated hot drinks and foods as more desirable compared to the included group. In other words, the socially excluded participants sought out warm products to remedy the coldness felt from social exclusion. These findings suggest that input from an abstract domain (i.e., social inclusion/exclusion) can influence reasoning in a concrete domain (i.e., temperature).

In the studies presented here we examine whether reasoning in a concrete domain (estimation of distance between two people) is related to differences in an abstract domain (reasoning about interpersonal social distance). Here we attempted to manipulate differences in reasoning about interpersonal distance by having people read either metaphors or literal sentence counterparts. The most explicit theory on reasoning about psychological distance is contained in construal level theory.

1.4 Construal level theory

Construal level theory includes two major assumptions. The first assumption is that there are four, cognitively related dimensions of psychological distance: spatial, temporal, social, and hypothetical. The second is that as distance between oneself and an object or event increases, people represent the object or event more abstractly.

In terms of the first assumption, it is clear that people metaphorically talk about time, social relationships, and hypothetical outcomes in terms of distance (Trope & Liberman, 2010; see also Lakoff & Johnson, 1980). For instance, the year 2050 is described metaphorically as “farther away” than 2020. Friends are “closer” than strangers. Hypothetical outcomes are also described in terms of distance. For example, if an event has a 50% chance of occurring, it is “closer” to happening than an event that has a 10% chance of occurring, which is a more “remote” possibility. For each of the four dimensions, Trope and Liberman (2010) argue that distance is egocentric; that is, the self is the reference point and objects or events are removed from the self in terms of spatial distance, time, social distance, or in the case of an event, the probability of it actually happening.

Much empirical evidence suggests that these four dimensions of distance are conceptually related and that reasoning in one of these dimensions is affected by information from the other dimensions. In one relevant study, Stephan, Liberman, and Trope (2010, study 6) had participants read statements that included either polite or colloquial language, which signify social distance and closeness respectively. When the language was polite (i.e., a sign of social distance), participants estimated the event would happen further in the future than when the language was colloquial (a proxy for social closeness). Especially relevant to the studies reported here, when polite language was used to describe a conversation between two characters, participants judged the characters to be spatially more distant than when colloquial language was used (Stephan et al., 2010, study 7). These studies suggest that social distance influences judgments of both temporal and spatial distance.

Recall that the second assumption of construal level theory is that as objects and events become increasingly removed from the perceiver, the perceiver will represent these objects and events in terms of higher-order, more abstract construals (Trope & Liberman, 2010). The argument is that people use higher-level construals for more distant things because higher-level construals are more stable across varying distances. For example, consider representing a friend’s behaviors in terms of a higher-order construal such as “being friendly” versus a lower-level construal such as “giving a hug.” The person we

are describing will likely remain friendly at different times and in different locations and contexts because friendliness is a stable personality trait. In contrast, when describing the behaviour more concretely as “giving a hug,” this is much more specific to the situation and is less likely to occur at different times and in different contexts.

Importantly, the effect also can work in the opposite direction; that is, construing things more abstractly will bring to mind instantiations that are more distant. Consider the example again of “being friendly.” Thinking of a friend being friendly will bring to mind many instantiations from this person’s past and different contexts in which the friend displayed this behaviour. In fact, we might even think back to when we first met this friend, which is as far back into the past as we can remember for this individual. In contrast, the lower-level construal “giving a hug” will bring to mind less instantiations, and these will likely be closer in time, social distance, and spatial distance to the perceiver (Trope & Liberman, 2010). Because higher-level construals are more likely to remain unchanged as distance increases, people are more likely to use them to represent more psychologically distant things.

Stephan et al. (2010) used politeness to signify social distance, and conversely, colloquial language to signify social closeness (it should be noted that colloquial language, especially slang, is commonly used when talking metaphorically; see Hussey and Katz, 2006). According to the findings of Horton (2007), the use of metaphor also signifies social closeness. One can hypothesize then that metaphoric statements should also influence participants to see others as spatially closer together, as in study 7 of Stephan et al. (2010). This is the primary hypothesis of the present study. However, an alternative hypothesis is that reading metaphor may highlight a fifth dimension of psychological distance – semantic distance². People often talk about similar concepts (e.g., “dog” and

² With the four psychological distances included in Construal Level Theory, each one is egocentric (Trope & Liberman, 2010). That is, the self is the reference from which events or objects are removed from in terms of space, time, hypotheticality, or social distance. Semantic distance on the other hand is not egocentric – the “distance” is

“cat”) as being semantically “close” and dissimilar concepts (e.g., “dog” and “airplane”) as being “far apart,” which suggests that people may conceptualize semantic information in terms of distance (Casasanto, 2008). Metaphor by definition consists of two unlike, or semantically distant, things; thus, reading metaphor may highlight semantic distance. And this dimension of distance might be more salient than social distance when metaphors are presented without context and without the presence of interlocutors (speaker and hearer), as is the case in the studies presented here. If this is the case, participants who read metaphor may project this semantic distance onto their spatial distance judgments and these judgments would thus be inflated relative to participants who read literal language.

1.5 The present set of studies

The present set of studies will explore the possible embodiment associated with inferring intimacy based on metaphor. According to embodied cognition, there should be a parallel effect in the physical (spatial) domain to what is induced in the social domain by reading metaphor or literal counterparts. There are two possibilities we examine. Recall that Horton (2007) found that reading metaphors embedded in dialogue influenced participants to see the interlocutors as closer friends. If an embodied effect is found then one should find that participants who read metaphor will judge the distance between people represented in pictures to be shorter compared to participants who read literal counterparts. As we speculate above, the processing of metaphor also involves the processing of dissimilar concepts and another possible embodied outcome would be if reading metaphor (relative to the literal control condition) led to the perception that the people in the picture were farther apart from one another. There are two additional reasons to think reading metaphor would lead to participants perceiving the people in the

between two concepts rather than between the self and the concept. Nonetheless, semantic distance may still be another form of psychological distance that can influence reasoning in other domains of psychological distance.

stimuli as farther apart. As discussed earlier, reading metaphor might create a general feeling of intimacy with others. If this is the case, the participants who read metaphor may perceive *themselves* to be closer to the two individuals in the picture. This greater perceived proximity may lead the participants to judge the two characters as farther apart, because when a perceiver approaches two objects, the objects themselves move farther apart in the perceiver's visual field. Another possibility is that reading and comprehending metaphor leads to a more abstract interpretation of the sentence, and as implicated by construal level theory, creating an abstract mental representation might be construed as indicating more physical distance. Naturally, if there is no embodiment observed, physical distance judgments should not be observed as a function of reading metaphor or literal sentences. The current study will test whether reading metaphor influences the physical (spatial) distance perceived in pictures of two people interacting.

The following experiments used a similar design to study 3 of Bowes and Katz (2015). Bowes and Katz asked participants to read 58 metaphorical (or literal counterpart) sentences that were not contextualized in any way, and then complete the RMET, an ostensibly unrelated task. For the current study, instead of completing the RMET, participants made several spatial distance judgments after the reading phase. The stimuli for the distance judgments were pictures of pairs of people conversing and the task was to judge the distance between the two characters using the eyes as the reference point. Recall, if embodiment effects obtain, reading metaphors should influence perception of physical distance, though we are uncertain whether the effect will be to increase or decrease the perception of distance of models in pictures. If there is no embodiment, then reading metaphor should have no effect on judgments of physical distance. We conducted and report next a set of studies that examine the effect of metaphor on judgments of physical distance.

Chapter 2

2 Study 1

2.1 Method

2.1.1 Participants

Participants were recruited via the University of Ontario SONA system. The sample consisted of 194 (149 females) psychology students from the University of Western Ontario who participated as a partial course requirement. The ages ranged from 16 to 28 ($M=18.20$, $SD=1.34$).

2.1.2 Materials

There were two separate phases: a reading phase and a perceptual judgment phase. The stimuli for the reading phase consisted of the 58 matched metaphorical and literal statements taken from the Cardillo, Schmidt, Kranjec, and Chatterjee (2010) norms that had been used by Bowes and Katz (2015; study 3). These sentences are matched so that the last word of the sentences is the same, but the context of the sentence makes this word either metaphorical or literal (e.g., Metaphorical: “The price change was a major drop”; Literal: “The bungee jump was a scary drop”). Sentence pairs had an equal number of words per sentence. The sentences were also matched on emotional valence, number of pronouns, and number of affect, social, motion, and cognitive mechanism words. Fourteen of the sentences were followed by simple comprehension questions. The sentences were presented in random order.

Of the 58 sentences, 14 were followed by simple comprehension questions that could be answered either yes or no. For example, in the metaphor condition, one of the sentences was “the dress was an attractive sizzle,” and the comprehension question was “was the dress attractive.” In this example, the correct answer is “yes.” The purpose of these questions was to check if the participant was paying attention to the task.

For the perceptual judgment task, the stimuli were 26 pictures of pairs of people interacting. The pictures were taken indoors against a white wall. For each picture, the

pair was facing each other and the picture was taken from the side so that each person's body was fully visible. The distance between the pairs varied from 12 in. to 60 in. measured from feet to feet and the average distance between the pairs across all pictures was 36.38 in.. Although some of the same models appeared in multiple pictures, there was no repeat of a pair of models across the 26 pictures. Five of the pictures featured two males, seven featured two females, and fourteen featured one male and one female. The models were all acquaintances of the researcher who volunteered to help with the study.

2.1.3 Procedure

Participants were tested three at a time, with each participant tested in a separate testing room. Participants were randomly assigned to conditions and rooms³. Upon arrival, participants were given a letter of information that explained the experiment's procedures and a consent form to sign.

In the first phase of the experiment, participants read either 58 metaphorical or literal sentences, depending on what condition they were randomly assigned to. The sentences were presented on a computer screen using E-Prime and participants read the sentences word-by-word. Having the participants read the sentences in this way allowed us to measure the reaction times for each word. Because the critical words were matched between conditions, this allowed us to compare the reaction times for these words directly without having to account for important factors like word length or frequency. Fourteen of these sentences were followed by simple comprehension questions to ensure that the participants were paying attention to the stimuli. The sentences were presented in random order.

Following the 58 sentences was a screen that indicated the participant had completed the first half of the study and that displayed instructions for the second half, which consisted of perceptual judgments. For this phase, participants were instructed to judge the distance

³ The computers in the rooms had different monitor sizes. To ensure that this did not influence the results, we spread the conditions across the three rooms equally.

between 26 pairs of people interacting in pictures and to base their judgment on what they thought the distance would be in real life, not just the distance on the computer screen. They were instructed to use the eyes as a reference point. The eyes were chosen first of all because we needed a reference to reduce variability. The eyes may also be important for social interaction and reading metaphor may increase attentiveness to the eyes and their display of emotion (Bowes & Katz, 2015). Thus, having the participants focus on the eyes may highlight the social interaction more than, for instance, having them focus on the models' feet (which is how the actual distance measurements were obtained due to simplicity). Participants were also given a sheet that had an inch drawn on it to use as a reference. The pictures were displayed on the computer screen using E-Prime. Underneath each picture were the instructions "please estimate the distance between the two people in inches." Underneath these instructions was a textbox that displayed the participants' key presses so they could verify that they had correctly entered their response. The 26 images were presented in random order. The whole experiment took approximately 15 minutes to complete. After the participants finished this task, they were thanked and given a debriefing form that explained the nature of the study.

2.2 Results

2.2.1 Error rates on comprehension questions

One participant was removed because English was not his first language. Participants in the metaphor condition made more errors on the comprehension questions on average compared to the literal group and this difference approached significance, $t(191) = 1.775$, $p = .077$. The mean errors for each group are displayed in table 2.1. Because we are hypothesizing that the reading stimuli will influence how participants respond in the perceptual task, we wanted to ensure that the participants were actually processing the sentences. Thus, we removed participants who made errors on over 33% (5 or more out of 14) of the comprehension questions. We wanted to remove as few participants as possible; however, because the comprehension questions were not difficult, an error rate above 33% likely indicated the participant was not fully attentive. It should be noted that even if these participants were not removed, the pattern of results would still be the same.

Two participants from the literal condition made errors on over 33% of the comprehension questions and were removed from further analysis. No participants in the metaphor condition had an error rate above 33%. The mean errors for each group after these participants were removed are displayed in table 2.2. When these participants were removed, a t-test revealed that the metaphor group made significantly more errors on average than the literal group, $t(189) = 2.431, p = .016$.

Table 2.1. Average errors on comprehension questions.

	<u>Metaphor</u>	<u>Literal</u>
N	97	96
Mean	1.48(10.60%)	1.17(8.33%)
SD	1.19	1.30

Table 2.2. Average errors on comprehension questions after removing participants with error rates over 33%.

	<u>Metaphor</u>	<u>Literal</u>
N	97	94
Mean	1.48(10.60%)	1.07(7.67%)
SD	1.19	1.14

2.2.2 Distance judgments

Two participants, one from each condition, misunderstood the task and were removed from further analysis. If one of the participant's responses was ambiguous, it was counted as an error and the participant was removed from further analysis. For example, one person entered the response "5-". It is likely this individual intended to enter "50," but hit the "-" key instead of the "0" key by mistake. However, it is impossible to determine the participant's intended answer, thus, it was counted as an error. These ambiguous cases will from this point on be referred to as "input errors." Because each stimulus had an actual distance associated with it, there was no simple way to remove the trial and take the average of the remaining trials because this would lead to a biased mean. Overall, eighteen participants (10 metaphor, 8 literal) were removed due to input error. Also, because this task allowed for an open-ended response, some participants had distance estimates that greatly varied from their group's mean. We removed participants who had average distance judgments that fell outside 3 standard deviations from their

respective group's means from further analysis so that these extreme scores would not obscure the overall pattern of results. Six participants (1 metaphor, 5 literal) had average distance judgments that fell outside 3 standard deviations from their respective group's means and were removed from further analysis. This yielded 80 remaining participants in the literal condition and 85 in the metaphor condition.

An independent t-test was conducted using type of language (metaphor vs. literal) as the independent variable and average distance judgment across the 26 pictures as the dependent variable. The t-test revealed that participants in the metaphor condition actually judged the pairs in the pictures to be farther apart on average compared to participants in the literal condition, $t(149) = 2.233$, $p = .027$. Levene's test indicated unequal variances ($F = 10.482$, $p = .001$); thus, the degrees of freedom were reduced from 163 to 149. The means are displayed in Table 2.3.

Table 2.3. Average distance judgment in inches by condition.

	<u>Metaphor</u>	<u>Literal</u>
N	85	80
Mean	44.60	42.11
SD	8.39	5.75

These results support two of the hypotheses mentioned above. One hypothesis was that reading metaphor creates general feelings of closeness with others. This perceived closeness could actually lead the participant to see two others as farther apart because as one moves closer toward two objects, the objects move farther apart in one's visual field. The other hypothesis, arising from construal level theory, was that reading metaphor highlights semantic distance, or conceptual abstractness. Based on this, we predicted that participants who read metaphor would judge participants as farther apart because they would project the semantic distance onto their spatial distance judgments. The results above are also consistent with this hypothesis.

The actual average distance between the pairs (as measured from feet to feet) was 36.38 inches, so both conditions overestimated the distance on average, but the metaphor group overestimated by about 2.5 in. more than the literal group on average.

We also divided the stimuli into four quartiles based on the actual distance between the models to see if the effect was consistent across the different distances. The first quartile had distances of 12, 13, 14, 18, 19, 22, and 24 in, the second quartile had distances of 28, 29, 30, 31, 34, and 37 in, the third quartile had distances of 38, 40, 41, 42, 43, and 46 in, and the fourth quartile had distances of 48, 50, 53, 57, 58, 59, and 60 in. We conducted a 2 x 4 split plot AVOVA using condition as a between subjects factor and distance as a within subjects factor. Mauchly's test of sphericity indicated that the assumption of sphericity was violated, $\chi^2 = 130.96$, $p < .001$; thus, the degrees of freedom for the main effect of distance and the interaction between distance and condition were adjusted using the Greenhouse-Geisser correction. Overall, there were significant main effects of both distance, $F(1.939, 316.126) = 1864.534$, $p < .001$, $\eta^2 = .920$, and condition, $F(1, 163) = 4.848$, $p = .029$, $\eta^2 = .029$. However, the interaction was not significant, $F(1.939, 316.126) = 0.741$, $p = .474$. This suggests that the main effect of condition was roughly equal in magnitude for each of the distance quartiles (i.e., participants who read metaphors judged the distance to be greater than the literal group in each quartile). The means and standard deviations for each group by quartile are displayed in Table 2.4.

Table 2.4. Means (and SD's) for average distance judgment by condition for each distance quartile.

	<u>First Quartile</u>	<u>Second Quartile</u>	<u>Third Quartile</u>	<u>Fourth Quartile</u>
Metaphor	23.40(5.49)	39.16(8.27)	49.82(10.13)	66.05(12.76)
Literal	22.05(4.54)	36.48(6.41)	47.24(7.40)	62.75(9.28)

2.2.3 Accuracy

Accuracy for each perceptual judgment was obtained by taking the absolute value of the participant's judgment subtracted from the actual distance between the pair⁴. A higher number in this case means that the participant was farther from the actual distance, and thus, less accurate. Two more participants (one from each condition) had accuracy averages that fell three standard deviations outside of their respective group's mean and were removed from further analysis. On average, the literal group was more accurate than the metaphor group, $t(139) = 3.086$, $p = .002$. Levene's test indicated unequal variances ($F = 12.832$, $p < .001$); thus, the degrees of freedom were reduced from 161 to 139. The means are displayed in Table 2.5.

Table 2.5. Average accuracy in inches by condition.

	<u>Metaphor</u>	<u>Literal</u>
N	84	79
Mean	10.58	8.33
SD	5.62	3.48

Note: Accuracy equals the absolute value of the participant's judgment subtracted from the actual distance. Therefore, a lower number indicates higher accuracy.

⁴ This is an imperfect measurement of accuracy because we obtained the actual distances between the pairs by measuring from feet to feet; however, participants were instructed to estimate the distance between the pairs using the eyes as reference points. The models in the pictures were standing upright, for the most part not leaning forwards or backwards. Thus, the measurement from feet to feet is a close approximation for the actual distance from the models' eyes to eyes.

Chapter 3

3 Study 2

The findings of study 1 indicated that participants who read metaphor judged pairs of people to be farther apart compared to participants who read literal language. This is a novel finding and contrasts with Horton's (2007) finding that reading metaphors embedded in dialogue led participants to judge the interlocutors as closer to one another, though in his study closeness referred to social and not physical closeness. As noted above, the findings are consistent with another instantiation of embodiment, which suggests reading metaphor induces participants to perceive the people interacting in the pictures as further apart. Due to the novelty of this finding, we sought to replicate the findings in study 2. Also, it is unclear whether it was metaphor driving the effect in study 1. For instance, perhaps reading literal language influenced participants to make more accurate judgments because literal language emphasizes accuracy and precision. Another possibility is that there was an effect of both types of language, with metaphor inducing greater inaccuracy and literal language inducing greater accuracy relative to a control condition. Thus, for study 2, we added a non-reading condition. These participants simply made the same distance judgments without reading anything except the instructions.

3.1 Method

3.1.1 Participants

There were 123 participants recruited via the University of Ontario SONA system for this experiment. The sample consisted of psychology students from the University of Western Ontario who participated as a partial course requirement. None of the participants had served in Study 1. Three participants were removed from the sample because English was not their first language and one participant was removed due to non-random assignment (in this case, the experimenter was running late and assigned the participant to the control condition, which was the shortest in duration). This yielded a sample of 119 (92 females) participants. The ages ranged from 17 to 21 ($M=18.32$, $SD=0.612$).

3.1.2 Materials

The materials were the same as study 1, except that there was an additional non-reading condition. In this condition, participants judged the physical distance between the same 26 pairs of people, but they did not read any of the Cardillo et al. (2010) sentences.

3.1.3 Procedure

The procedure was the same as study 1, except that for the non-reading condition, there was no reading phase. Thus, this was a between-subjects design with three levels: metaphor, literal, and non-reading. Participants were randomly assigned to the three conditions. The participants in the non-reading condition received similar instructions to what the participants in study 1 received following the reading task, only they received these instructions at the beginning of the experiment. The literal and metaphor conditions of study 2 were the same as the literal and metaphor conditions of study 1. The whole experiment took approximately 15 minutes to complete for participants in either the metaphor or literal conditions, and about 5 to 10 minutes for participants in the non-reading condition.

3.2 Results

3.2.1 Error rates on comprehension questions

Only participants in the metaphor and literal conditions answered comprehension questions. A t-test revealed that there were no significant differences in average errors between these two groups, $t(84) = 0.691, p = .491$. The means are displayed in Table 3.1. Two participants in the literal condition made errors on over 33% of the comprehension questions and were removed from further analysis. No participants in the metaphor condition had an error rate above 33%. The means for each group after these participants were removed are displayed in table 3.2. A t-test revealed that after these participants were removed, the metaphor group made significantly more comprehension errors than the literal group, $t(82) = 2.761, p = .007$.

Table 3.1. Average errors on comprehension questions.

	<u>Metaphor</u>	<u>Literal</u>
N	43	43
Mean	1.53(10.96%)	1.28(9.14%)
SD	1.14	2.14

Table 3.2. Average errors on comprehension questions after removing participants with error rates over 33%.

	<u>Metaphor</u>	<u>Literal</u>
N	43	41
Mean	1.53(10.96%)	0.90(6.45%)
SD	1.14	0.94

3.2.2 Distance judgments

A total of 15 participants (6 literal, 9 metaphor) were removed from further analysis due to input error. One additional participant from the literal condition was removed because her average distance judgment was over three standard deviations above her group's mean. This yielded 34 remaining participants in both the metaphor and literal conditions and 33 in the non-reading condition. An independent one-way ANOVA was conducted using type of language (metaphor vs. literal vs. non-reading) as the independent variable and average distance judgment across the 26 pictures as the dependent variable. The ANOVA revealed that the mean differences between the conditions were reliable, $F(2, 98) = 3.971, p = .022$. Least Significant Difference (LSD) post-hoc comparisons revealed that participants in the metaphor condition judged the pairs to be significantly farther apart on average than participants in either the literal condition or the non-reading condition. Distance judgments between the literal condition and non-reading condition did not differ significantly. The means are displayed in Table 3.3.

Table 3.3. Average distance judgment in inches by condition.

	<u>Metaphor</u>	<u>Literal</u>	<u>Non-reading</u>
N	34	34	33
Mean	46.13	41.15	41.23
SD	9.38	6.83	8.56

We also divided the distances into quartiles based on the actual distances between the models, as was done in study 1, and conducted a 3 x 4 split-plot ANOVA with condition as a between-subjects factor and distance as a within-subjects factor. Once again, Mauchly's test of sphericity indicated that the assumption of sphericity was violated, $\chi^2 =$

91.294, $p < .001$. The degrees of freedom for the main effect of distance and the interaction between distance and condition were adjusted using the Greenhouse-Geisser correction. The two main effects were once again found to be reliable; distance: $F(1.819, 178.286) = 1158.545$, $p < .001$, $\eta^2 = .922$, condition: $F(2, 98) = 4.027$, $p = .021$, $\eta^2 = .076$. The interaction was not significant, $F(3.638, 178.286) = 1.199$, $p = .313$. The means and standard deviations for each condition by quartile are displayed in table 3.4. In each quartile, the metaphor group judged the distance to be greater on average than either the literal or non-reading groups.

Table 3.4. Means (and SD's) for average distance judgment by condition for each distance quartile.

	<u>First Quartile</u>	<u>Second Quartile</u>	<u>Third Quartile</u>	<u>Fourth Quartile</u>
Metaphor	25.76(6.45)	42.28(10.01)	50.75(10.94)	65.84(13.15)
Literal	22.27(3.76)	35.88(6.59)	45.45(9.32)	60.87(11.34)
Non-reading	23.21(6.41)	36.60(9.49)	44.71(9.83)	60.23(10.51)

These results replicate the findings of study 1 and the fact that the literal and non-reading conditions did not differ significantly indicate that it is the reading of metaphor that is driving the effect.

3.2.3 Accuracy

Accuracy was measured, as in study 1, by comparing reported perceived distance relative to the actual distance of the models in the pictures. One additional participant from the metaphor condition was removed from the accuracy analysis because she had an average accuracy three standard deviations above her group's mean (remember that accuracy is the absolute distance from the correct answer; thus, a higher score indicates less accuracy). The effect of reading condition on accuracy approached significance, $F(2, 97) = 2.548$, $p = .083$. Least Significant Difference (LSD) post-hoc comparisons revealed that participants in the metaphor group were significantly less accurate than participants in either the literal or non-reading conditions, but that the literal and non-reading groups did not differ significantly. The means are displayed in Table 3.5.

Table 3.5. Average accuracy in inches by condition.

	<u>Metaphor</u>	<u>Literal</u>	<u>Non-reading</u>
N	33	34	33
Mean	11.22	8.52	9.55
SD	5.85	3.99	4.81

Note: Accuracy equals the absolute value of the participant's judgment subtracted from the actual distance. Therefore, a lower number indicates higher accuracy.

Thus, we replicated the effect found in Study 1, and demonstrated further the effect was driven by the reading of metaphor. The estimation of distance between the reading of literal control sentences and not reading any sentences at all did not differ from one another. Although we have found a replicable effect, the mechanism underlying this effect is not clear. The next two studies were attempts to identify possible mechanisms.

Chapter 4

4 Studies 3 and 4

The purpose of studies 3 and 4 was to examine further why processing metaphor (compared to a literal sentence counterpart) induces people to see two people interacting as being more spatially distant. Recall that one hypothesis suggested earlier is that reading metaphor causes people to feel closer to others in general. If this is true, the participants in the first two studies may have perceived both of the models to be closer to themselves after reading metaphors. When one draws nearer to two objects, the objects move farther apart in the perceiver's visual field; thus, if the participants felt closer to the models, they may have judged the distance between the models to be greater. For study 3, we examined this possibility directly by asking participants to imagine that they were the photographer of the pictures and to judge the distance between themselves as the photographer and the models in the picture.

The second hypothesis relates to the concept of "distance." So far in this series of experiments, only spatial distance judgements were obtained, but in study 4, we instead asked participants to judge the social distance between the models. We instructed participants to judge how well the two people in each picture know each other on a 5-point Likert scale with 1 being "not at all" and 5 being "very well." This is similar to Horton's (2007) task, except that the metaphors employed here are presented without context and are not directly related to the models for which the intimacy judgments are being made. The purpose of this experiment was to determine whether or not reading metaphors without context actually induced a sense of intimacy in this task. If Horton's findings are replicated in the non-contextualized conditions employed here and in Studies 1 and 2, participants who read metaphor would rate the models to be closer friends on average compared to participants who read literal language. Finding such an effect would be problematic because in Studies 1 and 2, reading metaphor led to judgments of greater physical distance, the opposite of what an embodied account based on social intimacies would predict.

4.1 Study 3 method

4.1.1 Participants

Seventy-three participants were recruited via the University of Western Ontario's SONA system. The sample consisted of psychology students who participated as a partial course requirement. None had served in the earlier studies. Four participants were removed from further analysis because English was not their first language and one participant was removed due to poor vision. This yielded a sample of 68 participants (42 females) whose ages ranged from 18 to 22 ($M=18.32$, $SD=0.68$).

4.1.2 Materials

As in study 1, study 3 had two between-subjects conditions: metaphor and literal. The reading phase of the experiment was identical to that of study 1. In the perceptual judgment phase, instead of asking the participants to judge the distance between the pair, we asked them to imagine they were the photographer in the picture and to estimate the distance (in inches) between themselves and the pair of models in the picture. The same 26 pictures that were used in studies 1 and 2 were used in study 3. Because we did not record the actual distances between the photographer and the models when these pictures were taken, accuracy analysis could not be done.

4.1.3 Procedure

The procedure is identical to that of study 1 except that in the perceptual judgment phase, we instructed participants to imagine themselves as the photographer and to judge the distance (in inches) between themselves and the pair in the picture.

4.2 Study 3 results

4.2.1 Error rates on comprehension questions

Participants in the metaphor condition made more errors on average compared to participants in the literal condition; however, this difference was not significant, $t(66) = 1.355$, $p = .180$. The means are displayed in Table 4.1. Three participants in the metaphor condition made errors on over 33% of the comprehension questions and were

removed from further analysis. No participants in the literal condition had an error rate above 33%. The mean errors for each group after these participants were removed are displayed in Table 4.2. A t-test revealed that after these participants were removed, the mean errors between the groups did not differ significantly, $t(63) = 0.030$, $p = .976$.

Table 4.1. Average errors on comprehension questions.

	<u>Metaphor</u>	<u>Literal</u>
N	32	36
Mean	2.06(14.73%)	1.39(9.92%)
SD	2.61	1.36

Table 4.2. Average errors on comprehension questions after removing participants with error rates over 33%.

	<u>Metaphor</u>	<u>Literal</u>
N	29	36
Mean	1.38(9.85%)	1.39(9.92%)
SD	1.18	1.36

4.2.2 Distance judgments

Instead of asking participants to judge the distance between the pair in the picture, for this experiment, we asked participants to imagine they were the photographer taking the picture and to judge how far they themselves were from the pair in the picture. Five participants (2 metaphor, 3 literal) were removed from further analysis due to input error. This left a remaining 27 participants in the metaphor condition and 33 in the literal condition. The mean distance judgments for the two conditions are displayed in Table 4.3. The means between the two conditions did not differ significantly, $t(58) = 0.345$, $p = .732$. Thus, these data indicate we cannot attribute the distance effects found in Studies 1 and 2 to metaphor inducing a third person (in this case the participant) to feel more physically close to other people in general.

Table 4.3. Average distance judgment in inches by condition.

	<u>Metaphor</u>	<u>Literal</u>
N	27	33
Mean	97.07	98.69
SD	16.91	19.11

4.3 Study 4 method

Recall the aim of this study was to test whether the task employed here induced participants to see people as more socially close just by the mere act of reading metaphor, even when done so without context.

4.3.1 Participants

A total of 95 participants were recruited via the University of Western Ontario's SONA system. The sample consisted of psychology students who participated as a partial course requirement. Three participants were removed from further analysis because English was not their first language and one participant was removed due to non-random assignment (in this case, the experimenter was running late and assigned the participant to the control condition, which was the shortest in duration). This yielded a sample of 91 participants (69 females) whose ages ranged from 17 to 20 ($M=18.21$, $SD=0.51$).

4.3.2 Materials

Study 4 had three between-subjects conditions: metaphor, literal, and non-reading. The reading phase stimuli for the literal and metaphor conditions are identical to those of studies 1 and 2. Instead of instructing participants to make a spatial judgment in the second phase of the experiment, we instead asked them to rate how well the pair in each picture knows each other on a 5-point Likert scale with 1 being "not at all" and 5 being "very well." The same 26 pictures that were used in the other studies were used again here.

4.3.3 Procedure

Comparable to study 2, study 4 consisted of three between-subjects conditions: metaphor, literal, and non-reading. The procedure was identical to that of study 2, except that instead of judging the spatial distance between each pair of models, participants instead estimated the intimacy between each pair on a 5-point Likert scale.

4.4 Study 4 results

4.4.1 Error rates on comprehension questions

On average, participants in the metaphor conditions made more errors on the comprehension questions than participants in the literal condition; however, the difference was only marginally significant, $t(61) = 1.980$, $p = .052$. The means are displayed in Table 4.4. One participant from the literal condition and three participants from the metaphor condition made errors on over 33% of the comprehension questions and were removed from further analysis. The mean errors for the two groups after these participants were removed are displayed in table 4.5. A t-test revealed that after these participants were removed, the metaphor group made significantly more errors than the literal group, $t(57) = 2.380$, $p = .021$.

Table 4.4. Average errors on comprehension questions.

	<u>Metaphor</u>	<u>Literal</u>
N	32	31
Mean	2.19(15.625%)	1.10(7.83%)
SD	2.49	1.81

Table 4.5. Average errors on comprehension questions after removing participants with error rates over 33%.

	<u>Metaphor</u>	<u>Literal</u>
N	29	30
Mean	1.52(10.84%)	0.83(5.95%)
SD	1.12	1.09

4.4.2 Intimacy judgments

For study 4, instead of asking for a spatial distance judgment, we asked participants to rate how well the pair in the picture know each other on a 5-point Likert (1=not at all, 5=very well). A total of 10 participants were removed due to input error; 3 from the non-reading condition, 2 from the literal condition, and 5 from the metaphor condition. This yielded 25 remaining participants in the non-reading condition, 28 in the literal condition, and 24 in the metaphor condition. The mean intimacy judgments are displayed in Table 4.6.

Table 4.6. Average intimacy judgment by condition

	<u>Metaphor</u>	<u>Literal</u>	<u>Non-reading</u>
N	24	28	25
Mean	2.65	2.70	2.70
SD	0.48	0.35	0.46

As can be seen above, the means between the groups differed very little and an independent one-way ANOVA indicated non-significance, $F(2, 74) = 0.097, p = .908$. Ultimately, reading metaphors without context did not influence participants' intimacy judgments.

We also ran a Pearson's correlation analysis between the participants' average intimacy judgment for each picture and each picture's actual distance. There was a strong negative correlation, $r(24) = -.851, p < .001$; that is, as the actual distance in the pictures increased, the participants judged the models to be less intimate. This indicates that the spatial distance between the models strongly influenced the participants' judgments of intimacy. This partially supports the embodied hypothesis, which states that abstract conceptual domains are understood in terms of more concrete, bodily experiences. In this case, we see an example of physical distance, a concrete, experiential domain informing the more abstract domain of intimacy. However, the effect here is not moderated by what one read prior to completing the physical judgment task. This finding also supports construal level theory, which states that social distance and spatial distance are cognitively related, and that these two dimensions influence and are influenced by each other.

Chapter 5

5 Supplementary Analysis

5.1 Comprehension errors across all studies

Across the four studies, the participants who read metaphor consistently had a higher percentage of comprehension errors in the reading task compared to participants who read literal language. Collapsing across the studies, a t-test revealed that this effect was significant, $t(408) = 2.905$, $p = .004$. The means and standard deviations are displayed in table 5.1.

Table 5.1. Average errors on comprehension questions collapsed across the four studies.

	<u>Metaphor</u>	<u>Literal</u>
N	204	206
Mean	1.70(12.115%)	1.22(8.70%)
SD	1.74	1.59

5.2 Reaction times across all studies

We also examined the reaction times for reading the critical words in each of the matched sentences. The experiment was programed so that the participant read the sentences word by word, pressing the spacebar to move from one word to the next. Thus, reaction times for the critical words were obtained by measuring the milliseconds between the spacebar press to move to the critical word and the spacebar press to move from the critical word to the next screen. Previous research suggests that reading times for metaphorical sentences are longer than reading times for literal sentences when the sentences are presented without context (Ortony, Schallert, Reynolds, & Antos, 1978; Inhoff, Lima, & Carroll, 1984). We analyzed the reaction times for the sentences we used to test whether the reaction times were consistent with this previous research. The critical words are the exact same for both conditions, but the context of the sentences make the words either literal or metaphorical (e.g., Metaphorical: “the price change was a major *drop*”; Literal: “The bungee jump was a scary *drop*”). Because the words are the same, this controls for potential confounds such as word frequency or word length. Seven participants from the metaphor condition and seventeen participants from the literal condition had reaction times that fell outside 2.5 *SD*'s of their groups' means and were removed from further

analysis. After these participants were removed, a t-test revealed that the metaphor group had significantly longer reaction times on these critical words than the literal group, $t(384) = 2.612, p = .009$. The means and standard deviations are displayed in table 5.2. This is consistent with previous research that has found metaphor takes longer to process than literal language when metaphor is presented without context.

Table 5.2. Average reaction times in milliseconds for critical words across the four studies.

	<u>Metaphor</u>	<u>Literal</u>
N	197	189
Mean	781 ms	727 ms
SD	215 ms	188 ms

Although the metaphor group had more errors and took longer to read critical words than the literal group, there was not a significant correlation between errors and reaction times across the two groups after the participants who had reaction times outside 2.5 *SD*'s of their groups' means were removed, $r(384) = .012, p = .821$, two-tailed.

Chapter 6

6 General Discussion

Studies 1 and 2, and the correlation analysis of Study 4 all support a version of embodiment. In Study 4, ratings of social intimacy were negatively correlated with the physical distance of the models in the stimuli; that is, participants' judgments of intimacy increased as the distance between the models in the pictures shortened. In Studies 1 and 2, reading sentences prior to performing the physical judgment task influenced the perceptual distance perceived in the models, with reading metaphor leading to greater judgments of physical distance than the reading of literal counterparts. In Study 3, one explanation for why this might occur was discounted, namely that reading metaphor induces a general sense of intimacy which, in turn, would lead participants to see the models as closer to themselves, and consequently further apart from one another. Some implications of these findings follow.

6.1 Metaphor without context and within a social context

Horton (2007) found that reading metaphors in dialogue influenced participants to see the interlocutors as more intimate. Bowes and Katz (2015) found that reading metaphor, even out of context, facilitated the inference of others' emotions, as measured by the RMET. We hypothesized that these two effects might be related – that reading metaphor induces a sense of intimacy that influences social judgments and facilitates the inference of others' emotions. Furthermore, we hypothesized that embodied simulation might be the mechanism that facilitated the emotional inferencing. Thus, we tested this embodied hypothesis directly by having participants make a spatial distance judgment between two people, rather than a social judgment as in Horton's experiment. However, participants perceived the models as further apart, which contradicts an embodied explanation of Horton's finding.

The first thing that should be noted is that the task of the present study differed from Horton's (2007) methodology in that the metaphors did not have context. The participants in Horton's study made a social judgment about the actual speakers and

hearers of metaphors, but in our task, the metaphors were not related to the models in the pictures; in fact, the distance judgments were presented as a separate task. From the results of study 4, it is clear that reading metaphor out of context in this way did not have an influence on participants' social judgments. It remains to be tested whether support for an embodied explanation based on social intimacy would occur if Horton's (2007) study were replicated using metaphors in a discourse context and directing participants to consider the people in the pictures as the interlocutors described in the discourse.

Regardless, the findings of Study 4 are problematic for our understanding of Bowes and Katz (2015). Recall that Bowes and Katz (2015, Study 3) found a facilitation effect of reading metaphor out of context on the RMET. The only effect linking that effect to intimacy was in their second study, in which ratings of greater intimacy (based on Horton-like stimuli) were related to higher scores on the RMET. Nonetheless, the findings presented here leave open the mechanism that underlies the effect reported by Bowes and Katz, when metaphor out-of-context is employed. As shown here, when out of context, metaphor might not induce a sense of intimacy and any explanation for the RMET effects cannot be attributed to metaphor inducing greater intimacy. It may well be the earlier findings were not based on intimacy per se but on the reading of metaphor engaging an emotional mechanism that one simulates on determining emotion from pictures of eyes.

6.2 Implications for construal level theory

The most direct effect found here that supports, in general, construal level theory, is that which was observed in Study 4, where participants' ratings of intimacy were correlated with the actual physical distance between the models in the pictures. In a study most similar to those conducted in this thesis, Stephan et al. (2010) found that reading colloquial language, which is indicative of intimacy, led participants to judge two interlocutors to be spatially closer together compared to reading polite language, which is indicative of social distance. Hussey and Katz (2006) found that people often use colloquial language when talking metaphorically, and report other instances where non-literal language is a signal to intimacy or social closeness, for instance, with irony (Kreuz, 1996) and idioms (Bell & Healey, 1992; Bell, Buerkel-Rothfuss, & Gore, 1987).

As such one would expect that the reading of metaphor should have led to judgments that the models in the pictures were closer to one another, compared to when literal language was employed. In fact, the results of Studies 1 and 2 are in the completely opposite direction. It remains to be seen if the methodology employed in Stephan et al. (2010) were replicated (using metaphor instead of colloquial language), whether this reversal of effects would still occur.

We propose an alternative possibility, even if the reversal we observe here is replicated using Stephan et al.'s (2010) methodology. Metaphor differs from colloquial language in several ways. As noted earlier, one way is that the comprehension of metaphor involves finding a similarity for unlike concepts (Wolff & Gentner, 2011; Ortony, 1979; Trick & Katz, 1986; Katz, 1989). We speculate that semantic distance may be another type of psychological distance (aside from the four dimensions that are already listed in construal level theory), and that when metaphors are presented without context and without any connection to a speaker or hearer (as done here), semantic distance may be a more salient dimension than social distance. From this perspective, participants may have projected the semantic distance found with most metaphors onto their spatial judgments. As such, the greater semantic distance (with perhaps attributions that the sentences are more “abstract” than the closer, literal counterparts), would be reflected in greater physical distance.

This explanation is not without its own difficulties. For instance, if as we speculate here, that semantic distance can influence reasoning at the other levels of psychological distance, we should have found inflated social distance judgments as well. That is, in study 4, participants who read metaphor should have judged the models to be less intimate (i.e., more socially distant) on average compared to the other conditions, but the results indicated that these groups did not differ. The reason for this may be that the instructions for the social judgment task were not framed in terms of distance. The instructions were simply “estimate how well these two people know each other.” No mention was made of social “distance.” Zhang and Wang (2009) found that the temporal, social, and hypothetical dimensions only influenced spatial reasoning when participants perceived similarity between these dimensions. The similarity between the semantic

dimension and the social dimension may not have been obvious in study 4 because no mention was made of “distance” in the instructions for the social judgment task. Perhaps if the instructions were worded to highlight distance (e.g., “how *close* of friends are the two people in this picture?”), reading metaphor would also lead to inflated social distance judgments. A test of this possibility is required.

Another issue is that the putative semantic distance did not influence spatial distance judgments in study 3. However, consider the nature of the tasks in studies 1 and 2 versus study 3. In studies 1 and 2, the judgment was *between* two people. Similarly, a metaphor is a comparison *between* two objects. Therefore, it is likely participants could have projected this relative semantic distance onto the spatial judgment task. However, in study 3, the spatial judgment was egocentric; that is, it involved the perceiver’s location. The connection between the two tasks is not nearly as parallel in this case. Therefore, it is less likely that participants would project the semantic distance highlighted by metaphor onto their spatial judgments in this task.

Interestingly, the metaphor groups also had much higher standard deviations than the literal groups in their distance estimates in studies 1 and 2. It is tempting to interpret this as reading metaphor simply leading to less accuracy and therefore more variance; however, in both of these studies the metaphor group consistently overestimated the distances in addition to showing more variance. Perhaps there are individual difference regarding the degree to which participants’ perceptual judgments are affected by reading metaphor. Bowes and Katz (2015) found that participants who sensed more intimacy between interlocutors using metaphor performed better on the RMET. This could suggest that some participants are more sensitive to metaphor than others. This difference in individual sensitivity to metaphor could explain why there was more variance in distance judgments in the metaphor groups.

6.3 Comprehension errors

Across the four studies, participants in the metaphor conditions made significantly more errors than participants in the literal conditions and also took significantly longer to read critical words. However, there was not a significant relationship between errors and

reading times. Previous research has found that metaphor takes longer to process than literal language when metaphor is presented without context (Ortony, Schallert, Reynolds, & Antos, 1978; Inhoff, Lima, & Carroll, 1984), so this result is not surprising. However, the question remains, why did the metaphor group make more comprehension errors than the literal group?

As mentioned earlier, metaphorical statements, when used in certain contexts, can also be interpreted as ironic (Katz, 1996). For instance, consider the following statement:

“Albert Katz is the Jose Bautista of his hockey team.” If this statement is uttered after Katz scores a goal, one would likely interpret this as metaphorical. However, if the same statement is uttered after Katz falls down on a breakaway, it would surely be interpreted as sarcastic irony, meaning Katz is anything but the superstar of his team. In the case of the present studies, the metaphorical sentences were presented without context; thus, it is possible that participants interpreted some of the statements as sarcastic irony rather than metaphor. For example, one of the metaphorical sentences was “the dress was an attractive sizzle,” and the comprehension question was “was the dress attractive?” If the participant interpreted this as sarcastic irony, they might respond “no” to this question, which would count as an error. This ambiguity might account for the larger number of errors in the metaphor group relative to the literal group.

One possibility is that this ambiguity led to less accuracy, and that this inaccuracy was carried over to the spatial judgments task, which would explain why participants in the metaphor groups were less accurate on their spatial judgments than the literal groups in studies 1 and 2. However, the issue with this explanation is that the effect was directional, that is, the metaphor group consistently overestimated the distance between the models in the pictures. If the effect was purely based on inaccuracy, we would expect to see both underestimates and overestimates. Therefore, the increased error rate in the metaphor group alone cannot account for the perceptual effects we obtained.

6.4 Some additional suggestions for future research

If semantic distance does influence spatial distance judgments, some questions remain. For instance, is this effect specific to metaphor? Metaphor is a special case because one

of its defining features is that it links two unlike (i.e., semantically distant) things, therefore, metaphor may make semantic distance especially salient. On the other hand, perhaps just reading pairs of semantically distant words could elicit the same effect. Future research could examine this possibility. Latent Semantic Analysis can be used to operationalize semantic distance (Landauer, Foltz, & Laham, 1998). Future research could make use of this technique and manipulate semantic distances between word pairs to examine whether greater semantic distances lead to inflated spatial judgments.

Another avenue for future research could be to examine whether spatial distance can influence semantic reasoning. For instance, if people are primed with words such as “far” and “distant,” would they be more likely to use metaphors to describe an object or situation than if they are primed with words such as “near” and “close.” Previous research has found that spatial distance can influence reasoning in the other psychological distances (i.e., temporal, social, and hypothetical); future research could explore whether spatial distance can have similar effects on semantic reasoning.

Future research could also make the relationship between the language stimuli and the spatial distance task more obvious. For our experiments, the two tasks were ostensibly unrelated, which may be why no social effects of reading metaphor were found. Perhaps having the sentence being spoken by one of the models in the picture (e.g., placing the sentence in a speech bubble above one of the characters) would connect the language to the people. If the experiment was altered in this way, perhaps participants reading metaphor would judge the models to be spatially closer because the models would now be the speakers and hearers of the metaphor.

Future research could also explore the process participants go through to arrive at their perceptual estimates. The data we have presented above demonstrates that participants who read metaphor judged pairs of models to be further apart, but the mechanisms the participants used to make these judgments is still a mystery. As far as visual cues, the only available information the participants had to go by was the models themselves, and the distance on the monitor screen. Some participants would touch the screen during the task, possibly using their fingers as a measure for distance. It is possible they created

rough rules to convert finger lengths on the screen into estimates of real life distance (e.g., “for every finger I can fit between these people, it is 6 inches in real life). Perhaps some participants imagined how many steps separated the two models. Another possibility is that participants used the models themselves as a marker for distance. If participants estimated a model was 5 feet tall, and the distance between the two models was approximately the same length as this model’s height, they may judge the distance to be 5 feet (60 inches). If this was the strategy used by most participants it would suggest that reading metaphor actually leads participants to see others as shorter. That is, because the measurement cue (i.e., the model’s height) is perceived as shorter, the models would be estimated to be farther apart. The issue with this explanation though is that in study 3, when the participants imagined themselves as the photographer and judged the distance between themselves and the models, there were no significant differences between participants who read metaphor and participants who read literal language. If reading metaphor lead to the perception of the models being shorter or smaller, than the participants who read metaphor in this study should have judged the models to be farther away. The process participants used to arrive at their estimates is unclear, and is a potential avenue for future research. Perhaps eye-tracking software could be used to examine where participants are looking during these perceptual tasks, and this may shed some light on the process participants go through to arrive at their decisions.

6.5 Some limitations

In addition to avenues for future research arising from the studies presented here, there are other ways the studies could be tweaked. For instance, in the reading phase of all the studies reported, we used the same 58 matched metaphor and literal sentences from Cardillo et al. (2010). Although these stimuli are some of the best matched metaphor and literal sentences available, we used only 58 sentences to generalize to all metaphorical and literal language. Future research should seek to replicate these findings with a different set of sentence stimuli.

The 26 pictures we used in the distance judgment phases of these experiments were also limited, particularly regarding studies 3 and 4. We created these stimuli specifically for judgments of spatial distance between the models, not for judgments between the

photographer and the models (study 3) or for judgments of social distance between the models (study 4). This is especially an issue for study 3. For one, we did not have the actual measurements between the photographer and the models, and thus, could not examine accuracy in that study. Perhaps the bigger issue though, is that there was limited variation in the actual distances between the photographer and the models across the 26 pictures. We took all of the pictures at approximately the same distance from the models. This lack of variability in actual distance may have decreased our ability to detect differences between the groups. Also, for the social judgment task (study 4), we did not control for other salient features in the pictures that may have influenced social reasoning, such as the facial expressions and postures of the models. For instance, in some of the pictures the models were smiling or laughing, whereas in others, they were not. These uncontrolled features likely acted as social cues that influenced the participants' intimacy judgments. We used the same pictures in studies 3 and 4 as used in the first two studies because the later studies were specifically aimed at identifying a mechanism wherein reading metaphor induced larger estimates of the distance between the models in our pictures. Nonetheless, these stimuli were not ideal for detecting subtle differences in judgments between the conditions for studies 3 and 4.

Also, it remains to be seen whether the effects found in studies 1 and 2 would replicate if non-social stimuli were used in the perceptual task. We used pictures of people conversing because we hypothesized that reading metaphors would induce a sense of intimacy which would lead participants to see the people in the pictures as closer. However, participants perceived the people in the pictures to be farther apart, which we attribute to the semantic distance associated with metaphor carrying over to the perceptual task. As mentioned above, metaphor highlights common ground between the speaker and hearer (Cohen, 1978), making in an especially social type of language; therefore, perceptual effects of reading metaphor may only occur when stimuli that highlight social interaction are used. Future research could replicate this study using more abstract stimuli, such as simple dots on the computer screen, to determine whether the same effects would occur with non-social perceptual stimuli.

Another issue is that a large amount of participants were removed due to input error. Although the number of participants removed from each condition did not differ greatly over the four studies, and thus, likely did not influence the pattern of results, it is not ideal to remove such a large number of participants. For future research, perhaps having a computer program that asks participants to verify their responses (e.g., a screen that asks “are you sure? y/n”) would reduce the amount of input errors.

Lastly, the ecological validity of the spatial judgments could be strengthened. In the physical world, as people move through the environment, they do not often have to explicitly judge the distance between two objects in terms of a unit of measurement such as inches. Distance judgments are relevant for such actions as grasping and driving a vehicle, but these judgments are not made by estimating distances in terms of a unit of measurement. Previous research involving distance judgments has used more action oriented measures, such as having participants toss a beanbag at an object, or having participants move towards an object until they match a certain distance, for instance, the distance between two pieces of tape on a wall (see Balcetus and Dunning, 2010). These types of measures would increase the ecological validity of the distance judgments, and future studies are envisioned employing such dependent measures.

6.6 Conclusion

Despite the limitations outlined above, and the many avenues for future research outlined, this thesis produced novel findings. Across four experiments, we found that reading metaphor induced participants to see pairs of models in pictures as farther apart, and that this effect was not due to the participants themselves feeling physically closer to the models, or due to participants seeing the pairs of models as being socially closer after reading metaphor. We speculate that reading metaphor highlights semantic distance, and participants projected this semantic distance onto their judgments of spatial distance. Future research should further investigate the link between semantic and spatial distance, and between the effects of metaphor in social contexts and physical distance.

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Appendices

Appendix A: Matched metaphor and literal sentences used in all four experiments. Taken from Cardillo et al. (2010).

Metaphor

His work experience was a clumsy clamber.

Her career was a rough climb.

The petition was a mad dash.

The therapy was an archeological dig.

His illness was a slow drift.

The writer's job is a lonely drive.

The price change was a major drop.

The art major was a glide.

The test review was a quick jog.

The date was a successful launch.

The secretary's promotion was a leap.

The prize money was a lift.

The marriage was a forced march.

The road was an irresistible pull.

The editorial was a brass-knuckle punch.

The new roommate was a dice roll.

The assignment was an easy sail.

Her inquiries were a nervous scamper.

The home purchase was a skydive.

The last month was a sprint.

The declined invitation was a stab.

The criticisms were a stampede.

The court case was a stroll.

The newspaper stories were a trickle.

His yacht was a rich swagger.

The numbers were a brain swarm.

Literal

The final ascent was an exhausting clamber.

The mountain was an easy climb.

The chase was a fast dash.

The expedition was a desert dig.

The current was a fast drift.

The vacation was a cross country drive.

The bungee jump was a scary drop.

The skater's entrance was a glide.

The race course was an easy jog.

The news was a rocket launch.

The creek was a small leap.

The bed was a heavy lift.

The parade was a military march.

The magnet was a weak pull.

The blow was a single punch.

The bowler's throw was a straight roll.

The bay was a difficult sail.

Her exit was a nervous scamper.

The prize was a free skydive.

The final competition was a sprint.

The injury was a knife stab.

The approach was a stampede.

The hike was a leisurely stroll.

The faucet leak was a trickle.

His gait was a confident swagger.

The bees were a black swarm.

The eviction was a mean sweep.
The reception was an icy swim.
The partnership was a financial tailspin.
The ceremony was a swamp trudge.
The anthology was a literary wander.
The letter was a goodbye wave.
The contract was a legal zigzag.
His novel was a perspective flip.
The puzzle was a logic cartwheel.
Her stare was a bull charge.
The review was a karate chop.
The interview was a painful crawl.
The taxes were a steady creep.
The divorce was a hard fall.
The cash was a steady flow.
The card was a sympathetic hug.
The lie was an integrity collapse.
His youth was a happy canter.
Her orders were a sharp bark.
The email was a desperate cry.
His job was an endless groan.
The letter was a polite grumble.
The film was a laugh.
The dress was a revealing sizzle.
The exhibition was a smash.
The reception was a real snore.
The coast was a beckoning voice.
The day's events were a whir.
The man's tattoo was a rebel yell.
The editorial was a middle class whine.
The letter was a lonely sigh.

The chore was a quick sweep.
The competitive relay was a swim.
The plane's trajectory was a tailspin.
The way back was a trudge.
The excursion was an afternoon wander.
The tsunami was a giant wave.
The mountain road was a zigzag.
His trick was a back flip.
The gymnastics stunt was a cartwheel.
The battle plan was a charge.
His gesture was a quick chop.
The motion was a swimmer's crawl.
The panther's approach was a creep.
The grandfather's accident was a fall.
The flood was a rapid flow.
The friend's greeting was a hug.
The tragedy was a building collapse.
The horse's trot was a canter.
The sound was a dog's bark.
The surprise was a hawk's cry.
The patient's reply was a groan.
The man's retort was a grumble.
Her reply was a mean laugh.
The bacon's cooking was a sizzle.
The disturbance was a smash.
The funny thing was his snore.
The hallucination was a ghostly voice.
The engine was a low whir.
His lawyer's interjection was an angry yell.
The child's request was a whine.
Her only comment was a sigh.

The pamphlet was a rant.

The speech was a rant.

Appendix B: An example of a picture used in the perceptual judgment tasks of all four experiments.



Note: These two models were 22 inches apart measured from feet to feet.

Appendix C: Ethics approval.



**Western
Research**

Research Ethics

**Western University Health Science Research Ethics Board
NMREB Delegated Initial Approval Notice**

Principal Investigator: Dr. Albert Katz
Department & Institution: Social Science/Psychology, Western University

NMREB File Number: 106447
Study Title: Reading and Social Perceptual Judgments
Sponsor: Social Sciences and Humanities Research Council

NMREB Initial Approval Date: March 30, 2015
NMREB Expiry Date: March 30, 2016

Documents Approved and/or Received for Information:

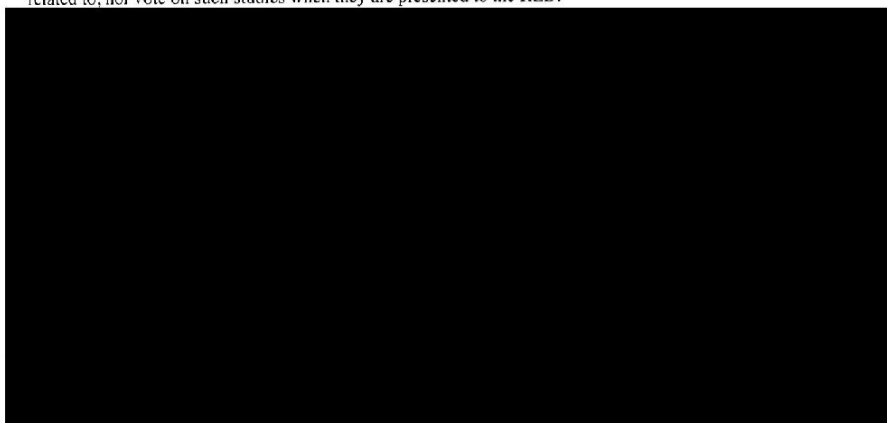
Document Name	Comments	Version Date
Revised Western University Protocol	Revised Western Protocol clean version	2015/03/23
Recruitment Items	Recruitment poster for SONA.	2015/03/23
Letter of Information & Consent	Letter of Information and Consent.	2015/03/23
Other	A third example of a picture used in the perceptual judgment task.	2015/03/23
Other	An example of a picture used in the perceptual judgment task.	2015/03/23
Other	A second example of a picture used in the perceptual judgment task.	2015/03/23
Other	Debriefing form	2015/03/23
Other	All metaphor and literal story stimuli.	2015/03/23

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the above named study, as of the NMREB Initial Approval Date noted above.

NMREB approval for this study remains valid until the NMREB Expiry Date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario.

Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.



Curriculum Vitae

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Post-secondary Education and Degrees: University of New Brunswick (Saint John campus)
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