

**Meaning and the Situated Mind: How Context Guides Mental Representations Formed
from Language**

by

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DEDICATION

For Li; my present, past, and future.

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ABSTRACT

How do humans understand the meaning of words? Generative views of language presume that word meanings are stored in a mental lexicon and retrieved when a word is encountered. On the other hand, new research on language suggests that word meanings are heavily derived from and dependent upon situational context. Furthermore, new research on situated social cognition emphasizes the situated nature of human reasoning, showing how stable thought processes are actually highly sensitive to context and situations.

In this dissertation, I argue that humans construct mental representations of word meaning by drawing upon contextual and situational information, in line with both new research on language and views of situated social cognition. I present three papers that support this hypothesis. In chapter two, I demonstrate how people draw upon surface metaphors relating cancer to an enemy to understand cancer and how to prevent it. In chapter three, I show that people draw upon incidental sensory states of heaviness to infer whether a book's synopsis relays its importance. And in chapter four, I establish that the generalized affect of a word's collocational profile (i.e., its semantic prosody) guides meaning inferences.

The final (fifth) chapter summarizes factors that guide what meaning is interpreted from words and statements. These factors are organized at different levels of analysis (word-, sentence-, text-, and reader-level), and come from a variety of disciplines. The model ultimately

demonstrates that inferences of meaning are highly sensitive to context, and implications for social psychology are discussed.

CHAPTER I

Interpreting meaning

When humans are exposed to words and statements, they usually derive some sort of meaning from them, which guides their judgments and behaviors. Students attempt to understand the material covered in a textbook; travelers try to decipher airport displays to reach their gate; readers parse through novels to understand what happens to their beloved characters in a fictional universe. Finding meaning in the communications of others is a critical element to human functioning.

Interpreting meaning with and without the mental lexicon

But how do humans interpret the meaning of words and statements? Many hold the conventional idea that interpreting the meaning of text is a matter of connecting words to stored meanings in a mental lexicon. The idea is an intuitively appealing one, suggesting that humans have a mental dictionary that stores the meanings of words. When a word is encountered, the corresponding meaning from the dictionary is retrieved from long-term memory and brought into short-term memory; thus, a mental representation is brought up, and meaning is interpreted (Katz & Fodor, 1963; Fodor, 1975; Jackendoff, 2002; Aitchison, 2012). Early theories from semiotics posit similar relations. Signs such as words correspond with underlying meaning. Issues of interpretation arise because sign -meaning relationships are arbitrary and not shared across languages and cultures, but most of the time, meaning is shared and all members of a culture agree to the same meaning of a given word (Chandler, 2007).

The theory of the mental lexicon is embedded within much of psychology. It draws upon familiar processes from the cognitive revolution such as memory stores and memory retrieval, and it utilizes a familiar conceptual metaphor of the MIND is a DICTIONARY (Lakoff & Johnson, 1980). It underscores the familiar dichotomy between denotative meaning, what a concept actually means, and connotative meaning, the associative properties of a concept (Lyons, 1977), and this dichotomy factors into some psychological research (Wimmer, Gruber, & Perner, 1985; Brownell, Potter, Michelow, & Gardner, 1984). Research has also attempted to measure the stable evaluative dimensions of words within the mental lexicon (Osgood, 1952; Osgood, May, & Miron, 1975), and some have developed dictionaries that contain normed ratings of different dimensions (affect, concreteness, dominance, etc) for large lists of words (Bradley & Lang, 1999; Stone, Dunphy, & Smith, 1966; Warriner, Kuperman, & Brysbaert, 2013; Pennebaker, Boyd, Jordan, & Blackburn, 2015). These efforts assume that words connect to stable meanings contained within the mental lexicon.

The mental lexicon is also a major part of social psychology, including the subfield of social cognition. Much of social cognition borrows from the processes of the cognitive revolution (Zajonc, 1980), examining aspects of perception of the outside world (Griffin & Ross, 1991; Sherif, 1936), schemas and stereotypes (Fiske, Cuddy, Glick, & Xu, 2002), person perception (Asch, 1946), etc. While social psychology often focuses upon how the situation matters (Sommers, 2011), many phenomena are interpreted in a cognitive light with an implicit assumption of a mental lexical store for words. For instance, conceptual accessibility research discusses how exposure to words activates associated mental representations (Srull & Wyer, 1979; Higgins, Rholes, & Jones, 1977), and person perception research shows how trait descriptor words change impressions of others (Asch, 1946). Indeed, much of social psychology

assumes the existence of relatively stable, context-independent cognitive processes, such as a mental lexicon (Zajonc, 1980).

However, many other approaches to the study of language acquisition and comprehension point to the crucial role of context in word meaning. First, many theories emphasize that context helps language-users determine what a target word means in any given instance. For instance, constraint-based approaches to language learning show how linguistic and non-linguistic context provides constraints on the possible meaning of a word within an utterance or statement – comprehending each word of a statement involves accounting for the constraints imposed by nearby words (for reviews, see Seidenberg & MacDonald, 1999; MacDonald & Seidenberg, 2006). Usage-based approaches to language learning posit similar relations, focusing upon how language is learned through interacting with other people, observing what words and grammatical constructions are used to describe things and phenomena, and abstracting meaning from these observations (for reviews, see Ellis, O'Donnell, & Romer, 2015; Beckner et al, 2009). Connectionist models of language (such as the Simple Recurrent Network) attempts to model language comprehension by describing how words activate mental representations in a recursive loop. Words prompt activations of mental states which are moderated by prior activations (via exposure to prior words and context) and which moderates the action that future words have upon mental states (for reviews, see Elman, 2004; 2011). In essence, the context surrounding a word is nearly as informative about the meaning of a word as the word itself. Thus, to say that word meanings are retrieved from stable representations in a mental lexicon ignores the large impact that situational context has in inferring meaning

Second, the context that a word appears in contributes to and iteratively updates a language-user's understanding of the range of meaning that any given word has. Constraint-

based approaches emphasize that people not only learn what a word “means” but they also they learn the entire range of possibilities of what a word could mean given the constraints of linguistic and non-linguistic context (Seidenberg & MacDonald, 1999; MacDonald & Seidenberg, 2006). Corpus and computational linguistics regularly demonstrate how words tend to co-occur (i.e., collocate) with other specific words and contexts (Hoey, 2005), and these collocational profiles are fundamental elements of the semantic space that a word occupies (Landuaer & Dumais, 1997). Further, many lexicographers acknowledge the importance of an individual’s experience with a word and how it is used as a crucial determinant of the range of meanings of that word, so much so that different audiences would require different dictionaries in order to accurately represent how experience can imbue words with different meanings (Kilgarriff, 1997). In essence, a language-user’s history of experiences with a word, including the context in which a word was used, feeds into his/her understanding and expectations of the word. Thus, to say that a words link to stable stored meanings in a mental lexicon which all users of a language share ignores the ample amount of learned contextual information that comprises an individual’s understanding of the “meaning” of a word.

These considerations imply either that the lexicon is infeasibly large in order to contain all of these disparate meanings and moderators of meaning or that there may be no mental lexicon at all. Context has a larger role to play in meaning interpretation than is traditionally assumed, and there are many more processes beyond the simple “retrieving meanings of words” in interpreting the meaning of a sentence. Instead, words may serve as cues to meaning, activating associations that are informed by prior context and that inform the upcoming associations. Meaning may be constructed by contextual cues which include words but also grammatical constructions, phonological patterns, and other contextual factors (MacDonald &

Seidenberg, 2006; Beckner et al., 2009; Hoey, 2005; Elman, 2011; Casasanto & Lupyan, 2015; Swales, 1990).

Situated social cognition

These ideas that meaning depends upon context share much with theories of situated cognition. Classic views of cognition posit automatic, context-independent processes like memory storage, memory retrieval, and conceptual schemas (Bartlett, 1932; Devine, Hamilton, & Ostrom, 1994; Jones, 1985). However, the idea behind situated cognition is that thinking is more tied to its situations and contexts than previously thought (Smith & Semin, 2004; Smith & Semin, 2007; Schwarz, 1994). In line with William James' remarks, "My thinking is first and last and always for the sake of my doing" (James, 1890), cognition and reasoning are adapted from helping humans interact with and make sense out of their environments and situations. Rather than seeing cognition as an abstract process that is detached from physical reality and environments, situation cognition posits that cognition should be intricately attuned to environments and contexts. This is because it is adapted from and adapted to dealing with the demands and affordances of physical environments and situations.

Recent research has supported the context-sensitivity of social cognitive processes that were classically presumed to be context-free. Context affects categorizing (Yeh & Barsalou, 2006); motivation affects the use of stereotypes (Sinclair & Kunda, 1999); accessibility affects the use of stereotypes (Bodenhausen et al, 1995); communicative context affects attribution (Norenzayan & Schwarz, 1999). Just as inferring the meaning of words is dependent upon context, so too are cognitive processes in general.

Understanding how humans interpret meaning has mostly been studied in the domain of language learning, usage, and comprehension, focusing upon how shared language users learn

and understand a language. This literature often discusses models that are demonstrated by investigating how readers and listeners resolve ambiguity in texts (Zwaan & Radavansky, 1998; Elman, 2011; MacDonald & Seidenberg, 2006; Beckner et al., 2009). As language is the variable of interest, manipulations are typically text-based; investigators uncover how words and grammar affect the meaning of target words. However, mental representations that are derived from texts are also studied in social cognition research. Many of these studies demonstrate how mental representations are affected by contextual, situational processes. As this field is interested in the role of context in general, studies examine simple text-based manipulations and complex situational manipulations on judgments. While these judgments take many forms (e.g., judgments about people, objects, situations, etc), they can still be conceptualized as exacting effects upon mental representations that are derived from text. In responding to a question, one must first comprehend it and construct a mental representation that adequately models it (Cannell, Miller, & Oksenberg, 1981; Tourangeau, Rips, & Rasinski, 2000). It is at this stage when contextual processes may contribute information or modify existing information that formulates the mental representation, which then affects reasoning and judgments.

Connecting literatures on the context-sensitivity of meaning

I argue that these two disparate literatures deserve to be connected as they both illustrate critical aspects of how humans interpret the meaning of statements. While research on language comprehension has focused on how words and linguistic context affects meaning, research on situated social cognition has expanded the scope to also investigate how other non-text based factors affect the meaning derived from texts.

The purpose of this dissertation is to examine how contextual features of the situation can affect the mental representations derived from texts. While many classic phenomena in social

cognition are couched in cognitive theories, many of them actually demonstrate contextual processes that affect meaning interpretation. As such, they can be reinterpreted as evidence in support of the context-sensitivity of meaning. For instance, research on category accessibility demonstrates how activating categories affects judgments due to cognitive processes such as semantic networks and spreading activation (Srull & Wyer, 1979; Higgins et al., 1977) However, “primed” judgments often concern assessments of the traits of another person based on a character vignette, and the “primed” category acts as a contextual factor that affects the assessment of such text vignettes. Thus, these studies demonstrate how context (i.e., incidentally activated concepts) affects the conclusions that people draw about another person from reading statements about them; context affects inferred meaning. A similar lens can (and will) be applied to many findings in the social cognition literature.

This dissertation presents research from three projects that all show how contextual factors affect the meaning that people interpret from statements. In the second chapter, I examine how popular metaphors that relate cancer to a hostile enemy affect thinking about cancer. While these metaphors are commonplace in modern discourse, three studies demonstrate that surface metaphoric language relating cancer to an enemy (vs more neutral language) affect the mental representations that people hold about cancer. Because limiting is less associated with fighting enemies, these metaphors make limiting cancer risk-increasing behaviors (such as eating red meats) seem less effective for preventing cancer and lessen people’s intentions for them (vs when no conceptual metaphors are activated). As such, contextual metaphors surrounding words can affect people’s understanding of such words.

In the third chapter, I demonstrate how sensory states with metaphoric relevance affect the mental representations that people form from a book synopsis. Just like metaphorical

statements imply that heavy objects are important, the incidental heaviness of an object often affects impressions of its importance (Jostmann, Lakens, & Schubert, 2009; Ackerman, Nocera, & Bargh, 2010). In this study, I demonstrate boundary conditions for this effect that suggest it occurs because of confirmatory reasoning processes. Only participants who were thinking elaboratively and viewing substantive information about a book (in the form of a book synopsis) judged heavier books to be more important than light books. However, the study demonstrates that incidental sensory states with metaphoric relevance can affect the meaning that participants draw from reading a book synopsis.

In the fourth chapter, I describe how a word's collocational profile affects inferences of meaning. Words that have negative semantic prosody are said to typically collocate (i.e., co-occur) with words of negative valence, and vice versa for words with positive semantic prosody. In this chapter, I describe how even though readers may not be fully aware of the semantic prosody of words, they nonetheless react to them when forming judgments about ambiguous concepts. For example, even though most people see the word "cause" as having no affect, the word has negative semantic prosody because most of the things that are "caused" are strongly negative in affect ("death," "disease," "problems," etc; Stubbs, 1995). Accordingly, several studies show that participants infer "caused" outcomes as being more negative than "produced" outcomes (even though they see "cause" and "produce," a word with no semantic prosody, as being synonymous). Overall, we find that semantic prosody guides people's inferences concerning meaning.

The final (fifth) chapter provides a model of inferring meaning that summarizes the variety of factors that guide what meaning is interpreted from words and statements. Some factors are language-focused fields (e.g., cognitive linguistics, psycholinguistics, corpus

linguistics, lexicography, etc) while others are from situated social cognition. Finally, implications of this model for social psychology are discussed.

CHAPTER II

Metaphoric framing affect inferences about cancer

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Abstract. Cancer health information is dominated by enemy and war metaphors intended to motivate the public to “fight” cancer. However, enemy metaphoric framing may influence understanding of, and responses to, cancer. Cancer prevention benefits from avoiding risk increasing behaviors, yet self-limitation is not closely associated with fighting enemies. If so, the metaphor may hurt prevention intentions involving self-limitation. Participants read messages with minute wording variations that established different metaphoric frames. Results show that metaphorically framing cancer as an enemy lessens the conceptual accessibility of (Study 1) and intention for self-limiting prevention behaviors while not increasing intention for monitoring and treatment behaviors (Studies 2 and 3). Framing self-limiting prevention behaviors in terms of fighting an enemy increases their appeal, illustrating the benefits of metaphor matching (Study 3). Overall, these results suggest that enemy metaphors in cancer information reduce some prevention intentions without increasing others, making their use potentially harmful for public health.

“Now is the time to commit ourselves to waging a war against cancer as aggressive as the war cancer wages against us.” –Barack Obama (Lennon, 2009)

Public discourse about cancer is dominated by enemy metaphors, from society’s “war on cancer” to an individual’s “heroic battles” with a “harsh enemy” (Gibbs & Franks, 2002; Bowker, 1996; Sontag, 1978). Although discussion of cancer has included this bellicose discourse for some time, it was elevated when the War on Cancer was popularized by fear-appeal based advertisement campaigns in the 1970s as a way to drum up funding for cancer research. The Cold War was a salient fear at the time, and advertisements simply asked for governmental funding to deal with the cancer “threat” (Mukherjee, 2010). Framing cancer as an enemy served as an effective fear appeal because it met the necessary conditions for effective fear appeals (for reviews, see McGuire, 1972; Hovland, Janis, & Kelley, 1953): it evoked fear by riding the coattails of a salient theme (war with enemies), and it made a clear recommendation that was easy for the public and government to implement (support cancer research). However, while times have changed, this portrayal of cancer as an enemy has persisted. It pervades public discourse, figures prominently in slogans of cancer research organizations (e.g., “Celebrate. Remember. Fight back.” – American Cancer Society’s Relay for Life; “Love life. Fight cancer.” – Dutch Cancer Society), and even enters into discussion of preventative behaviors (*Foods that Fight Cancer: Preventing Cancer through Diet*, Beliveau & Gingras, 2006). It is also the most common conceptual metaphor employed in science journalism about cancer (Camus, 2009). Some fear appeals have proven effective in cancer prevention (Stephenson & Witte, 1998), and video game interventions where players virtually battle and destroy enemy cancer cells can increase treatment adherence in young cancer patients (Kato, Cole, Bradlyn, & Pollock, 2008) as well as perceptions of cancer risk in young non-patient populations (Khalil, 2012). Indeed, the prevailing wisdom suggests that fear evoked by portraying cancer as an enemy would encourage

people to “fight” cancer in their own personal lives and promote beneficial behavioral change.

Because metaphors shape and structure thought (Lakoff & Johnson, 1980), however, it is possible that metaphorically framing cancer as an enemy affects people’s *understanding* of the disease in unintended ways. For instance, thinking of cancer as an enemy may give patients a preference for overly aggressive treatment options (because one acts aggressively toward enemies; Aktipis, Maley, & Neuberg, 2010) and may hurt the intention to engage in preventive behaviors that are less associated with fighting enemies. While such conjectures are compatible with conceptual metaphor theory (Lakoff & Johnson, 1980), they go against the prevailing wisdom that emphasizes the potential of the enemy metaphor to motivate beneficial behaviors (Mukherjee, 2010; Stephenson & Witte, 1998; Kato et al., 2008; Khalil, 2012). The current research investigates the potential effects of bellicose conceptual metaphors on people’s understanding of cancer and intention to engage in a range of prevention behaviors.

Metaphors shape thought

Conceptual metaphor theory (Lakoff & Johnson, 1980) posits that metaphors structure thinking by providing conceptual mappings between concrete and abstract concepts. Concrete concepts highlight relevant aspects of metaphorically related abstract concepts, deemphasize irrelevant aspects, and ultimately guide knowledge of and reasoning about the abstract concept. Since the initial work in cognitive linguistics, extensive experimental research has illuminated how abstract concepts are understood in terms of metaphorically related concrete domains (for a review, see Landau, Meier, & Keefer, 2010). For instance, interpersonal warmth is often understood in terms of physical warmth (Williams & Bargh, 2008); importance is understood in terms of physical weight (Ackerman, Nocera, & Bargh, 2010; Chandler, Reinhard, & Schwarz, 2012; Jostmann, Lakens, & Schubert, 2009); valence and power are related to verticality (Meier

& Robinson, 2004; Schubert, 2005), and so are God and Devil related concepts (Meier, Hauser, Robinson, Friesen, & Schjeldahl, 2007). As many conceptual metaphors are learned via linguistic experience, linguistic framing of an abstract concept via the use of metaphoric expressions can also activate a metaphoric representation of the abstract concept and influence reasoning (Lakoff & Johnson, 1980; Landau, Sullivan, & Greenberg, 2009; for reviews, see Gibbs, 2014; Ottati, Renstrom, & Price, 2014). For instance, metaphorically framing crime as either a virus plaguing a city or as a beast ravaging a city causes people to propose different solutions to a hypothetical crime wave (Thibodeau & Boroditsky, 2011). Similarly, metaphoric framing of America as a body harshens Americans' attitudes toward immigration when they are threatened by physical contamination (Landau, Sullivan, & Greenberg, 2009). In short, varying the accessibility of concrete metaphors for abstract concepts via metaphoric framing can guide reasoning in the abstract domain in metaphor-consistent ways.

Further illustrating the power of metaphors, a meta-analysis of persuasive messages found that the use of metaphors reliably increases persuasion when they metaphorically frame a familiar target early in the message in terms of a single novel source domain (Sopory & Dillard, 2002). The persuasive influence of metaphors can unfold through multiple pathways (for reviews, see Ottati & Renstrom, 2010; Ottati, Renstrom, & Price, 2014). For instance, metaphoric conceptualizations of abstract concepts can be activated in multiple ways (Ottati, Renstrom, & Price, 2014), such as by directly stating the root metaphor ("Cancer is an enemy"), or through more subtle means like evoking the root metaphor through surface metaphoric utterances ("We must win the war on cancer"). Additionally, once a root metaphor is activated, metaphors can affect judgments through multiple processes. Metaphors can affect the amount of message elaboration when they link the target to a domain that is of interest to the recipient; for

example, sports metaphors increase elaboration of persuasive messages for sports fans and decrease elaboration for non-sports fans (Ottati, Rhoads, & Graesser, 1999). Metaphors also increase persuasion when they match the recipient's lay metaphoric representation of the topic (Sopory, 2005) and hence increase fluent access to related knowledge. Metaphors can also contribute to attitude change by directly mapping attributes from the source to the target domain, as is the case for the NATION IS A BODY metaphor, which maps attributes of physical contamination onto the abstract concept of national immigration policy (Landau et al., 2009).

Present research

Drawing on these insights from metaphoric framing research, the present studies investigate whether conceptual metaphors that relate cancer to an enemy influence people's reasoning about cancer and their willingness to engage in a variety of preventive behaviors. The studies also bear on whether key theoretical findings of metaphoric framing research extend across different manipulations and into socially-relevant content domains. As noted in recent discussions (Stroebe & Strack, 2014), consistent effects of multiple operationalizations of a conceptual variable across diverse content domains are a crucial criterion for the robustness of a theoretical approach.

The prevailing wisdom in health communication is that fear raised by enemy framing will motivate people to engage in beneficial preventive behaviors (Mukherjee, 2010; Stephenson & Witte, 1998; Kato et al., 2008; Khalil, 2012). However, we hypothesized that, in line with the theory of metaphoric framing (Lakoff & Johnson, 1980), framing cancer as an enemy should cause people to bring attributes of enemies to bear on their representation of cancer. While this may enhance motivation to engage in prevention behaviors related to an enemy metaphor, it may hurt the motivation to engage in prevention behaviors that are difficult to reconcile with this

metaphor. Unfortunately, the latter applies to the bulk of behaviors that support cancer prevention.

The enemy metaphor emphasizes power, strength, masculinity, and taking aggressive actions toward an enemy (Reisfield & Wilson, 2004; Harrington, 2012). As such, behaviors which entail active engagement are particularly suited to the enemy metaphor because they help bolster these attributes and promote attacking an enemy. However, behaviors which entail limitation and restraint are less applicable to the enemy metaphor because they often undermine attributes of power, strength, and masculinity, and they don't promote attacking an enemy. Cancer prevention recommendations promote either engagement or limitation and, accordingly, differ in their applicability to fighting enemies. Table 1 displays the eleven cancer prevention recommendations that an expert review identified as efficient in reducing the risk of developing cancer (World Cancer Research Fund & the American Institute for Cancer Research, 2007); the table also notes whether the recommendation promotes engagement or limitation. Other organizations have arrived at similar prevention recommendations (see Kushi et al., 2012).

Table 1. How common cancer prevention recommendations fit with engagement and limitation

Prevention recommendation (American Institute for Cancer Research, 2012)	Engagement or limitation?
Be as lean as possible without becoming underweight.	engage
Be physically active for at least 30 minutes every day.	engage
Avoid sugary drinks. Limit consumption of energy-dense foods.	limit
Eat more of a variety of vegetables, fruits, whole grains and legumes such as beans.	engage
Limit consumption of red meats (such as beef, pork and lamb) and avoid processed meats.	limit
If consumed at all, limit alcoholic drinks to 2 for men and 1 for women a day.	limit
Limit consumption of salty foods and foods processed with salt (sodium).	limit
Don't use supplements to protect against cancer.	limit
It is best for mothers to breastfeed exclusively for up to 6 months and then add other liquids and foods.	---
After treatment, cancer survivors should follow the recommendations for cancer prevention.	---
And always remember – do not smoke or chew tobacco.	limit

As the prevention recommendations in Table 1 illustrate, cancer prevention is only occasionally characterized by active engagement in behaviors that also come to mind while thinking of fighting a battle against an aggressor. Instead, many of the more efficient prevention behaviors amount to self-limitation (avoid smoking; avoid alcohol; avoid fatty foods; avoid red meats; etc). Unfortunately, self-limitation is a class of behaviors that is unlikely to figure prominently in people's associations with fighting enemies.

A pilot study using the Corpus of Contemporary American English (Davies, 2008) confirmed this intuition. Linguistically, limitation is less associated with attacking than it is with prevention. In natural language, there is less co-occurrence of limitation related words with the word ATTACK than with the word PREVENT; for instance, the odds of seeing the word INHIBIT within nine words before or after the target word ATTACK in natural language are one-twentieth that of seeing it within nine words before or after the target word PREVENT.

Given that word co-occurrence corresponds with semantic association (Landauer & Dumais, 1997), this data highlight that limitation is less associated with an enemy concept than with a prevention concept. This suggests that people don't think of limiting the self when they think of fighting enemies. If so, framing cancer in terms of an enemy metaphor may lessen people's intention to engage in some of the more effective prevention behaviors available to them.

In the following series of studies, we test this possibility. In study 1, we examine if the enemy representation affects the accessibility of limitation-related prevention behaviors. In studies 2 and 3, we explore if the enemy representation affects intention for various prevention, monitoring, and treatment behaviors. In addition, study 3 explores whether the predicted adverse effects of enemy framing are attenuated when prevention behaviors are presented in a metaphorical language that matches the metaphor used in the message.

Study 1

Assuming that limiting the self is not closely associated with the concept of fighting an enemy, framing cancer as an enemy should impair the accessibility of prevention behaviors that involve self-limitation. Study 1 tests this hypothesis.

Method

Participants

Sixty-four American participants (22 female) from Amazon Mechanical Turk completed the task in exchange for 30 cents.

Materials and Procedure

Participants first read background information on cancer. The information concerned the development of cancer, who was at risk of developing cancer, the percentage of people who survive cancer diagnoses (adapted from *Cancer Facts & Figures*, American Cancer Society,

2012), and how eating habits relate to cancer. Participants were then asked to list what they would do to lessen their chances of developing cancer in their lifetime; they were provided nine open-ended text boxes to type in their responses.

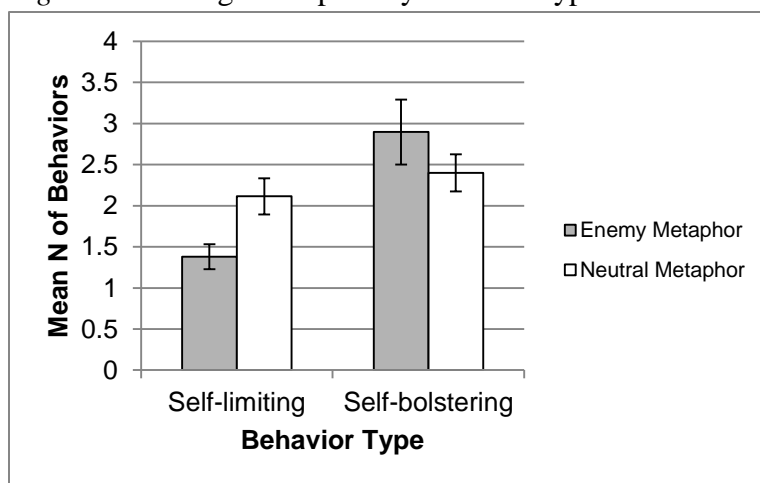
Participants were randomly assigned to either an enemy metaphoric frame or a neutral frame. In the enemy frame condition, the background information included two additional words in the first sentence of the passage (shown here in italics): “Cancer is a broad group of diseases characterized by the *hostile* growth and *invasive* spread of abnormal cells.” The two italicized words were missing in the neutral frame condition. Additionally, the listing task prompt read “what things would you do to *fight against* developing cancer” in the enemy frame condition, but “what things would you do to *reduce* your risk of developing cancer” in the neutral frame condition. Our method of framing falls in line with the “surface metaphoric utterances” method of subtly activating a root metaphor as discussed in Ottati, Renstrom, & Price (2014).

Two coders, blind to hypotheses and participant condition, rated whether each behavior listed by the participants was a self-limiting behavior or a self-bolstering behavior. Rating instructions said a self-bolstering behavior was “one that people engage in in order to lower their risk of cancer,” while a self-limiting behavior was “one where people limit or avoid a behavior which is associated with increasing one’s risk of cancer.” Coders classified the behaviors as self-bolstering, self-limiting or neither by rating them along a 1 (clearly self-bolstering) to 5 (clearly self-limiting) scale. The two coders’ ratings were highly consistent, $r(330) = .94$; coders disagreed on 37 items (11.2% of items), which were resolved through discussion. Our analysis draws on the number of reported self-bolstering vs. self-limiting behaviors; analyses based on the raw rating scores lead to the same conclusions.

Results and Discussion

We counted the number of self-bolstering and self-limiting behaviors listed and conducted a 2 (metaphor: enemy, neutral) x 2 (behavior type: self-bolstering, self-limiting) mixed analysis of variance. Overall, participants listed more self-bolstering than self-limiting behaviors, $F(1, 62) = 12.18, p = .001, \eta_p^2 = .164$, for the main effect of behavior type. More important, this observation was qualified by the predicted interaction of behavior type and metaphor, $F(1, 62) = 5.68, p = .020, \eta_p^2 = .084$. As shown in Figure 1, exposure to the enemy metaphor reduced the listing of self-limiting behaviors relative to the neutral frame condition { $F(1, 62) = 6.96, p = .011, d = .66, 95\% \text{ CI } [0.17, 1.29]$, for the simple effect} without increasing the listing of self-bolstering prevention behaviors { $F(1, 62) = 1.30, p = .26$, for the simple effect}. This indicates that an enemy metaphor reduces the accessibility of self-limiting prevention behaviors without increasing the accessibility of self-bolstering ones. Finally, the main effect of metaphor was not significant, $F < 1$, suggesting that, counter to the prevailing wisdom, enemy framing does not simply increase thoughts of beneficial behaviors.

Figure 1. Message metaphor by behavior type on the mean number of behaviors listed



Note. Bars denote +/- 1 SE of the mean.

These results parallel those observed in the linguistic analysis. When thinking of cancer as an enemy, limitation related prevention behaviors don't come to mind. However, there was no

beneficial effect of enemy-framing on self-bolstering behavior accessibility as one would intuitively expect. One reason for this may be differences in chronic accessibility of the behavior types; participants listed more self-bolstering than self-limiting behaviors, suggesting that self-bolstering behaviors may be more chronically-accessible than self-limiting ones. We explore these differences in chronic accessibility and ambiguity in the next study.

While these effects on accessibility provide preliminary support for our hypotheses, additional framing manipulations are necessary to rule out alternate explanations stemming from the use of one specific method of framing. Therefore, Study 2 employs a different framing manipulation in a conceptual replication and extension of study 1.

Study 2

Building on the observation that metaphorical framing influences what comes to mind when people are asked to list potential prevention measures (study 1), study 2 tests whether the observed effects extend to behavioral intentions. The prevailing wisdom would suggest that enemy framing would increase intentions for all behaviors that would help someone “fight” cancer (i.e., prevention, monitoring, and treatment). However, in line with conceptual metaphor theory, we hypothesized that metaphorically framing cancer as an enemy in a message would lessen intention for self-limiting prevention behaviors.

Furthermore, many have offered the conjecture that an enemy representation might boost motivation for active, agentic behaviors against cancer. For instance, because one must be active to fight enemies, one must also take active steps to fight cancer (Reisfield & Wilson, 2004; Harrington, 2012). Additionally, because one fights enemies aggressively, one must also fight cancer by opting for aggressive treatments (Aktipis et al., 2010). To our knowledge, study 2 provides the first experimental test of these conjectures by examining the effect of enemy cancer

framing on a range of preventive intentions (i.e., self-limiting and self-bolstering prevention, monitoring, and treatment). If the enemy representation boosts motivation for active agentic behaviors, enemy framing should boost intention for self-bolstering, monitoring, and treatment behaviors, while undermining intentions to engage in self-limiting behaviors.

Finally, study 2 added another metaphoric framing condition to the design – that of cancer as imbalance. Recent research has shown that the use of any applicable metaphor in health information about vaccination can increase a reader’s intention to get vaccinated (Scherer, Scherer, & Fagerlin, in press). Therefore, the imbalance metaphor condition serves as a control that tests whether the predicted effect of enemy framing is unique to this metaphor (as we expect) or also observed for other metaphors that have different substantive implications. Furthermore, the imbalance conceptualization was once the dominant conceptual metaphor for disease (Goatly, 2007; Mukherjee, 2010) and is still the dominant conceptual metaphor for most diseases in Chinese cultures (Stibbe, 1996). In fact, some medical scholars suggest that illness and treatment may better fit an imbalance metaphor than an enemy metaphor. For example, ecological balance metaphors emphasize population-level prevention and sustainable treatment practices (Annas, 1995; Nesse & Williams, 1996), unlike bellicose metaphors which emphasize defeating diseases at all costs. . For these reasons, the remaining studies include an imbalance metaphor framing group for comparison purposes.

Method

Participants

Three hundred and thirteen American participants (113 female; age range 18 to 67) completed the survey on Amazon Mechanical Turk in exchange for 25 cents each.

Materials and Procedure

In an ostensible pre-test of health information messages, participants were randomly assigned to read one of three messages that framed cancer either in neutral terms or in terms of an enemy or imbalance metaphor. The message is presented below, with the words unique to the enemy message in brackets and words unique to the imbalance message in parentheses. The neutral message consisted of all words outside of parentheses and brackets:

Colorectal cancer is cancer of the colon. This disease involves (an imbalance of) [an enemy uprising of] abnormal cellular growth in the large intestine. At any given point in time, a healthy person has small amounts of cancerous cells which his/her body deals with. However, (an unbalanced) [a hostile] growth of cancerous cells in the large intestine can form a tumor, which can metastasize in nearby or distant parts of the body. The average American faces a 5% lifetime risk of developing colorectal cancer as a result of (unbalanced) [hostile] abnormal cellular growth. In 2008, 608,000 deaths worldwide were due to colorectal cancer.

Following filler questions about the message, participants reported their intention to engage in various health behaviors related to cancer (1 = do not intend; 7 = strongly intend). Self-limiting prevention questions asked “how much do you intend to limit” behaviors associated with a high risk of cancer (drinking alcohol excessively; eating red meats more than once per day; eating high fat, high calorie foods). Self-bolstering prevention questions asked “how much do you intend to engage in” behaviors that are associated with a low risk of cancer (eating fruits and vegetables, eating foods high in fiber, eating foods made of whole grains). Monitoring questions asked “how much do you intend to undergo” medical procedures associated with detecting cancer (stool test, barium enema and abdominal X-rays, colonoscopy).

Participants were also presented with a hypothetical diagnosis of stage three colorectal cancer (with a 64% 5 year survival rate) and were asked “how much do you intend to undergo” various treatment plans associated with removing cancerous cells (surgery; surgery & chemotherapy; radiation, surgery, & chemotherapy).

Results and Discussion

We created indices for intention to self-limit ($\alpha = .77$), self-bolster ($\alpha = .91$), monitor ($\alpha = .87$), and treat ($\alpha = .90$) by averaging the ratings of the respective items. A 3 (message metaphor: enemy, imbalance, neutral) x 4 (intention: self-limiting, self-bolstering, monitoring, treatment) x 2 (gender: male, female) mixed analysis of variance revealed the predicted significant omnibus two way interaction between message metaphor and intention, $F(6, 921) = 2.48, p = .022, \eta_p^2 = .016$.

Self-limiting behavior

As predicted, enemy-framing lowered intentions for self-limiting behaviors compared to the neutral representation, $t(307) = -2.21, p = .028, d = .29, 95\% \text{ CI } [-.96, -.03]$, and compared to the imbalance representation, $t(307) = -2.54, p = .012, d = .28, 95\% \text{ CI } [-.80, -.14]$ (Table 2). These differences are reflected in an omnibus simple main effect of message frame, $F(2, 307) = 3.91, p = .021, \eta_p^2 = .025$, which was not moderated by gender, $F < 1$ for the metaphor x gender interaction. Thus, framing cancer as an enemy hurt intentions to limit risky behaviors, consistent with the accessibility effects observed in study 1.

Self-bolstering behaviors

An omnibus simple main effect of message metaphor for the self-bolstering index, $F(2, 307) = 4.13, p = .017, \eta_p^2 = .026$, further indicated that imbalance framing increased bolstering intentions. Specifically, participants exposed to imbalance framing intended to self-bolster more

than both enemy-framing, simple effect $t(307) = 2.33, p = .020, d = .29$, and the neutral representation, simple effect $t(307) = 2.63, p = .009, d = .30$. In contrast, enemy-framing did not increase intention to self-bolster relative to the neutral representation, $t(307) = 0.40, p = .686$, indicating that enemy framing does not boost intentions to engage in risk-reducing behaviors. This also replicates the non-effect of enemy-framing on self-bolstering behaviors observed in study 1. The effect of message framing was not moderated by an interaction with gender; $F(2, 307) = 1.53, p = .218$, for the metaphor x gender interaction.

Monitoring and treatment

Finally, the framing manipulations did not affect the monitoring or treatment intentions. For the monitoring index, the simple main effects of message metaphor, $F(2, 307) = 1.61, p = .201$; gender, $F < 1$; and the message metaphor x gender simple interaction, $F < 1$, were not significant. Similarly, for the treatment index, the simple main effects of message metaphor, $F(2, 307) = 1.12, p = .327$; gender, $F < 1$; and the message metaphor x gender simple interaction, $F(2, 307) = 1.04, p = .356$, were not significant.

Table 2. Message metaphor by intention index on mean (SD) behavioral intention

Intention Index	Message Metaphor		
	Enemy	Imbalance	Neutral
Self-limiting	3.69 (1.70)	4.16 (1.66)	4.17 (1.62)
Self-bolstering	4.92 (1.42)	5.33 (1.44)	4.89 (1.48)
Monitoring	2.65 (1.58)	2.95 (1.52)	2.98 (1.70)
Treatment	5.78 (1.25)	5.80 (1.21)	5.48 (1.43)

Gender effects

In the overall model, there was an additional significant two way interaction between gender and intention, $F(3, 921) = 8.26, p < .001, \eta_p^2 = .026$. Although gender did not moderate the effect of message framing on intentions $\{F(6, 921) = 1.24, p = .285$, for the three-way

interaction}, the observation is worth noting. Specifically, women intended to engage in prevention behaviors more than men: simple main effect of gender on self-limiting intentions, $F(1, 307) = 23.37, p < .001, \eta_p^2 = .071$, and simple main effect of gender on self-bolstering intentions, $F(1, 307) = 6.28, p = .013, \eta_p^2 = .020$. However, both males and females had equal intentions for monitoring ($F < 1$) and treatment ($F < 1$) behaviors.

Discussion

In sum, the current findings suggest that enemy framing undermines self-limiting prevention intentions but has no effect on self-bolstering prevention intentions, monitoring intentions, or treatment intentions. This absence of a beneficial effect on self-bolstering, monitoring, and treatment intentions is both surprising and concerning because it is one of the primary reasons cited for the continued use of the enemy metaphor (Reisfield & Wilson, 2004; Harrington, 2012) and it goes against the prevailing wisdom that enemy framing motivates people to “fight” cancer (Muhkerjee, 2010; Kato et al., 2008; Khalil, 2012).

However, research may provide clues as to why the enemy representation only affects intention for a subset of preventive behaviors. Metaphoric framing manipulations appear to be constrained to the same variables as conceptual priming manipulations (see Higgins, 1996); a source concept must be applicable to the target (Jones & Estes, 2006) and its impact increases with the abstractness and ambiguity of the target (Jia & Smith, 2013; Keefer, Landau, Sullivan, & Rothschild, 2011). Thus, participants may only draw upon metaphoric entailments when they are unsure of their intentions, but may not when their intentions are clear. As such, intention for self-limiting behaviors may be more ambiguous than intentions for self-bolstering, monitoring, and treatment behaviors, creating the observed pattern of results for the enemy metaphor.

Our data indirectly bear on this hypothesis. Participants making ambiguous judgments

tend to stick to the midpoint of the scale, shying away from the descriptive anchors on scale endpoints. In our study, participants rated their intention for behaviors on a one (do not intend) to seven (strongly intend) point scale, making a rating of four the scale midpoint. Thus, we would expect ambiguous intention indices to hover around a scale value of four, whereas unambiguous intention indices would deviate from the neutral point.

A oneway within subject analysis of variance on the deviation of each index from the scale midpoint (four) found a significant omnibus effect of index, $F(3, 936) = 67.15, p < .001, \eta_p^2 = .18$. We conducted follow up one sample t-tests assessing the extent to which each intention index differed from the scale midpoint (four). As expected, intention for self-limiting ($M = 4.0, SD = 1.7$) was no different from the scale midpoint, $t(312) = .011, p = .991$, indicating that it was an ambiguous judgment. However, intentions for self-bolstering [$M = 5.0, SD = 1.5; t(312) = 12.69, p < .001$], monitoring [$M = 2.9, SD = 1.6; t(312) = -12.59, p < .001$], and treatment [$M = 5.7, SD = 1.3; t(312) = 22.98, p < .001$] were significantly different from the scale midpoint, indicating that these were unambiguous judgments. Thus, since metaphoric framing is more influential for ambiguous concepts, enemy framing may only affect intentions for self-limiting behaviors since intentions for them are more ambiguous.

We additionally observed that imbalance framing increased intentions for self-bolstering behaviors. Because we had not predicted this effect, the next study examines if this effect replicates in a different sample.

Study 3

The preceding two studies consistently showed that framing cancer messages in terms of an enemy metaphor has adverse consequences for prevention behaviors that involve self-limitation, from avoiding overexposure to the sun to avoiding fatty foods. The theoretical

rationale of metaphor framing implies that these adverse effects can be attenuated when the target behavior is framed in a way that matches the metaphor (Lakoff & Johnson, 1980; Landau et al., 2010; Lee & Schwarz, 2014a). Because aptness facilitates metaphoric processing (Jones & Estes, 2006), metaphorically describing the behaviors in a way that makes them a better fit with a metaphoric conceptualization should facilitate fluent processing (Thibodeau & Durgin, 2011; Thibodeau & Durgin, 2008), which may attenuate the adverse effects of the enemy metaphor. Study 3 tests this implication.

Method

Participants

One hundred and seventy-six undergraduates (95 females; age range 18 to 29) at the University of Michigan participated in the study in exchange for subject pool credit.

Materials and Procedure

The procedure and materials were identical to those of study 2 except for the addition of a manipulation that linked preventive, monitoring, and treatment behaviors to the metaphoric framing of cancer. Just as in study 2, each participant first read one of the messages with metaphorical cancer framing (metaphoric frame: enemy, imbalance, neutral) and answered filler questions.

Next, each participant was randomly assigned to a behavioral frame that introduced each set of behaviors as apt for the different metaphoric conceptualizations (behavior frame: enemy, imbalance, neutral). All participants read introductions to the behaviors that mirrored those of study 2 (“The following behaviors are associated with a higher risk of developing cancer” for self-limiting behaviors). In the neutral behavior frame condition, the introduction was limited to these sentences; for the other behavior frame conditions an additional sentence was added. In the

enemy behavior frame condition, participants read an additional sentence on how each set of behaviors (self-limiting, self-bolstering, monitoring, and treatment) was *apt for fighting enemies*, while those assigned to the imbalance behavior frame read how each set of behaviors was *apt for restoring balance*.

The enemy behavioral frame for the self-limiting behaviors expressed that the following behaviors “weakened the body’s ability to fight colorectal cancer,” whereas the imbalance frame expressed that the behaviors “impaired the body’s ability to restore balance.” The enemy behavioral frame for self-bolstering behaviors expressed that the following behaviors “strengthened the body’s ability to fight colorectal cancer,” and the imbalance frame expressed that the behaviors “improved the body’s ability to restore balance.” The enemy behavioral frame for monitoring behaviors expressed that the following behaviors “detected colorectal cancer in its early stages when it is weak and easier for your body to fight,” and the imbalance frame expressed that the behaviors “detected colorectal cancer in its early stages when it is smaller and easier for your body to restore balance.” Finally, the enemy behavioral frame for hypothetical treatment behaviors expressed that the following treatment options “help your body fight colorectal cancer,” and the imbalance frame expressed that the behaviors “help your body restore health and balance.”

Aside from the additional introductory paragraph framing the behaviors, participants followed the same procedure as in study 2 when rating their intention for each set of behaviors pertaining to self-limiting, self-bolstering, monitoring, and treatment.

Results

We computed intention indices for each type of behavior (self-limit $\alpha = .73$; self-bolster $\alpha = .93$; monitor $\alpha = .89$; treatment $\alpha = .90$) by averaging the respective behavior ratings. We first

address whether study 3 replicates the effects of message framing observed in study 2; subsequently, we turn to the new predictions and address the influence of metaphor matching.

Do the effects of study 2 replicate?

The materials of the neutral behavior framing condition of the present study were identical to the materials of study 2. This allows us to assess the robustness of our results with a new sample. To do so, we assessed the influence of message framing on participants' prevention intentions under neutral behavior framing.

Message framing again affected participants' intention to engage in self-limiting prevention behaviors, $F(2, 57) = 2.68, p = .077, \eta_p^2 = .068$. Replicating study 2, participants reported lower intention under enemy framing than under neutral framing conditions, $t(57) = 1.95, p = .056, d = .60$. In contrast to study 2, however, intentions under imbalance framing did not differ from those under enemy framing, $t(57) < 1$, and intentions under imbalance framing were significantly less than those under neutral framing, $t(57) = 2.03, p = .047, d = .62$.

There were no effects of message framing on the remaining behavioral intention indices; omnibus main effect of message framing on the self-bolstering index, $F(2, 57) = 1.59, p = .212$; on the monitoring index, $F < 1$; on the treatment index, $F(2, 57) = 1.07, p = .351$.

In a meta-analytic analysis of study 2 and the replication conditions of study 3, enemy framed messages undermine recipients' intention to engage in self-limiting prevention behaviors, relative to neutrally framed messages; $Z = 4.11, p = .004$, following the procedures of the Stouffer method as described by Rosenthal (1978). Further, enemy framed messages do not affect intention to engage in self-bolstering ($Z = .25, p = .80$), monitoring ($Z = -.74, p = .46$), and treatment behaviors ($Z = 1.51, p = .13$) in the individual studies or the meta-analytic analyses. Thus, across studies, enemy framed messages lessen intentions for self-limiting behaviors while

remaining ineffective on altering intentions for self-bolstering prevention, monitoring, and treatment intentions.

Additionally, the effects of imbalance-framed messages in study 2 did not replicate in our new sample. In contrast to study 2, imbalance framed messages did not increase intention for self-bolstering behaviors. Further, imbalance framed messages lessened intentions for self-limiting behaviors. Thus, it appears as if the effects of this once dominant metaphor for disease have as-of-yet unknown moderating conditions which preclude us from drawing firm conclusions. Additionally, populations differed between study 2 (MTurk) and study 3 (subject pool) and differences between populations in chronic accessibility, aptness, or conventionality of the imbalance metaphor may also account for the inconsistent effects.

Does metaphor matching improve intentions?

A 3 (message metaphor: enemy, imbalance, neutral) x 3 (behavior frame: enemy, imbalance, neutral) x 4 (intention: self-limit, self-bolster, monitor, treat) x 2 (gender: male, female) mixed analysis of variance revealed the predicted omnibus three way interaction between message metaphor, behavior frame, and intention, $F(12, 474) = 1.90, p = .033, \eta_p^2 = .046^1$.

To diagnose this 3-way interaction, we examined the simple two-way interactions of message metaphor and behavior frame for each set of behaviors. There was no simple two-way interaction of message metaphor and behavior framing for treatment intentions, $F(4, 158) = 1.19, p = .315$, monitoring intentions, $F < 1$, or self-bolstering intentions, $F(4, 158) = 1.63, p = .170$, indicating that metaphor matching did not influence intentions for these behaviors. This was expected and replicates study 2, which found no effect of initial metaphoric framing in the

¹ Additional significant but theoretically-uninteresting effects: main effect of intention, $F(3, 474) = 217.98, p < .001$; interaction of behavior frame and intention, $F(6, 474) = 2.13, p = .049$.

message on intentions for these behaviors.

In contrast, the intention to engage in self-limiting prevention behaviors was affected by the experimental variables, $F(4, 158) = 3.07, p = .018, \eta_p^2 = .072$, for the simple interaction of message and behavior framing. Next, we turn to a more detailed analysis of this simple interaction.

Intention to engage in self-limiting behaviors

Enemy frame. Previous research has shown that a neutral, non-metaphoric sentence about a target concept can be considered to “mismatch” a metaphoric representation of the target concept; after reading a metaphoric sentence, reading times for a neutral non-metaphoric sentence about the same topic are delayed to the same extent as reading times for a sentence utilizing a different source metaphor for the topic (e.g., Thibodeau & Durgin, 2008, study 3). Our planned contrasts take this observation into account. A planned contrast pertaining to the enemy message metaphor, which compared enemy behavioral framing (match) to neutral and imbalance behavioral framing (mismatch), revealed a marginally significant metaphor matching effect (Figure 2), $t(167) = 1.88, p = .062, d = .52$. Follow up comparisons showed that participants who had received an enemy-framed message reported higher intentions to engage in self-limiting behaviors when these behaviors were framed as apt for fighting enemies than when they were framed neutrally, $t(167) = 1.82, p = .070, d = .66, 95\% \text{ CI } [-0.01, 1.79]$, or as apt for restoring imbalance, $t(167) = 1.41, p = .159, d = .43, 95\% \text{ CI } [-0.36, 1.72]$. Thus, metaphor matching can eliminate the otherwise observed adverse effects of the enemy metaphor – for participants with an enemy conceptualization of cancer, describing self-limiting behaviors in enemy-consistent terms increased intention relative to describing those behaviors in enemy-inconsistent terms (either described literally or in terms of imbalance).

Of theoretical and applied interest is a comparison of the above conditions with the neutral control conditions. As metaphor matching effects typically only compare metaphor matches against metaphor mismatches (see Thibodeau & Durgin, 2008), it is currently unknown if metaphor matching effects actually facilitate comprehension and intention over basic literal statements. Further, this comparison has applied interest, as it might potentially demonstrate that enemy framing has a persuasive advantage over non-framing when behaviors are described as apt for the enemy conceptualization.

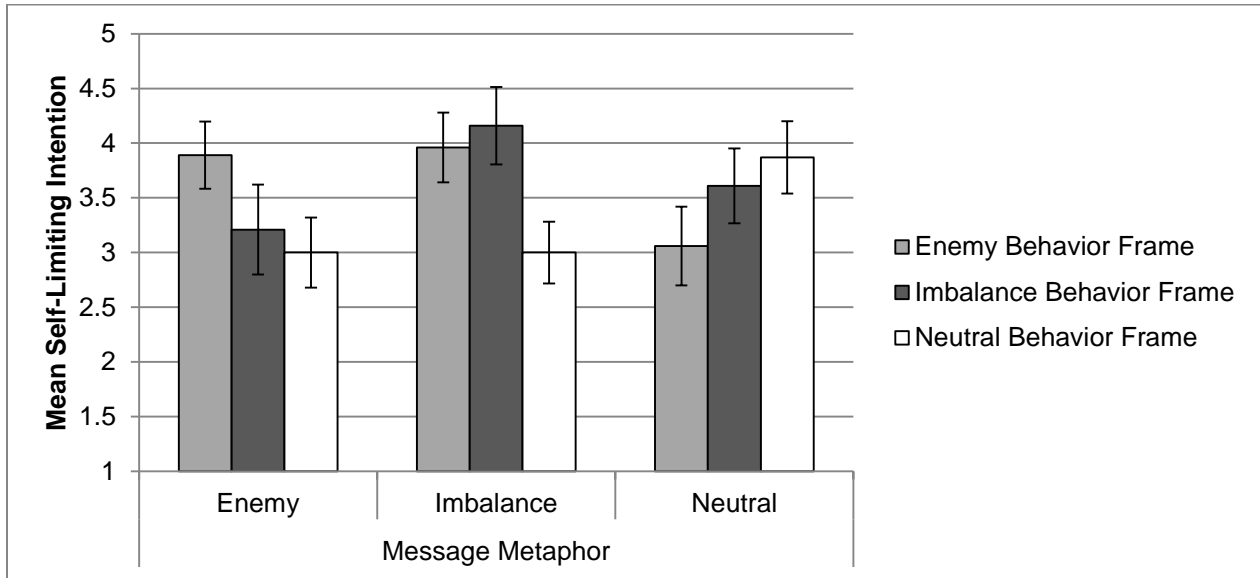
The comparison with the neutral control condition shows that metaphor matching did not endow the enemy metaphor with any persuasive advantage. When the enemy frame of the message matched the enemy frame of the target behavior, participants' intentions merely equaled, but did not exceed, the intentions under neutral control conditions, where neither the message nor the behavior was described in metaphorical terms; $t(167) = 0.05, p = .963$.

Imbalance frame. The planned contrast looking at imbalance message framing and comparing imbalance behavior framing (match) to neutral and enemy behavior framing (mismatch) also revealed a marginally significant metaphor matching effect (Figure 2), $t(167) = -1.69, p = .092, d = .46$. Follow up comparisons showed that participants who had received an imbalance-framed message reported higher intentions to engage in self-limiting behaviors when they were framed as apt for restoring balance than when they were framed neutrally, $t(167) = 2.52, p = .013, d = .80, 95\% \text{ CI } [.24, 2.07]$, but not when they were framed as apt for fighting enemies, $t(167) = 0.41, p = .679$. This indicates a conditional metaphor matching effect – relative to literal behavioral framing, imbalance behavioral framing enhanced intention for self-limiting behaviors when participants had an imbalance conceptualization of the disease.

Neutral frame. Finally, the planned contrast looking at neutral message framing and

comparing neutral behavior framing to enemy and imbalance behavior framing showed no effect of matching on intentions in the neutral control conditions, $t(167) = 1.31, p = .192$.

Figure 2. Message metaphor by behavior frame on self-limiting intention



Note. Bars denote +/- 1 SE of the mean.

Gender effects

As in study 2, there were significant effects of gender in the overall model that, while not bearing on the proposed hypotheses, still deserve discussion. Also, as in study 2, gender did not moderate the effects described earlier as the four way interaction of gender, message metaphor, behavior frame, and intention was not significant, $F(12, 474) = 1.38, p = .17$.

There was a significant main effect of gender, $F(1, 158) = 20.04, p < .001, \eta_p^2 = .113$.

Females had higher intentions for the behaviors ($M = 4.5$) than males ($M = 3.9$). There was also a marginal interaction of gender and behavior frame, $F(2, 158) = 2.51, p = .085, \eta_p^2 = .031$.

Females had much more intention than males for the behaviors when they were neutrally-framed, $F(1, 158) = 8.28, p = .005, \eta_p^2 = .050$ for the simple effect, framed as an enemy, $F(1, 158) = 6.92, p = .009, \eta_p^2 = .042$ for the simple effect, and slightly more when they were framed as imbalance,

$F(1, 158) = 5.04, p = .026, \eta_p^2 = .031$ for the simple effect.

Last, there was an interaction of gender and intention type that was similar to the one observed in study 2, $F(3, 474) = 3.46, p = .016, \eta_p^2 = .021$. Females had more intention than males for self-limiting behaviors, $F(1, 158) = 20.84, p < .001, \eta_p^2 = .117$ for the simple effect and self-bolstering behaviors, $F(1, 158) = 13.95, p < .001, \eta_p^2 = .081$ for the simple effect. Further, males and females didn't differ in monitoring intentions, $F < 1$ for the simple effect. But unlike study 2, females had more intention than males for hypothetical treatment intentions, $F(1, 158) = 8.97, p = .003, \eta_p^2 = .054$ for the simple effect.

General Discussion

Counter to the prevailing wisdom's expected benefits of framing cancer as a feared enemy, our findings suggest that framing cancer in terms of bellicose enemy metaphors has unintended side-effects that may impair efficient prevention strategies. Many behaviors that reduce the risk of cancer require one to limit enjoyable activities, from sunbathing to drinking alcohol and eating red meats. Yet, limiting and constraining oneself is not a concept closely associated with fighting enemies. Hence, a bellicose message frame that emphasizes fighting an enemy may render these protective behaviors less compelling than they might otherwise be. Three studies provided consistent support for this prediction. First, enemy framing reduced the likelihood that self-limiting behaviors were listed when participants described prevention options in a free response format (study 1). Second, enemy framing reduced participants' intention to engage in self-limiting prevention behaviors when a list of prevention options was presented to them (studies 2 and 3). Third, counter to the prevailing wisdom, this negative impact of enemy framing on prevention intentions was not offset by the increased intentions to engage in other preventive behaviors (studies 2 and 3), most notably self-bolstering behaviors, such as eating

more fruits or more high fiber foods. Fourth, also in contrast to the prevailing wisdom, enemy framing did not increase participants' intention to engage in effective monitoring procedures (studies 2 and 3), nor did it affect their preference for different treatment options (studies 2 and 3). Most notably, it did not increase their intention to seek aggressive treatments, in contrast to conjectures offered in the literature (Reisfield & Wilson, 2004; Aktipis, Maley, & Neuberg, 2010). Finally, framing self-limiting behaviors as particularly apt in "fighting" cancer eliminated the negative impact of enemy framing, but did not provide any advantage over a neutral frame (study 3). In combination, these findings cast doubt on the benefits of a metaphorical frame that has come to dominate public discourse about cancer: cancer as an enemy against whom we ought to wage a war "as aggressive as the war cancer wages against us" (Obama, cited in Lennon, 2009).

The findings are consistent with conceptual metaphor theory (Lakoff & Johnson, 1980) and extend earlier work that showed metaphorical framing effects on sociopolitical attitudes (Landau et al., 2009), relationship perception (Lee & Schwarz, 2014b), and reasoning about fictional cities (Thibodeau & Boroditsky, 2012). However, not all predictions of conceptual metaphor theory were fully supported. Most notably, the expected beneficial effect of metaphor matching (Landau et al., 2010; Lee & Schwarz, 2014a) was only partially observed. On one hand, describing preventive behaviors as apt to fight cancer eliminated the otherwise observed disadvantage of enemy framing; on the other hand, an imbalance framed message not only increased prevention intentions when the behavior was described as apt at restoring balance (as predicted), but also when it was described as apt at fighting enemies (study 3). One might conjecture that fighting enemies is one way of restoring balance on a battle field, but this possibility merely highlights an ambiguity that frequently plagues metaphor research: as the

meaning of any other utterance, the meaning of metaphors is highly context sensitive and open to unanticipated interpretations.

Although the current research makes no predictions about the time-course of the effect of metaphorically-framing cancer as an enemy, prior research suggests the effect would be relatively short lived. Metaphoric framing effects are often thought to operate similarly to conceptual priming effects (Lee & Schwarz, 2014a), so the metaphoric framing effect might be quickly replaced by the next activated concept. However, our messages with very minor wording differences were able to affect behavioral intentions, which are reliable predictors of behavior (at $r = .47$ in meta-analyses; Armitage & Conner, 2001). Hence, even though the influence of a single metaphoric framing manipulation may be short lived, it may have long-term consequences if people can be induced to form behavioral intentions, preferably in ways that facilitate the later implementation of the intention (see Gollwitzer, 1999). More important for the present issue, enemy metaphoric framing of cancer is pervasive in public discourse, and the influence of this continuous exposure is likely to far exceed the observed impact of a single additional exposure in an experiment. To illustrate the ubiquity of enemy framing in discussions about cancer, we conducted a collocation analysis of sources of contemporary American English using the COCA data base (Davies, 2008). This analysis revealed that two verbs related to the enemy metaphor, FIGHT and BATTLE, are among the top ten verbs found up to two words prior to the word CANCER. This high frequency of use may ultimately make the enemy metaphor for cancer a powerful influence on public health.

Our findings carry implications for public health messages, which now follow the view that enemy framing of cancer, through evoking fear, would increase public adherence to beneficial health behaviors. The enemy metaphor has pervaded media portrayals of cancer

(Camus, 2009) and information created by cancer funding organizations. Yet, our studies suggest that enemy metaphoric language for cancer undermines intention for limitation-related prevention behaviors. Further, it does not increase motivation for active, agentic behaviors to *fight* the disease among a lay audience. As such, the evidence suggests that the use of enemy metaphors for cancer in public health information does not boost intention for active agentic behaviors as intended. Rather, it seems more likely that it hurts intention for self-limiting prevention behaviors. Hence, the continued use of the enemy metaphor in public information campaigns on cancer may not be warranted and may ultimately be hurting more than helping public health.

CHAPTER III

Incidental states with metaphoric relevance guide meaning inferences

Note. This work was published in Hauser, D. J. & Schwarz, N. (2015). Elaborative thinking increases the impact of physical weight on importance judgments. *Social Cognition*, 33, 120-132.

Abstract. Previous research showed that a book seems more important when its physical heft is increased through concealed weights. Do such embodied metaphor effects reflect shallow reasoning in the absence of more diagnostic information? To address this issue, participants judged the importance of a heavy vs. light book in the presence vs. absence of substantive information about its content. Of interest is how participants' disposition to engage in elaborative thought (need for cognition, NFC) moderates the impact of weight. In the absence of substantive information, weight did not exert any influence under high or low need for cognition. In the presence of substantive information, the influence of weight increased with elaborative thought; the heavy book was judged more important by high NFC participants, whereas low NFC participants remained unaffected. This is incompatible with the shallow reasoning assumption; instead, sensory experience exerts its influence through elaborative thought about diagnostic inputs.

A rapidly growing body of research provides converging evidence that sensory experience can

influence judgment and decision making in ways that are consistent with common metaphors (for reviews, see Landau, Meier, & Kiefer, 2010; Lee & Schwarz, 2014; and the contributions in Landau, Robinson, & Meier, 2014). While the accumulating findings make a persuasive case for the existence of metaphorical embodiment effects, many questions remain about the conditions under which they emerge. The present research addresses two of these questions: (i) Does sensory information of metaphorical relevance to the judgment at hand primarily exert an influence when people have little other information they can draw on? (ii) Does reliance on sensory information of metaphorical relevance decrease the more people engage in elaborative thought about the task at hand? Couched in the familiar language of classic dual process models (Chaiken, Liberman, & Eagly, 1989; Petty & Cacioppo, 1986), these questions pertain to whether reliance on sensory information of metaphorical relevance is more likely under conditions that foster heuristic processing or under conditions that foster elaborative processing. To shed light on these questions, we rely on a well-established embodiment effect, namely the influence of physical weight on judgments of importance (e.g., Ackerman, Nocera, & Bargh, 2010; Jostmann, Lakens, & Schubert, 2009), and a well-established determinant of differentially elaborative processing, namely need for cognition (NFC; Cacioppo & Petty, 1982).

Weight and importance

Many familiar expressions of everyday life reflect a metaphorical link between physical weight and importance – when thinking of “weighty matters” we may hope that people don’t take them “lightly” and we do our best to bring them to the attention of those whose word “carries a lot of weight”. Testing the impact of this metaphorical link, experimental research showed that people find societal issues more important when the questionnaire is presented on a heavy rather than light clipboard (e.g., Ackerman et al. 2010; Jostmann et al., 2009), that a book

is considered more important and influential when its heft is increased through a concealed weight (e.g., Chandler, Reinhard, & Schwarz, 2012), and that nutritional information on packaged food is considered more relevant when the shopping bag is heavy (Zhang & Li, 2012). Reversing the direction of influence, the same book (Schneider, Rutjens, Jostmann, & Lakens, 2011) or memory stick (Schneider et al., 2014) feels heavier when people think that its content is important than when it is not, resulting in differential estimates of the object's physical weight.

Many psychologists share the intuition that such metaphor effects should be more likely to emerge when people know little else about the target of judgment. One variant of this intuition assumes that embodied information serves as a heuristic cue, which people are most likely to rely on when they have little other information or lack the motivation to engage in an elaborate search (Chaiken et al., 1989; Petty & Cacioppo, 1986). Another variant conceptualizes sensory inputs and their metaphorical associations as one of many target attributes that may enter a judgment, suggesting that their impact should decrease as the number and accessibility of alternative inputs increases (set size principle; Anderson, 1971; Bless, Schwarz, & Wänke, 2003). Moreover, the sensory experience of heaviness resembles other subjective experiences, which typically exert less influence when more diagnostic information is available (Schwarz, 2012). Indeed, Landau and colleagues (2010, p. 1060) suggested in their influential review of metaphor effects that “people will rely on metaphors to comprehend information that appears unfamiliar.” However, the available empirical evidence challenges this intuition.

Specifically, Chandler and colleagues (2012) observed that the experimentally manipulated weight of a book only influenced judgments of the book's importance when participants had substantive knowledge about the book. For example, increasing the heft of *Catcher in the Rye* through a concealed weight increased the book's perceived impact on

American literature, but only among participants who had read the book (Study 2) and knew details about its plot (Study 3). Participants who had not read the book were unaffected by its weight. Similarly, participants who held the unknown book *Dogboy* were influenced by its experimentally manipulated weight when they were handed the book with the back cover up, which allowed them to read a short synopsis and snippets from reviews. The book's weight exerted no influence when they were handed the book with the front cover up, depriving them of substantively relevant information (Study 1). In short, Chandler and colleagues' (2012) results suggest that an object's physical weight only influences judgments of the object's importance when the perceiver has access to relevant declarative information about the object. This conclusion stands in stark contrast to the popular assumption that sensory experiences of merely metaphorical relevance serve as heuristic cues that people rely on when they lack more diagnostic information.

The role of elaborative thought

The present research revisits the conceptual issues raised by Chandler et al.'s (2012) findings by taking advantage of reliable individual differences in elaborative reasoning, namely participants' need for cognition (NFC; Cacioppo & Petty, 1982). Across numerous tasks, individuals high in NFC have been found to be more likely to enjoy and engage in effortful elaborative thought than individuals low in NFC, who are more likely to rely on less effortful processing strategies and heuristic cues (for reviews, see Cacioppo, Petty, Feinstein, & Jarvis, 1996; Petty, Brinol, Loersch, & McCaslin, 2009). This makes NFC a valuable diagnostic tool for exploring the role of elaborative reasoning in the emergence of weight effects on judgments of importance.

If sensory experiences of metaphorical relevance serve as heuristic cues, their influence

on judgment should be most pronounced when perceivers are (i) low (rather than high) in NFC and (ii) lack (rather than have) substantive information about the target. Whereas Chandler and colleagues (2012) did not observe weight effects in the absence of substantive information, such effects may emerge for participants low in NFC, a variable not considered in the earlier research.

Moreover, differences in elaborative reasoning can also shed light on the processes that give rise to weight effects in the presence of substantive information. Three possibilities are worth considering. First, people sometimes hesitate to offer a judgment when they feel that their knowledge is insufficient. They may therefore only draw on metaphorically related information when their perceived knowledge exceeds a threshold of “judgeability” (Leyens, Yzerbyt, & Schadron, 1992; Croizet & Fiske, 2000). From this perspective, one’s perception of one’s own knowledge is more crucial than one’s actual knowledge about the book. In contrast, Chandler et al. (2012) found that actual knowledge about the book’s plot, rather than perceived knowledge or expertise, was the crucial prerequisite for weight effects. This renders a judgeability account of the observed interaction of weight and knowledge unlikely, and we will not address it in the present research. A second possibility is suggested by theories of knowledge accessibility (Higgins, 1996; Wyer & Srull, 1989), which assume that contextual influences can only increase the accessibility of information that the person already has. From this perspective, the book’s heft may increase the accessibility of metaphor-consistent information about the book, making it more likely that importance related attributes of the book come to mind when the book sits heavily in one’s hand. If importance related attributes of the book are not available in memory because the person lacks relevant knowledge, no influence of the book’s heft is observed. Finally, research into hypothesis testing (for reviews, see Kunda, 1999; Nickerson, 1998; Oswald & Grosjean, 2004) raises the possibility that the book’s heft suggests a metaphor consistent

hypothesis (“This book seems important”) that is only endorsed when some supportive information can be identified. If supportive information is not available, no effect is observed.

The latter two accounts differ in their assumptions about the role of elaborative reasoning. From the perspective of mere knowledge accessibility (Higgins, 1996; Wyer & Srull, 1989), the metaphorical link between physical weight and importance results in an activation of the concept “important” when a person holds a weighty book. This can influence the retrieval of previously acquired information as well as the encoding of new information. People who evaluate a previously read book (e.g., *Catcher in the rye*) are more likely to recall important attributes of the book when that concept is available, whereas people who read about an unfamiliar book (e.g., *Dogboy*) may encode the new information as more important when that concept is available (for reviews of both processes, see Higgins, 1996; Wyer & Srull, 1989). The associative process underlying priming effects on the encoding of new information is assumed to be relatively automatic and effortless (Bargh, 1994; Higgins, 1996; Wyer & Srull, 1989) and its impact is attenuated under conditions that foster systematic processing (e.g., Ford & Kruglanski, 1995). From this perspective, a book’s weight influences the encoding of information about the book; accordingly (iii) weight effects should only be observed when information about the book is provided and they should (iv) be more pronounced among individuals who rely on the first thing that comes to mind while encoding new information, that is, participants low (rather than high) in NFC.

In contrast, theories of hypothesis testing assume that hypothesis testing involves a high degree of elaborative reasoning (for reviews, see Kunda, 1999; Klayman & Ha, 1987). Although people generally prefer information that is diagnostic over information that is not (e.g., Trope & Bassock, 1982), they usually pursue a positive testing strategy (Klayman & Ha, 1987) that

involves a focus on information that is suitable to support their hypothesis. When asked to evaluate the importance of a book, they are likely to search for information that bears on its importance (rather than its triviality), resulting in hypothesis confirmation under most circumstances (Nickerson, 1998). From this perspective, a weighty book suggests the hypothesis that the book is important; participants test this hypothesis by examining accessible information and accept it when they can identify satisfactory support. Accordingly, (v) weight effects should only be observed when information about the book is provided and they should (vi) be more pronounced among individuals who tend to engage in elaborative thought, that is, participants high (rather than low) in NFC.

The present research

Following the procedures of Chandler and colleagues (2012, Study 1), participants high or low in need for cognition were presented with an unknown book of normal or heavy heft (due to the insertion of a concealed weight). Some were handed the book with the front cover up, exposing them to little substantive information about the book (only the title, *Dogboy*, and the name of the novel's author, Eva Hornung); others were handed the book with the back cover up, exposing them ample substantive information about the book (a short synopsis of the book and snippets from reviews). This results in a 2 (weight: control vs. heavy) x 2 (substantive information: given vs. not) x NFC (as a continuous variable) factorial between subjects design.

Previous research (Chandler et al., 2012) predicts that the weight of the book will only influence participants' judgments of the book's importance when the back cover is up, giving them access to applicable information. Of key interest is how the previously observed interaction of weight and substantive information is moderated by participants' NFC. As a first possibility, it is conceivable that low NFC participants will be influenced by the book's weight in the absence

of any exposure to substantive information. This would confirm the popular intuition that sensory information of metaphorical relevance is information of last resort, which people draw on when they lack sufficient motivation. Chandler et al.'s (2012) data are silent on this possibility because measures of processing motivation were not included. Second, if the previously observed interaction of weight and substantive information is driven by low-effort associative processes, it should be more pronounced among participants who are low rather than high in NFC. In this case, low NFC individuals should find the book more important when it is heavy rather than not, but only when the back cover is up; this pattern should be less pronounced for high NFC individuals. In contrast, third, if the previously observed interaction of weight and substantive information is driven by more elaborative hypothesis testing, it should be more pronounced among participants who are high rather than low in NFC. In this case, high NFC individuals should find the book more important when it is heavy rather than not, but only when the back cover is up; this pattern should be less pronounced for low NFC individuals.

Method

As part of a larger set of studies, 277 participants (177 female; age range 17 - 23) evaluated the *Dogboy* book (following the procedures of Chandler et al., 2012, study 1) and subsequently answered the 18 item Need for Cognition (NFC) scale (taken from Cacioppo, Petty, & Feng Kao, 1984) in exchange for course credit. The *Dogboy* task was part of an initial set of three tasks that were presented in counterbalanced order; none of the other tasks involved variations of weight. The NFC scale was one of two scales presented at the end of data collection; the order of both scales was counterbalanced. Neither of these order variations had any influence on the *Dogboy* task or the NFC scale ($p > .27$ for all main effects and interactions). No observations were excluded. To collect a large sample size, the study was initiated at the

onset of the introductory psychology subject pool at a large Midwestern University, with the pre-decision to stop when the pool closed for the semester.

Dogboy task

Experimenters handed participants a copy of the hardcover book *Dogboy* as part of a product evaluation. The book was either a control copy (420 g) or a heavy copy containing concealed weights (645 g). The book was handed to participants either with the front cover up, displaying the title, author, and cover art, or with the back cover up, displaying a synopsis of the content of the book and snippets from positive reviews. Participants reported their interest in reading the book (1 = not at all interested, 10 = extremely interested), how much they would be willing to pay for a hard copy of the book (free response), and the likelihood that the book would be named among the most influential books of the year by the New York Times (1 = not at all likely, 10 = extremely likely).

Results

Standardized responses to the questions in the *Dogboy* task were compiled into an index of importance ($\alpha = .47$). We summed responses on the NFC scale (with appropriate items reverse-coded) to compute each participants' NFC score ($\alpha = .87$).

We submitted the importance index to a multiple regression, with NFC (continuous), weight (control vs. heavy), book cover (front up vs. back up) and their interactions entered as mean-centered predictors. As expected, the influence of the book's weight on judgments of the book's importance depended on NFC and the availability of substantive information; this is reflected in a three-way interaction of these variables, $b = .035$, $t(269) = 2.249$, $p = .025$, 95% CI [.004, .065], $r = .136$. We diagnosed this interaction with a spotlight analysis (Aiken & West, 1991; Hayes, 2012) that assessed the interaction between weight and NFC in the absence (front

cover up) and presence (back cover up) of substantive information.

Table 3. Projected mean importance by book weight, presence of substantive information, and NFC

	Weight	
	Control	Heavy
Substantive information absent		
Low NFC (-1 SD)	-.18	-.03
High NFC (+1 SD)	.06	.07
Overall (Mean)	-.06	.02
Substantive information present		
Low NFC (-1 SD)	.00	-.21
High NFC (+1 SD)	-.10	.30
Overall (Mean)	-.05	.04

Recall that Chandler and colleagues (2012) did not observe an influence of weight in the absence of substantive information. The present study replicates this finding as shown in the top panel of Table 3. When participants were handed the book with the front cover up, the book's weight did not influence their importance judgments $\{b = .087, t(134) = .787, p = .433, 95\% \text{ CI } [-.131, .305], r = .068, \text{ for the simple main effect of weight}\}$, independent of whether participants were low or high in NFC; neither the simple main effect of NFC $\{b = .008, t(134) = 1.556, p = .122, 95\% \text{ CI } [.002, .017], r = .133\}$ nor the simple interaction of NFC and weight $\{b = -.007, t(269) = -.664, p = .507, 95\% \text{ CI } [-.027, .014], r = .040\}$ were significant. These findings replicate Chandler and colleagues' (2012) results by showing that an object's weight does not influence evaluations of the object's importance in the absence of substantive information that can be brought to bear on this judgment. Going beyond the earlier findings, the present results further show that this observation is independent of whether the judge is high or low in NFC. This is incompatible with the assumption that the influence of weight on metaphorically related judgments reflects a reliance on weight as a heuristic cue that people resort to in the absence of

more diagnostic information; if so, the influence of weight should have been most pronounced for low NFC participants in the absence of substantive information.

In contrast, the book's weight did influence judgments of its importance when it was presented with the back cover up, thus making substantive information available (see bottom panel of Table 3). However, the simple main effect of weight was not significant $\{b = .109, t(135) = .885, p = .378, 95\% \text{ CI } [-.135, .354], r = .076\}$ and weight's impact depended on participants' NFC scores $\{b = .028, t(269) = 2.438, p = .015, 95\% \text{ CI } [.005, .050], r = .147, \text{ for the simple interaction of weight and NFC}\}$. At low NFC (-1 SD), weight did not significantly affect judgments of importance despite the availability of substantive information $\{b = -.210, t(269) = -1.21, p = .228, 95\% \text{ CI } [-.553, .132], r = -.073, \text{ for the simple main effect}\}$. In contrast, at high NFC (+1 SD), the book was judged as more important when its heft was increased through a concealed weight $\{b = .396, t(269) = 2.361, p = .019, 95\% \text{ CI } [.066, .727], r = .142, \text{ for the simple main effect}\}$. This replicates Chandler et al. (2012) by showing that weight influences judgments of importance in the presence of applicable substantive information. Going beyond the previous findings, the present results further show that this influence is limited to people high in NFC, that is, people likely to engage in elaborative thought, and not obtained for people low in NFC.

Finally, a main effect of NFC indicated that higher NFC scores were associated with higher judgments of importance, independent of all other variables, $b = .009, t(269) = 2.257, p = .025, 95\% \text{ CI } [.001, .016], r = .136$. This is of little theoretical interest and may simply reflect that high NFC individuals are more likely to value books. The remaining main effects and interactions did not reach significance, all $ps > .17$.

Discussion

Numerous experiments have shown profound effects of incidental sensory experiences on metaphorically related judgments (for examples and reviews, see the contributions in Landau et al., 2014; Krishna & Schwarz, 2014). The observed effects are often assumed to emerge because perceivers lack more diagnostic information and/or are insufficiently motivated to engage in more analytic processing. Challenging this perspective, Chandler et al. (2012) found that the weight of a book only influenced judgments of the book's importance when perceivers had access to substantive information about the book, either because they had read the book in the past or could read back-cover information. The present study replicated and extended these findings by testing several process hypotheses.

If judging a book by its weight reflects a shallow strategy to which people resort when they lack diagnostic information and/or sufficient motivation, the influence of a book's weight should be most pronounced for low NFC participants who lack more diagnostic inputs. This was not the case. Replicating Chandler et al. (2012), weight exerted no influence in the absence of substantive information. More important, this observation was independent of participants' disposition to engage in elaborative thought and held for low as well as high NFC participants.

Further replicating Chandler et al. (2012), the book's weight did influence judgments of importance when participants could read relevant substantive information in the form of snippets from reviews. However, the impact of weight was moderated by participants' disposition to engage in elaborative thought. In the presence of supporting information, the influence of weight increased with readers' NFC; it was significant for participants high in NFC, but not for participants low in NFC. Thus, weight failed to influence low NFC participants in the presence as well as absence of substantive information. Put simply, to judge a book by its weight, you not only need to know its content (as Chandler and colleagues asserted), you also need to think about

it, suggesting that cognitive laziness is not a guarantee for pronounced embodiment effects.

Finally, the pattern of the observed moderation is consistent with a hypothesis testing account. From this perspective, the book's weight suggests an initial hypothesis ("This seems important"), which participants test by drawing on relevant content. When such content is not available, weight exerts no influence; when it is available, weight exerts more influence the more participants elaborate on the available content, resulting in higher weight effects for high NFC participants. The pattern is less easily reconciled with a metaphor congruent encoding account. From this perspective, the sensory experience increases the accessibility of the associated concept "important", which is then more likely to guide encoding of the substantive information presented. This process is assumed to be relatively automatic and an impact of accessible concepts should also be observed at low NFC. This was not the case. Future research may shed further light on these competing process assumptions. From an encoding perspective, concept accessibility should exert more influence when the substantive information on the back-cover of the book is ambiguous and allows for different encodings. We did not vary this information but presented the actual back-cover of the trade book. From a hypothesis testing perspective, weight should influence what participants look for and measures of information search could be brought to bear on this issue.

We close with an obvious, but important, caveat. Our findings falsify the popular assumption that incidental sensory experiences only influence metaphorically related judgments when little other information is available and/or people are unwilling or unable to consider it – in fact, we observe the opposite. This does not imply, however, that sensory experiences of metaphorical relevance will never exert an influence under low elaborative processing or in the absence of supporting information. As decades of social cognition research illustrate, any input

can exert an influence through multiple pathways that are rarely mutually exclusive. Work on embodied metaphors has so far paid little attention to alternative pathways, which we consider a promising avenue for future research.

CHAPTER IV

Semantic prosody guides inferences about meaning

Note. This work was published in Hauser, D. J. & Schwarz, N. (2016). Semantic prosody and judgment. *Journal of Experimental Psychology: General*, 145, 882-896.

Abstract. Some words tend to co-occur exclusively with a positive or negative context in natural language use even though such valence patterns are not dictated by definitions or are part of the words' core meaning. These words contain semantic prosody, a subtle valenced meaning derived from co-occurrence in language. As language and thought are heavily intertwined, we hypothesized that semantic prosody can affect evaluative inferences about related ambiguous concepts. Participants inferred that an ambiguous medical outcome was more negative when it was *caused*, a verb with negative semantic prosody, than when it was *produced*, a synonymous verb with no semantic prosody (Studies 1a, 1b). Participants completed sentence fragments in a manner consistent with semantic prosody (Study 2), and semantic prosody affected various other judgments in line with evaluative inferences (estimates of an event's likelihood in Study 3). Finally, semantic prosody elicited both positive and negative evaluations of outcomes across a large set of semantically prosodic verbs (Study 4). Thus, semantic prosody can exert a strong influence on evaluative judgment.

Why does “work” seem worse when someone *causes* work for us rather than *produces* work for us? Some might say that *produce* and *cause* mean different things, but the words themselves are largely synonymous; both take outcomes that are brought about to exist (like “work”) as their objects, and both are cross-listed in popular thesauri as being strong synonyms. Yet each word seems to prompt different interpretations of “work,” with *caused* work seeming additional and burdensome and *produced* work seeming like a provided opportunity. Why do these synonymous words color “work” with such different valences?

Analyses of the co-occurrence of words in text and natural language have shown that some words occur predominantly in contexts with strong negative or positive valence (Sinclair, 1991; Louw, 1993; Stubbs, 1995; Partington, 2004). Frequent co-occurrence, in turn, can give rise to the expectation that the context is likely to reflect the usually associated valence whenever the word is encountered. These expectations are not inherent in the word’s ascribed definition (Stubbs, 1995, Partington, 2004) and are not drawn upon when native speakers are asked to consider a word’s meaning in isolation (see review in Xiao & McEnery, 2006). Linguists refer to this phenomenon as semantic prosody², which denotes the covert valenced connotation of a word derived from frequent co-occurrence in natural language.

Language and thought are heavily intertwined, such that minor variations in wording can exact profound effects on judgments and memory. Asking people how they *feel* about themselves leads them to more negativity than asking how they *think* about themselves (Holtgraves, 2015); accidents in which cars were said to *smash* into one another are recalled as more violent than accidents in which cars *hit* one another (Loftus & Palmer, 1974); and saying *Daniel helps X*

² Additional terms for the phenomenon include discourse prosody, evaluative prosody, and semantic preference. Note that the term *prosody* here is used metaphorically. Semantic prosody does not directly involve speech patterns of stress or intonation; rather, it references them. Just as the speech intonation of vowels can depend upon neighboring letters, the semantic profile of words can depend upon neighboring words, hence the use of the use of the term *prosody*.

elicits fewer dispositional attributions of Daniel's helpfulness than saying *Daniel is helpful* (Semin & Fielder, 1991). Nearly synonymous ways to express the same information can lead the reader to very different inferences. We therefore predict that the valence of a word's typical co-occurrences (i.e., semantic prosody) can also influence judgment, affecting evaluative inferences and creating disparate valence implications for similar sentences as illustrated in our opening example.

Semantic prosody

Lexical priming theories of language suggest that context is key to concept representation (Hoey, 2005). Words do not occur in isolation but appear in context with critical links to other elements of a sentence (Elman, 2011; Casasanto & Lupyan, 2015). The typical context in which a given word appears allows readers to infer attributes of the word that go beyond its lexical definition. For instance, the word "cloud" historically had no associations with computers, but recent conceptual metaphors associating clouds with remote data storage added a novel conventionalized meaning to the term. Similarly, a concept's co-occurrence with valenced contexts may provide new conceptual associations with valence. Indeed, co-occurrence is a crucial factor in creating conventional metaphors (Bowdle & Gentner, 2005), fostering semantic association (Landauer & Dumais, 1997) and learning (Skinner, 1938).

One pattern of conceptual co-occurrence with relevance to valence has been dubbed "semantic prosody". A word is said to have semantic prosody when it occurs predominantly with other words of positive or negative valence (Sinclair, 1991; Louw, 1993). According to theories of lexical priming, the continued co-occurrence of a word with a positive or negative context is encoded as part of that word's representation, which produces evaluative preferences for that word (Hoey, 2005; Stubbs, 1995; Partington, 2004) and affects evaluation of related concepts in

affective priming tasks (Ellis & Frey, 2009). These findings suggest that the valence of a word's typical context may influence evaluations of other concepts with which the word is presented in a sentence.

As an example, the verb *cause* has clear negative prosody. Researchers have documented that nearly all of *cause*'s most associated collocates (commonly co-occurring words) are clearly negative in valence (for a review of the evidence and statistical techniques for extracting most associated collocates, see Stubbs, 1995). In the Corpus of Contemporary American English (COCA), a database of English-language text used in media (Davies, 2008), *cause* typically occurs alongside negative words (most common noun collocates within 4 words to the right: death, problems, damage, pain, cancer, trouble, concern, disease, effect, harm). In contrast, the nearly-synonymous verb *produce* has no such co-occurrence patterns (most common noun collocates within 4 words to the right: results, effects, images, produces, electricity, goods, weapons, tons, amounts, films). Other researchers have identified more words with semantic prosody, spanning verbs, adjectives, and adverbs. For example, the verbs *happen* and *set in* have negative prosody (e.g., *shit happens*, *doubt sets in*; Sinclair, 1987), as does *bent on* (e.g., *the teens were bent on mayhem*, Louw, 1993). The effect also appears in adjectives and adverbs, as the adverb *utterly* has clear negative prosody (Partington, 2004). Semantic prosodies are not restricted to English and have also been identified in other languages (e.g., Italian, Portuguese, and Chinese; Tognini-Bonelli, 2001; Sardinha, 2000, Xiao & McEnery, 2006). However, only a limited number of words with semantic prosody have been studied. The literature on semantic prosody typically identifies a limited number of words per paper and heavily documents the collocational profile of words in corpora in order to validate them as having semantic prosody.

As a result, there are no official lists of words with semantic prosody, but the limited number of words that have been identified have been extensively studied.

Semantic prosody and valenced meaning

It is important to note the distinction between semantic prosody and valenced meaning. Some words have valence at the core of their meaning, which is assumed to be imposed on other words in a sentence. For instance, the words *right* and *evil* have clear positive and negative valenced meanings as seen in common definitions and participants own definitions of the words. *Right* refers to correctness or accuracy, typically a desirable attribute, while *evil* refers to malevolent intentions, a clearly negative attribute. Valenced core meaning is apparent in how people define these words. There exist no non-valenced synonyms for words with clear valenced meaning. For example, there is no neutral word that can be exchanged for the word *evil* in the sentence “The toy was *evil*” and still result in the sentence conveying the same information. Thus, words with valenced core meaning have no non-valenced synonyms. Valence is at the core of what these words mean and is readily identified as such by native speakers.

In contrast, words with semantic prosody often lack valence at the core of their meaning. In these cases, valence is absent in lexical entries, and participants do not include valence in their own definitions of the word. Unlike valenced core meaning, semantic prosody may not be apparent in definitions. Additionally, words with semantic prosody often have synonyms which can be substituted for the word and still have the sentence mean the same thing (e.g., “bent on” determining the cause vs “intent on” determining the cause). Thus, unlike words with valenced core meaning, words with semantic prosody may share a neutral core meaning with other non-valenced words.

In sum, semantically prosodic words co-occur with valenced contexts, but valence is not a core part of what these words mean to native speakers, which distinguishes them from explicitly valenced words. We expect, however, that these words may nevertheless impose an evaluative meaning on related outcomes as a function of their typical co-occurrence with valenced outcomes in text and in natural language use (e.g., *caused* outcomes may seem more negative than *produced* outcomes).

The present research

To date, most studies of semantic prosody are limited to analyses of naturally-occurring text, which merely show that certain words typically co-occur with valenced outcomes. Experimental investigations of the possible influence of semantic prosody on judgment and decision making are missing, which has been noted by critics (cf. Hunston, 2007; Stewart, 2010; Whitsitt, 2005). Further, the phenomenon has remained unstudied in social and cognitive psychology despite its applicability to impression formation, persuasion, and social cognition in general. Addressing this neglect, the current research aims to provide a valuable proof of concept by showing that semantic prosody can affect evaluative judgments. It asks: Is semantic prosody merely a language phenomenon or can it reliably affect the inferences people draw from an utterance? If the latter, what moderates the size of semantic prosody effects?

As discussed, semantically prosodic words are assumed to carry valence expectations that reflect the valence of the contexts in which they typically occur. If these valence expectations become accessible when a semantically prosodic word is encountered, they should influence the interpretation of material to which they are applicable, consistent with models of knowledge accessibility (for reviews, see Förster & Liberman, 2007; Higgins, 1996; Wyer & Srull, 1989). Accordingly, a given act should be evaluated more negatively when its description includes a

term with negative rather than positive (or no) semantic prosody – even when participants see the terms as meaning the same thing and being similarly valenced.

Note that the latter aspect distinguishes the expected prosody effects from other knowledge accessibility effects, where the influence of accessible concepts is a function of their inherent valenced core meaning as seen in definitions. In these familiar knowledge accessibility effects, explicit valence is imposed on other concepts. In contrast, semantically prosodic words do not have a valenced core meaning, but may nevertheless foster valence expectations for other concepts as a function of their frequent co-occurrence with valenced contexts. This distinguishes the predicted phenomena from standard knowledge accessibility effects.

Nevertheless, standard principles of knowledge accessibility should apply to the influence of semantically prosodic words. Knowledge accessibility experiments showed that accessible concepts have more influence on judgments of ambiguous than on judgments of unambiguous concepts (Higgins, Rholes, & Jones, 1977; Srull & Wyer, 1979). Paralleling this observation, the expected influence of semantic prosody on evaluative judgments should increase with the ambiguity of the described target behavior. In addition, the size of the expected effects should decrease with the accessibility of alternative inputs, consistent with the set size principle (Anderson, 1971; Bless, Schwarz, & Wänke, 2003).

We test these predictions in five experiments. Studies 1a and 1b test whether semantic prosody affects readers' inferences about the valence of an outcome. Study 2 tests whether inferences from prosody are moderated by other information about the actor's intentions. Study 3 tests the influence of prosody on the evaluation of outcomes. Study 4 tests a generalized effect of both positive and negative semantic prosody across a large set of prosodic verbs. Throughout, the materials presented to participants differ only in a single, semantically prosodic word. As

detailed below, the prosodic words used are nearly synonymous with control words and contain no valence associations in lexical definitions -- but nevertheless may exert a powerful influence on participants' inferences from descriptions in which they occur.

It is important to note that different methods of measuring word associations may result in different estimates of the extent to which people associate semantically prosodic words with valence. Collocation is part of conceptual representation (Hoey, 2005) and people seem to have at least implicit awareness of collocational patterns (Ellis & Frey, 2009). Accordingly, simply asking for valence ratings of words may show that participants view semantically prosodic words as being valenced because participants may draw upon collocational patterns to fulfill these ratings. Further, there could be a circular relationship between a semantically prosodic word's rated valence and collocation, such that they drive each other, making it fruitless to discover the valenced meaning (or lack thereof) of a semantically prosodic word via word ratings. In the following pilot tests, we explore alternate ways of establishing that our semantically prosodic stimuli and control stimuli do not differ in the valence of their core meaning.

Pilot studies: synonymy and valence of semantically prosodic terms and control terms

Although words with semantic prosody occur in valenced contexts, the words themselves may lack a valenced core meaning. If so, words with semantic prosody should be seen as similar in meaning and valence to non-semantically prosodic synonymous words.

As an example, *cause* is often listed as having negative semantic prosody (Stubbs, 1995; Xiao & McEnery, 2006), and *produce* is often identified as being its non-semantically prosodic synonym. Most dictionaries list similar definitions for the words, and thesauri commonly cross-list the words as being strong synonyms of each other. As shown in Table 4, both words have few orthographic neighbors and are relatively frequent in language despite having different

collocational profiles. Some affective lexicons specify that both words contain no valence associations (*General Inquirer*; Stone, Dunphy, & Smith, 1966; *EmoLex*; Mohammad & Turney, 2013) while others suggest that *cause* is more negative than *produce* (Warriner, Kuperman, & Brysbaert, 2013). However, as previously discussed, it is difficult to discern if differences in participant ratings of valence are derived from differences in valenced core meaning or differences in semantic prosody.

Table 4. Word statistics for stimuli in studies 1 through 3.

	Cause	Produce
Most frequent right noun collocates within 4 (Davies, 2008)	death, problems, damage, pain, cancer, trouble, concern, disease, effect, harm	results, effects, images, produces, electricity, goods, weapons, tons, amounts, films
Orthographic neighbors	1 (pause)	1 (product)
Frequency as verbs (COCA, Davies, 2008)	24,282 (52 per mil)	32,021 (69 per mil)
Mean coded definition valence	1.9	2.0
Mean sentiment analysis definition valence	5.4	5.8
Synonymy in pilot study	19/21 participants (90%) identified produce as a synonym of cause	19/19 participants (100%) identified cause as a synonym of produce

We conducted pilot tests to ascertain whether words with semantic prosody are seen as similar in meaning and valence to non-semantically prosodic synonymous words. Participants defined words with semantic prosody and non-semantically prosodic synonyms, and raters coded their definitions for valence. Participants also identified whether non-semantically prosodic synonyms were synonymous with semantically prosodic words. These measures assess whether words with semantic prosody can be similar to their non-semantically prosodic synonyms in all but their associated collocates. Thus, we distinguish word meaning from semantic prosody by evaluating the valence of how pilot participants define words with semantic prosody and whether

pilot participants perceive synonymy between semantically prosodic words and non-semantically prosodic words.

Unfortunately, the number of well-documented words with semantic prosody is currently limited. Although numerous words with semantic prosody exist, extracting them and compiling comprehensive lists has not been a focus of linguistic researchers. Hopefully, the observation that semantic prosody can influence judgment in systematic ways will motivate the extraction of a larger corpus of semantically prosodic words.

Pilot study

Participants. Forty Amazon Mechanical Turk workers (14 female; age range 20 – 64) participated in exchange for 50 cents.

Materials. From the materials of Ellis and Frey (2009), we selected five words with positive semantic prosody (attain, lack, restore, lend, emphasize) and four words with negative semantic prosody (cause, encounter, commit, arouse) that contained no valence associations in their definitions. Information regarding common collocates, orthographic neighbors, and frequency for these words can be found in Table A1 in the Appendix. To determine if a word had semantic prosody, Ellis and Frey (2009) extracted collocates of commonly-identified semantically prosodic verbs from the British National Corpus (BNC), coded the valence of collocates, and established which verbs had high proportions of positive or negative collocates. We searched dictionary entries for their verbs to determine if definitions contained explicit positive or negative valence associations, which some did. For example, while *gain* is identified as having positive semantic prosody, common definitions for *gain* specify that it takes objects that are wanted or valued. From a judgment perspective, such cases are of little interest – that words with valenced meanings influence evaluative judgment is well documented (e.g.,

Anderson, 1971). In contrast, the possibility that words without a valenced core meaning can nevertheless influence judgment because they usually occur in a valenced context is novel and interesting. Accordingly, we only selected positive semantically prosodic verbs and negative semantically prosodic verbs that contained no defined valence in line with collocational patterns. This resulted in a set of nine words.

We then identified non-semantically prosodic synonyms (control words) for these words from thesauri. Matched control words had definitions similar to those of the prosodic words and had no entries in *EmoLex* (Mohammad & Turney, 2013) that conflicted with the valence associations of the prosodic words. This gave us nine word pairs, each containing one semantically prosodic word and a matched non-semantically prosodic synonym: attain-get; lack-not have; restore-bring back; lend-loan; emphasize-stress; cause-produce; encounter-happen upon; commit-engage in; arouse-evoke.

Procedure. Participants were directed to a survey on defining words. A sentence containing a target word (either a word with semantic prosody or a matched non-semantically prosodic synonym, randomly assigned) was presented, and participants were asked to define the target word in a free text response box. For example, for the *cause-produce* word pair, the sentence read: “The drug causes (produces) increased blood circulation in the extremities.” All sentences are shown in the first column of Table 5.

We then presented a list of six words and asked participants to identify all of the words that could be substituted for the target word and still have the sentence mean the same thing (that is, identify all synonyms). The list of response options contained three non-synonyms, two synonyms, and the matched word in the word pair (the semantically prosodic word if the target word was the matched non-semantically prosodic synonym or the matched non-semantically

prosodic synonym if the target word was the semantically prosodic word). Response option order was randomized. As an example, for the *cause-produce* word pair, the response options were: brings about, leads to, produces (causes), needs, results from, dampens. This procedure was repeated for each of the nine word pairs (order randomized).

Table 5. Valence and synonymy ratings for semantically prosodic words and non-prosodic synonyms

Semantically prosodic (control) sentence	Mean coded definition valence	Mean sentiment analysis definition valence	Synonymy of words in pair	Average synonymy with synonyms
System justification attains (gets) more power as more buy in.	2.0 (2.0)	6.0 (6.0)	95% (85%)	92% (90%)
Steve lacks (does not have) experience with this machine.	1.9 (2.0)	5.7 (5.6)	95% (100%)	92% (85%)
The electrician restores (brought back) power to the building.	2.3 (2.2)	5.2 (5.5)	100% (100%)	95% (90%)
Banks lend (loan) money to their clients.	2.0 (2.0)	6.3 (6.1)	100% (100%)	65% (65%)
Our professor emphasizes (stresses) the role of expectations on gender disparities.	2.0 (1.9)	5.9 (5.5)	95% (95%)	98% (90%)
The drug causes (produces) increased blood circulation in the extremities.	1.9 (2.0)	5.4 (5.8)	90% (100%)	95% (92%)
Protagonists often encounter (happen upon) hurdles in their journeys.	2.0 (2.0)	5.8 (5.6)	80% (95%)	85% (82%)
Joshua commits (engages in) decision-making fallacies whenever he plays poker.	2.0 (2.0)	5.8 (5.4)	95% (85%)	88% (72%)
Great movies arouse (evoke) complex emotions in viewers.	2.2 (2.0)	6.0 (5.8)	95% (100%)	80% (68%)

Note. Numbers in parentheses indicate ratings when the non-semantically prosodic word was the target word in the sentence (i.e., non-semantically prosodic word definitional valence, synonymy with semantically prosodic word, synonymy with synonyms).

Results

Coded valence of definitions. In order to see if there were differences in valenced core meaning between the words in each word pair, we coded participants' definitions of the words for valence. Recall that participants often identify valence associations in their definitions of words with explicit positive or negative core valence. If words in each word pair differ in the valence of their core meaning, then the presence of valenced terms in participant definitions should indicate so. Two coders (blind to hypotheses) rated whether each definition contained unambiguously positive (score of 1) or negative (score of 3) elements or if the definition was neutral in valence (score of 2). Coders disagreed on the valence of only 38 out of the 360 total definitions (10.5%), and disagreements were resolved by a third coder. As shown in the 2nd column of Table 5, for each semantically-prosodic word and its matched synonym, there were no significant differences in explicit valence in the participants' definitions, all $ps > .154$. Thus, our matched words are equivalent in the valence of their core meaning and only differ in the valence of their common collocational contexts.

Sentiment analysis of definitions. In order to get another measure of the valence of the definitions, we also conducted a sentiment analysis of the outcomes that participants listed in the textboxes (see Miner, Elder, Hill, Nisbet, Delen, & Fast, 2012, for a review of sentiment analysis techniques and considerations). We matched the words within each definition to the available entries of the word norming database of Warriner et al. (2013) and retrieved the corresponding valence rating for each word (1 = very negative, 9 = very positive). We then computed the average valence of the words within each definition to arrive at an overall valence for each definition. As shown in the 3rd column of Table 5, this analysis also showed no differences in the valence of the definitions for semantically-prosodic words and their matched synonyms, all $ps > .254$. Thus, our pilot testing assured that each word pair contained no core valence associations

in participants' lay definitions. Participants see the stimuli as being similar in the valence of their meaning.

Synonymy. Recall that words with valenced core meaning lack non-valenced synonyms. If the words in each word pair are similar in all but their associated collocates, then participants should identify them as being synonymous with each other. As shown in the 4th column of Table 5 and as expected, participants identified the words in each word pair as being synonymous. Notably, the synonymy ratings of paired words equaled or exceeded the average synonymy ratings of each pair word to other synonyms commonly found in thesauri (shown in the 5th column of Table 5). The lowest amount of average synonymy agreement between words in a word pair was 87.5% (encounter – happen upon), which exceeded the average amount of synonymy agreement for that word's other synonyms (84%). Thus, all semantically prosodic words and their synonyms were identified as synonymous and seen as conveying similar meanings by the overwhelming majority of participants.

Furthermore, this pilot study demonstrates that *cause* is seen as synonymous with *produce* even in positive contexts. We asked an additional twenty participants whether the object of the sentence for this word pair (“increased blood circulation”) was a good or bad thing, and 75% of participants identified it as a positive outcome. This demonstrates the overlap in core meaning of *produce* and *cause*, as *cause* is able to convey the same meaning as *produce* even when the object conflicts with the negative collocational patterns of *cause*.

Discussion

Overall, we find that many words with semantic prosody lack a valenced core meaning. Participant's definitions of semantically prosodic words and non-prosodic synonyms were equivalent in valence, and participants largely identified the words in these pairs as being

synonymous. The remaining studies use the words assessed in these pilot tests as stimuli. Studies 1 through 3 focus on just a single pair: produce and cause. Study 4 examines all of the words piloted.

Causing bad outcomes and producing good ones:

Studies 1a and 1b

In study 1, we investigate whether semantic prosody affects evaluative inferences about an ambiguous concept. As noted before in pilot testing, the word *cause* is typically followed by affectively negative concepts, and thus has a negative semantic prosody (Stubbs, 1995), whereas the nearly-synonymous word *produce* has no typical valence co-occurrences (Davies, 2008). Importantly, both *produce* and *cause* have no explicit valence associations in their definitions (Stubbs, 1995) and native speakers largely consider the two terms synonymous (see Table 4). While *cause* typically occurs in a negative context, it is currently unknown whether this convention influences people’s inferences about the valence of whatever was “caused”. If semantic prosody affects valence expectations about the target, then an ambiguous outcome should be seen as more negative in valence when it is described as being *caused* rather than *produced*. Study 1a tests this possibility.

Study 1a

Method. Four hundred and five Amazon Mechanical Turk workers (165 female, 2 unidentified; age range 18 – 62) participated in exchange for 30 cents. We deliberately oversampled in this first study in order to reach more than 95% power for a “small” to “medium” sized effect ($\varphi = .2$). To be eligible for participation, workers were required to have a HIT approval rate of 95% and fifty prior accepted HITs, requirements which are empirically-established as ensuring attentive MTurk participants (Peer, Vosgerau, & Acquisti, 2014). As part

of a series of tasks assessing decision making, participants were randomly assigned to read either the *produce* version or the *cause* version of the following sentence: “Surprisingly, ingestion of the substance produces (causes) endocrination of abdominal lipid tissue.” Both *cause* and *produce* have similar meanings of making things to exist or happen, and analyses of their associated collocates in COCA (Davies, 2008) indicates that each verb commonly takes medical-related objects³; thus, each verb is similarly fluent and frequent in the context of this sentence.

Participants then identified, in a forced choice format, whether “endocrination of abdominal lipid tissue” was a good or bad thing. As *endocrination* is not an actual word, this concept constitutes a fictional, ambiguous target.

Results and discussion. As predicted, participants were more likely to think that endocrination of abdominal lipid tissue was a bad thing when it was *caused* (72.9% bad) than when it was *produced* (48.5% bad), $\chi^2(1, N = 405) = 25.26, p < .001, \phi = .25$. Study 1b replicates and extends this finding.

Study 1b

As observed in numerous social cognition studies, contextual influences are more pronounced when the target of judgment is highly ambiguous (for reviews, see Higgins 1996; Landau, Meier, & Kiefer, 2010; Schwarz & Strack, 1991), as was the case for the fictitious issue of “endocrination” in study 1a. We expect that semantic prosody exerts a weaker influence when the target concept is less ambiguous. Study 1b tests this prediction by presenting a clearly positive or clearly negative outcome in addition to the ambiguous outcome used in study 1a.

³ Some of *cause*'s medical related collocates include cancer [mutual information (MI) 5.75], disease (MI 4.88), and infections (MI 5.79). Some of *produce*'s medical related collocates include insulin (MI 6.64), cells (MI 3.27), and symptoms (MI 3.68). MI scores compare the probability of a node word and collocate occurring together by chance to their probability of actual co-occurrence. MI scores above three, indicating that co-occurrence is eight times more likely than if by chance, are generally considered to be interesting (Church & Hanks, 1990).

Method. One-thousand, one-hundred, and seventy-seven Amazon Mechanical Turk workers (425 female, 7 unidentified; age range 18 - 76) participated in exchange for 10 cents. As this study replicates study 1a and adds two new conditions (for a total of three between subjects conditions), sample size was determined by attempting to recruit a sample size three times the size of the sample of study 1a. This is in accordance with suggestions to oversample in replication studies (Brandt et al., 2014). As in study 1a, participation was limited to workers with at least 50 prior HITs and a 95% approval rate. In addition, worker IDs were screened to restrict participation to workers who had not participated in study 1a (Peer, Paolacci, Chandler, & Mueller, 2012). Similar screening criteria are used in all remaining studies.

In an ostensible study on semantics, participants were randomly assigned to read either the *produce* version or *cause* version of a sentence. The sentence began “Surprisingly, ingestion of the substance produces (causes) *outcome*.” Depending on condition, the outcome was unambiguously positive (*shrinking of cancerous tumors*), unambiguously negative (*gall bladder infections*), or ambiguous (*endocrination of abdominal lipid tissue*). As in study 1a, participants reported, in a forced choice format, if the outcome was a good or a bad thing.

Results and discussion. Replicating the effect of verb prosody obtained in study 1a, participants were more likely to consider the ambiguous *endocrination of abdominal lipid tissue* a bad thing when it was *caused* (61.4% bad) than when it was *produced* (47.9%), for a difference of 13.5 percentage points; $\chi^2(1, N = 391) = 7.2, p = .007, \phi = .14$. We predicted that this prosody effect would be attenuated or eliminated when the outcome is unambiguous. This was the case. Specifically, participants were as likely to consider *gall bladder infections* a bad thing when they were *caused* (99.5%) as when they were *produced* (99.0% bad); $\chi^2(1, N = 397) = 0$ (with Yates’ correction for continuity), $p = 1, \phi = 0$. Similarly, participants were as unlikely to consider

shrinking cancer tumors a bad thing when it was *caused* (3.0%) as when it was *produced* (0.5%), $\chi^2(1, N = 389) = 2.1$ (with Yates' correction), $p = .145$, $\phi = .07$. Therefore, ambiguity moderated the effect of verb on outcome evaluation, as seen in the significant two way interaction between outcome ambiguity (contrast coded as -2 for the ambiguous condition and +1 for unambiguous conditions) and verb (-1 = cause, 1 = produce) in a logistic regression predicting responses (0 = good, 1 = bad), $b = -0.09$, $SE = 0.04$, $Wald = 4.639$, $p = .031$, *odds ratio* = .91.

The remaining observations are of little theoretical interest. Confirming our manipulation of outcome ambiguity, almost all participants considered *gall bladder infections* a bad thing (99.2%), few considered *shrinking of cancerous tumors* a bad thing (1.8%), and the ambiguous *endocrination of abdominal lipid tissue* fell in between (54.7% bad).

In sum, the semantic prosody of the verb *caused* (vs. *produced*) elicited more negative assessments of an outcome. In line with theories of knowledge accessibility, the effect of semantic prosody was attenuated when participants had more informational inputs with which to judge the outcome's valence. While floor and ceiling effects may have contributed to the negated the effect of semantic prosody in the unambiguous conditions, evaluations at the floor and ceiling are likely due to the lack of ambiguity in those conditions. Thus, when clues to valence are plentiful (i.e., when targets of judgment are unambiguously positive or negative), semantic prosody has no effect.

Another look at whether ambiguity moderates semantic prosody effects:

Study 2

Study 2 tests the robustness of semantic prosody effects across a wider range of behaviors and outcomes. Moreover, it addresses two ambiguities of study 1, which are both related to participants' perceptions of intentionality, a potential conceptual difference between our stimuli.

The first ambiguity pertains to the role of the actor's intentions. In study 1, participants read that "*Surprisingly, ingestion of the substance produces (causes)...*"; this sentence presents an inanimate agent (the substance) that has no identifiable intention. Hence, the semantic prosody of the verb is arguably the only information from which recipients can infer the likely valence of an ambiguous outcome – and when the outcome was unambiguous, little influence of semantic prosody was observed. This raises the possibility that semantic prosody effects may only be observed under very limited conditions, namely when the outcome as well as the actor are ambiguous in valence. If so, prosody effects would be of limited relevance in most contexts.

Study 2 addresses this possibility by varying the intentions of the actor. Specifically, the materials described actors who were clearly associated with positive intentions (e.g., *aid workers*), negative intentions (e.g., *terrorists*), or no clear intentions (e.g., *workers*). These actors were paired with the verb *cause* or *produce*, and participants were asked to fill in the outcome (e.g., *The aid workers caused ____*); subsequently they rated how good or bad those self-generated outcomes were. In this format, semantic prosody effects would take the form of more negative blank completions following the verb *cause* than the verb *produce*. If the influence of semantic prosody is limited to conditions where an actor's intentions are unknown, participants' sentence completions should only be affected by *cause* vs. *produce* when the actor is neutral, but not when the actor's intentions are positive or negative.

A second ambiguity relates to the intentionality implied by the verbs *cause* and *produce*. Although these verbs are near synonyms, it seems that *produce* might be more intentional than *cause*; that is, that intended outcomes are more likely to be described as *produced* than as *caused*. This raises the possibility that the results of study 1 reflect an effect of intentionality rather than semantic prosody: in the absence of information about intentions, participants may

have perceived an ambiguous outcome as more positive when it was *produced* rather than *caused* because the former term implied intentionality, whereas the latter term allowed interpretation of the outcome as an unintended side-effect. Thus, because most intentional outcomes are intended to be positive, *produced* outcomes might be considered more positive than *caused* outcomes because *produced* outcomes are intended.

The actor manipulation of study 2 bears on this issue. If intentionality drove the association of positive outcomes with *produce* and negative outcomes with *cause* in Study 1, then manipulating the intentionality of the actors in the sentence should affect this process. While the actor in Study 1 had ambiguous intentions, in Study 2, we vary the valence of the actor to manipulate whether they have clearly positive, negative, or neutral intentions. If intentionality differences between *produce* and *cause* account for the previously observed differences, then participants should infer that an actor with clearly negative intentions would *produce* more negative outcomes (compared to *caused* outcomes), as a person with negative intentions should intend to create more negative outcomes. That is, intentionality would predict that bad people would *produce* worse outcomes because *producing* is more intentional than *causing*.

Alternatively, if semantic prosody drives the association of positive outcomes with *produce* and negative outcomes with *cause*, then we should not expect to see this pattern emerge. Rather, if co-occurrence with valenced contexts creates valenced expectations, then intentionality should not matter, and participants should infer that a negative actor with clearly negative intentions would *produce* outcomes with more positive valence (compared to *caused* outcomes). Additionally, semantic prosody should affect outcome valence of negative outcomes even when accounting for the perceived intentionality of the outcome. Thus, *produced* outcomes of negative actors should be seen as more positive than *caused* outcomes when controlling for intentionality

differences between such outcomes. Note that these two process assumptions do not make differential predictions for actors with clearly positive intentions.

Method

One hundred and eighty-four Amazon Mechanical Turk workers (111 male, 1 unspecified; age range 19 - 70) participated in exchange for 30 cents. Because study 1a found close to a small effect, sample size was determined in order to approximate 80% power for a small effect ($d = .2$) in a within-subjects design. Each participant received six sentence fragments of the form, *[Actor] caused (vs. produced) ____*. Participants were asked to fill in the blank. The set of actors (subjects of the sentence) is shown in Table 6; they were either positive actors, neutral actors, or negative actors, and were pretested to have clearly positive intentions, neutral intentions, or negative intentions. Each participant completed one sentence from each cell of a 3 (actor valence: negative, neutral, positive) x 2 (verb: produce, cause) within-subjects design. Condition order was counterbalanced in a balanced Latin square design, and fragment order was randomized.

Table 6. Actor valence for sentence fragments used in Study 2

	Negative	Neutral	Positive
Actor			
1	The terrorists	The workers	The aid workers
2	A giant financial conglomerate	A company	A Wall Street overwatch nonprofit group
3	The tyrannical dictator	The company administrator	The United Nations peacekeeping forces
4	The mean-spirited supervisor	The new supervisor	The kind and warm supervisor
5	The arsonist	The marathon runner	The Habitat For Humanity volunteers
6	The sneaky committee member	The oldest committee member	The very hard-working committee member

Procedure. Participants were directed to an online survey on sentence completion. They were instructed to complete each sentence fragment with the word or phrase they would expect to come next, and were given the example “The circus clown created...” with *balloon animals* as a possible completion example. Six fragments varied in actor valence and verb and provided an open text box in which participants were to input their answers.

After completing the six sentence fragments, participants rated the valence and intentionality of their self-generated outcomes. Participants were asked “To what extent is your ending to sentence *X* (*outcome to X*) a positive or a negative thing?” (1 = very negative to 7 = very positive). Piped text displayed the participants’ original answer in the parentheses. Participants were also asked “To what extent did the actor in sentence *X* (*actor in X*) intend to (cause / produce) *outcome in X*?” (1= did not intend to 7 = strongly intended). Piped text displayed the actor in the sentence, the verb in the sentence, and the participant’s self-generated outcome. Participants answered these two questions for each of the six self-generated sentence fragment outcomes.

In order to get another measure of the valence of the outcomes, we also conducted a sentiment analysis of the outcomes that participants listed in the textboxes (see Miner et al, 2012). This also allows us to assess whether semantic prosody affects the valence of outcomes generated, separated from participant’s evaluations of outcomes following words with semantic prosody. We matched the words within each outcome to the available entries of the word norming database of Warriner et al. (2013) and retrieved the corresponding valence rating for each word (1 = very negative, 9 = very positive). We then computed the average valence of the words within each outcome to arrive at an overall valence for each outcome.

Results and discussion

Participant ratings of outcome valence. We conducted a 3 (actor valence: negative, neutral, positive) x 2 (verb: produce, cause) within-subjects analysis of variance on participants' ratings of the valence of their own, self-generated outcomes. As predicted, semantic prosody influenced the valence of participants' sentence completions, as evident in a significant main effect of verb, $F(1, 183) = 146.40, p < .001, \eta_p^2 = .44, 95\% \text{ CI } [1.03, 1.44]$: Participants completed the sentence fragments with more negative outcomes when the actor *caused* it ($M = 3.21, SE = .07$) than when the actor *produced* it ($M = 4.44, SE = .07$).

Confirming our actor intent pretests, there was a significant main effect of actor valence, $F(2, 366) = 339.75, p < .001, \eta_p^2 = .65$. Participants completed the sentence fragments with more positive outcomes when the actor was positive ($M = 5.37, SE = .10$) rather than neutral ($M = 4.05, SE = .08$), $t(366) = 10.31, p < .001, r = .47, 95\% \text{ CI } [1.07, 1.58]$. Conversely, they completed the sentence fragments with more negative outcomes when the actor was negative ($M = 2.08, SE = .08$) rather than neutral, $t(366) = 17.24, p < .001, r = .67, 95\% \text{ CI } [1.74, 2.20]$.

As predicted, the strength of the effect of semantic prosody depended upon the ambiguity of the actor's intent, as seen in a significant two way interaction between actor valence and verb, $F(2, 366) = 33.11, p < .001, \eta_p^2 = .15$. We diagnosed this interaction with simple effects of verb at each level of actor valence (Table 7). Consistent with study 1b, semantic prosody had the strongest effect when the actor had ambiguous (neutral) intentions, $F(1, 183) = 193.29, p < .001, r = .72, 95\% \text{ CI } [2.09, 2.79]$, for the simple effect of verb. As shown in the top row of Table 7, when the actor had neutral intentions, *produced* outcomes were substantially more positive than *caused* outcomes.

Table 7. Mean (standard deviation) valence rating by subject valence and verb.

Actor Valence	Example	Verb	
		Produce	Cause
Neutral	Workers	5.3 (1.4)	2.8 (1.8)
Positive	Aid workers	5.6 (1.7)	5.1 (2.2)
Negative	Terrorists	2.4 (1.8)	1.7 (1.2)

Also as predicted, the effects of semantic prosody were significantly attenuated when the actor had unambiguous intentions, independent of whether these intentions were negative, $F(1, 183) = 20.26, p < .001, r = .32, 95\% \text{ CI } [.40, 1.03]$ for the simple effect, or positive, $F(1, 183) = 7.14, p = .008, r = .19, 95\% \text{ CI } [.14, .94]$ for the simple effect. As shown by non-overlapping 95% CIs, the simple effect of verb was significantly stronger when the actor had neutral intentions, 95% CI [2.09, 2.79], than when the actor had negative intentions, 95% CI [.40, 1.03], or positive intentions, 95% CI [.14, .94]. However, even under these unambiguous conditions, *produced* outcomes were significantly more positive than *caused* outcomes (as shown in the second and third row of Table 7). Thus, significant effects of semantic prosody were observed under all conditions and the interaction of actor valence and verb merely reflects an attenuation, but not elimination, of prosody effects when actors' intent is clearly specified. Hence, the influence of semantic prosody is not limited to conditions that provide little other information for evaluative judgments, unless that information clearly specifies the valence of the actual outcome (as in study 1b).

Controlling for perceived intentionality. We also conducted follow-up tests to assess if the simple effect of verb at each level of actor valence persisted even when controlling for perceived intentionality. We conducted three separate 2 (verb: produce, cause) within-subject analyses of covariance, entering two measures of mean-centered perceptions of intentionality (of the *produced* outcome and of the *caused* outcome) as covariates, on participants' ratings of the

valence of their own, self-generated outcomes. In all of these ANCOVAs, the main effect of verb persisted, all $ps < .008$, and the means maintained similar patterns (with *caused* outcomes seeming more negative than *produced* outcomes). Thus, the effect of semantic prosody persisted even when controlling for the perceived intentionality of outcomes.

The obtained results also argue against an intentionality account of the observed differences between the verbs *produce* and *cause*. Because *produce* is more intentional than *cause*, an intentionality account would predict that the previously observed differences reverse when the actor is negative in valence and has negative intentions. That is, according to an intentionality account, *produced* outcomes should be more negative than *caused* outcomes when actors have negative intentions. Empirically, the opposite was observed. Even for negative actors, participants' sentence completions were more positive when the actor *produced* the outcome than when the actor *caused* the outcome. Similarly, the effect of semantic prosody persisted even when controlling for the perceived intentionality of outcomes. Thus, this alternative explanation can be ruled out as accounting for the observed valence differences between *caused* and *produced* outcomes.

Sentiment analysis of outcome valence. We conducted a 3 (actor valence: negative, neutral, positive) x 2 (verb: produce, cause) within-subjects analysis of variance on the valence ratings of outcomes provided by our sentiment analysis⁴. Semantic prosody influenced not only participants' *inferences* about the valence of their outcomes (as seen in the previous section) but also influenced the perceived valence of the outcomes themselves, as evident in a significant main effect of verb, $F(1, 71) = 70.62, p < .001, \eta_p^2 = .49, 95\% \text{ CI } [0.82, 1.34]$: Participants

⁴ Only 72 participants supplied outcomes to all six fragments that were able to be coded by our sentiment analyzer. The remaining 140 participants responded with at least one outcome that contained words which were not normed by Warriner et al. (2013), resulting in missing data.

completed the sentence fragments with more negative outcomes when the actor *caused* it ($M = 4.68, SE = .09$) than when the actor *produced* it ($M = 5.56, SE = .08$).

Also confirming our actor intent pretests, there was a significant main effect of actor valence, $F(2, 142) = 35.92, p < .001, \eta_p^2 = .34$. Participants completed the sentence fragments with more positive outcomes when the actor was positive ($M = 5.83, SE = .12$) rather than neutral ($M = 5.06, SE = .11$), $t(142) = 3.77, p < .001, r = .30, 95\% \text{ CI } [0.29, 0.94]$. Conversely, they completed the sentence fragments with more negative outcomes when the actor was negative ($M = 4.45, SE = .12$) rather than neutral, $t(142) = 5.01, p < .001, r = .39, 95\% \text{ CI } [0.46, 1.07]$.

Mirroring the effects upon participant's ratings of outcome valence, the strength of the effect of semantic prosody depended upon the ambiguity of the actor's intent, as seen in a significant two way interaction between actor valence and verb, $F(2, 142) = 3.29, p = .040, \eta_p^2 = .04$. We diagnosed this interaction with simple effects of verb at each level of actor valence. Consistent with study 1b and participant's ratings, semantic prosody had the strongest effect on outcome sentiment when the actor had ambiguous (neutral) intentions, $F(1, 71) = 56.83, p < .001, r = .67, 95\% \text{ CI } [0.70, 1.20]$, for the simple effect of verb. When the actor had neutral intentions, *produced* outcomes were substantially more positive ($M = 5.74, SE = .12$) than *caused* outcomes ($M = 4.39, SE = .16$).

Also as predicted, the effects of semantic prosody on sentiment were attenuated when the actor had unambiguous intentions, independent of whether these intentions were negative, $F(1, 71) = 12.27, p < .001, r = .38, 95\% \text{ CI } [0.23, 0.85]$ for the simple effect, or positive, $F(1, 71) = 4.90, p = .030, r = .25, 95\% \text{ CI } [0.04, 0.72]$ for the simple effect. Even under these conditions, however, *produced* outcomes were significantly more positive than *caused* outcomes. Thus, not

only does semantic prosody affect the valence of how participants rate their own outcomes, but it also affects the sentiment of how participants complete the sentence fragments. Participants use more negative words when describing *caused* outcomes than *produced* outcomes.

Perceived intentionality. We further assessed whether *produce* carries more intentionality than *cause* by conducting a 3 (actor valence: negative, neutral, positive) x 2 (verb: produce, cause) within subjects analysis of variance on participants' ratings of the intentionality of the outcomes they had generated. As expected, participants perceived the outcomes they generated as more intentional when they were *produced* ($M = 5.85, SE = .08$) than when they were *caused* ($M = 4.66, SE = .09$), $F(1, 183) = 140.04, p < .001, \eta_p^2 = .43, 95\% CI [1.00, 1.39]$.

There also was a significant main effect of actor valence on the intentionality of outcomes, $F(2, 366) = 24.74, p < .001, \eta_p^2 = .12$. Whereas the outcomes attributed to positive actors ($M = 5.53, SE = .10$) or negative actors ($M = 5.45, SE = .10$) did not differ in perceived intentionality, $t(366) = .66, p = .52, 95\% CI [-.33, .16]$, participants perceived less intentionality in the outcomes they attributed to neutral actors ($M = 4.77, SE = .08$), $t(366) = 6.06, p < .001, r = .30, 95\% CI [.46, .90]$. This confirms the effectiveness of our subject intent manipulation -- participants associated the clearly positive and negative actors with higher intentionality than the neutral actors, for whom clear intent information was not available.

The two way interaction between actor valence and verb on outcome intentionality was also significant $F(2, 366) = 19.56, p < .001, \eta_p^2 = .10$. As shown in the second row of Table 8, the simple effect of verb on intentionality was strongest when the actor had neutral intentions, $F(1, 183) = 111.90, p < .001, r = .62, 95\% CI [1.71, 2.49]$. Conversely, the simple effect of verb on intentionality was less strong when the actor had negative intentions, $F(1, 183) = 10.21, p =$

.002, $r = .22$, 95% CI [.21, .88], or positive intentions, $F(1, 183) = 30.11$, $p < .001$, $r = .38$, 95% CI [.60, 1.27].

Table 8. Mean (standard deviation) intentionality rating by subject valence and verb.

Actor Valence	Verb	
	Produce	Cause
Positive	6.0 (1.5)	5.1 (2.1)
Neutral	5.8 (1.6)	3.7 (1.9)
Negative	5.7 (1.6)	5.2 (2.0)

In sum, semantic prosody can affect the valence of expected outcomes of a variety of actors. *Produced* outcomes were always seen as more positive than *caused* outcomes, and this effect was strongest when information was ambiguous. While the effect of semantic prosody was weaker when the actor was unambiguously valenced, *produced* outcomes were still believed to be significantly more positive than *caused* outcomes, ruling out intentionality as an alternative explanation and demonstrating a robust effect of semantic prosody on evaluative expectations. Further, the words used were more negative for *caused* outcomes than *produced* outcomes according to affective word norms.

From evaluations of the outcome to predictions about the actor:

Study 3

Studies 1 and 2 showed how the semantic prosody of action verbs guides the evaluation of outcomes resulting from the actions. In study 3 we test whether semantic prosody effects can extend beyond inferences about outcomes to inferences about the actor. To do so, we presented participants with a sentence about a senator who was described as initiating legislation that either *produced* or *caused* additional work for middle class families. Participants then rated how they thought middle class families felt about the senator’s legislation and estimated the likelihood that the senator would be re-elected. We predicted that semantic prosody would make “additional

work” seem more favorable when the senator *produced* it (for example, as if the senator created more jobs for his constituents) than when the senator *caused* it (for example, as if the senator placed an extra bureaucratic requirement upon his constituents). Accordingly, middle class families should be less in favor of the senator’s legislation when it *caused* (rather than *produced*) additional work, which should affect the perceived likelihood of the senator’s reelection.

Method

Six hundred and one Amazon Mechanical Turk workers (261 female, 2 unspecified; age range 18 – 76) participated in exchange for 10 cents. Because study 2 suggests the effect size is larger than a small effect, sample size was determined to exceed 80% power for a slightly larger than “small” effect size ($d = .25$). In an alleged study of semantics, participants were randomly assigned to read either the *produce* or *cause* version of the sentence, “In his first term, Representative Johnson initiated legislation that produced (caused) additional work for middle class families in his district.” Analyses in COCA (Davies, 2008) indicated that “work” was not a strongly associated collocate of neither *produce* nor *cause*⁵, suggesting that each verb is similarly fluent and frequent in the context of this sentence.

Participants then rated how they thought middle class families felt about Representative Johnson’s legislation (1 = strongly dislike to 7 = strongly like) and estimated the likelihood that Representative Johnson would be re-elected (1 = very unlikely to 7 = very likely).

Results and discussion

As hypothesized, inferences about the senator were in line with the semantic prosody valence associations of the verb. Participants believed middle class families liked the senator’s legislation far less when it *caused* additional work ($M = 3.0, SD = 1.8$) than when it *produced* additional work ($M = 5.3, SD = 1.5$), $t(599) = 16.57, p < .001, r = .56, 95\% CI [2.00, 2.54]$. They

⁵ MI scores of “work” with both *produce* and *cause* were under one.

also believed the senator was less likely to be re-elected when his legislation *caused* ($M = 3.4$, $SD = 1.7$) rather than *produced* additional work ($M = 5.3$, $SD = 1.5$), $t(599) = 14.91$, $p < .001$, $r = .52$, 95% CI [1.66, 2.16]. Thus, not only did semantic prosody affect evaluative inferences about an ambiguous concept (“additional work”), but it also affected participants’ inferences of a related future event – estimates of the likelihood that the senator would be re-elected. Semantic prosody clearly functions as an important predictor of how people interpret the sentence and make related inferences.

A generalized effect of semantic prosody across stimuli

Study 4

In study 4, we sought to build upon the prior studies by illustrating an effect of semantic prosody across many prosodic words. Such results would provide converging evidence for an effect of semantic prosody on judgment. We also extended our stimuli set to investigate the effect of positive semantic prosody. While linguistic research into semantic prosody seems to focus primarily on negative semantic prosody (Louw, 1993; Stubbs, 1995; Partington, 2004; Xiao & McEnery, 2006), words with positive semantic prosody should exist and similarly guide judgment. If frequent co-occurrence with negative contexts causes a word to elicit more negative evaluations in novel contexts, frequent co-occurrence with positive contexts should similarly elicit more positive evaluations in novel contexts as well.

Similar to study 2, participants completed sentence fragments containing semantically prosodic verbs (or matched, non-prosodic synonyms) and then rated the valence of their answers. We tested verbs of both positive and negative semantic prosody. We hypothesized that valence ratings would be in accordance with semantic prosody, such that outcome completions in

response to verbs with positive (negative) prosody would be more positive (negative) than outcome completions in response to their non-prosodic synonyms.

Method

Participants. One hundred workers from MTurk (50 female, age range 19 - 64) participated in the study in exchange for 30 cents each. We deliberately oversampled in order to achieve greater than 80% power for a larger than “small” effect size ($d = .3$) in a within subject design.

Materials and procedure. As in study 2, participants were directed to an online survey on sentence completion and were given eighteen sentence fragments. They were instructed to complete each sentence fragment with the word or phrase they would expect to come next, and were given the example “The circus clown created...” with *balloon animals* given as a possible completion example.

Eighteen sentence fragments contained the nine semantically-prosodic words (five positive, four negative) and the nine matched non-prosodic synonyms from pilot testing (described earlier in this article). Each word in a word pair was presented with the same sentence fragment, once with the semantically prosodic verb, and again with the matched non-prosodic synonym (order randomized). The sentence fragments for the positive prosody verbs (and their matched non-prosodic synonyms) read: kids often attain (get); many countries lack (do not have); the man’s efforts restored (brought back); you can usually count on co-workers to lend (loan); the teacher emphasized (stressed). The sentence fragments for the negative prosody verbs (and their matched non-prosodic synonyms) read: the workers cause (produce); women often encounter (happen upon); the man committed (engaged in); some words arouse (evoke). All

conditions were presented, and item order was randomized. Participants entered their responses into a text box.

After completing the sentence fragments, participants rated the valence of the outcomes they had listed in the textboxes. For each completed sentence, participants were asked “to what extent is your ending to this sentence (*piped text*) a positive or a negative thing?” Piped text displayed the participant’s prior answer within each question. Ratings were made on a seven point scale (1 = very negative, 4 = neutral, 7 = very positive).

Similar to study 2, we also conducted a sentiment analysis of the outcomes that participants listed in the textboxes (see Miner et al., 2012). We matched the words within each outcome to the entries of the word norming database of Warriner et al. (2013), retrieved the corresponding valence rating for each word (1 = negative, 9 = positive), and computed the average valence of the words within each outcome.

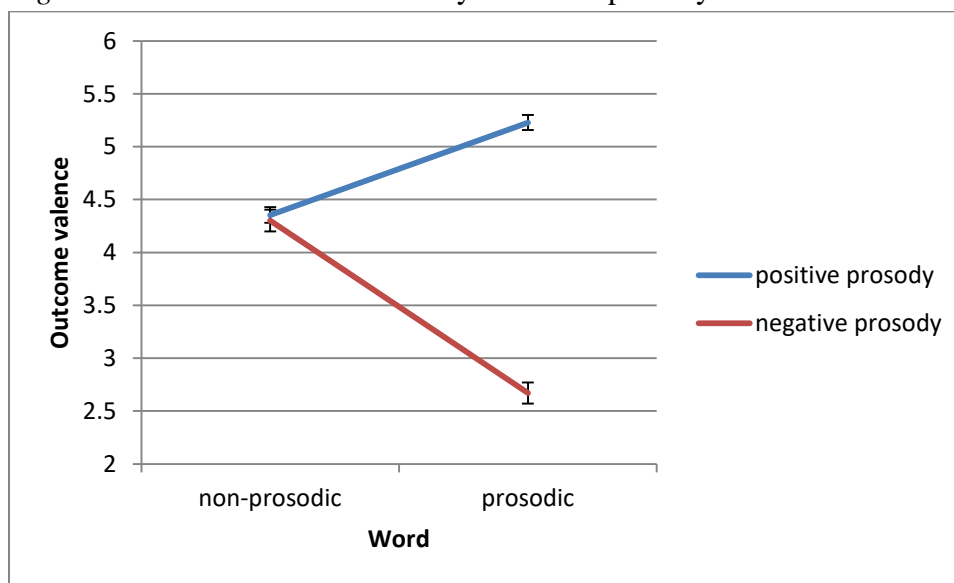
Results

Participant’s valence ratings. We computed each participant’s average valence rating for positive prosodic outcomes (and matched non-prosodic synonyms) and negative prosodic outcomes (and matched non-prosodic synonyms). We then conducted a 2 (word: prosodic, non-prosodic) x 2 (prosody valence: positive, negative) within-subjects analysis of variance on the mean valence of these outcomes.

Recall that we hypothesized that semantic prosody has a general effect on valence inferences, such that outcomes to sentences with positive prosody words should be seen as more positive than those for matched non-prosodic synonyms, and outcomes for sentences containing negative prosody verbs should be seen as more negative than those for non-prosodic synonyms. In line with this hypothesis, there was a significant two way interaction of word and prosody

valence, $F(1, 99) = 291.77, p < .001, \eta_p^2 = .75, 95\% \text{ CI } [1.11, 1.40]$. As displayed in Figure 3, when words had positive semantic prosody, outcomes were seen as being more positive than outcomes for matched non-prosodic synonyms, $t(99) = 11.06, p < .001, r = .74, 95\% \text{ CI } [0.51, 0.73]$ for the simple effect. However, when words had negative semantic prosody, outcomes for prosodic words were seen as being more negative than outcomes for matched non-prosodic synonyms, $t(99) = 13.44, p < .001, r = .80, 95\% \text{ CI } [0.98, 1.32]$ for the simple effect.

Figure 3. Mean outcome valence by word and prosody valence



Note. Bars denote +/- 1 standard error of the mean.

Additionally, we conducted t-tests on the valence of prosodic and non-prosodic words of each pair in order to see if prosody had a consistent effect across all stimuli. Seven out of the nine pairs (attain-get; restore-bring back; lend-loan; emphasize-stress; cause-produce; encounter-happen upon; commit-engage in) showed significant effects of prosody on outcome valence ratings in line with the prosodic valence, $ts > 3.74, ps < .002, rs$ range .30 to .86. However, two pairs (lack-do not have; arouse-evoke) showed no significant effects of prosody, $ts < .40, ps > .691$, although the means of the first pair showed the predicted pattern.

In hindsight, reasons for the two null effects are easily generated and the usual caveats apply. Specifically, *lack*, while having positive semantic prosody, also has inherent negative valence – good things tend to be lacked, but lacking them tends to be unpleasant. This contradiction between semantic prosody and explicit valence may have contributed to the null effects of semantic prosody for this word. As for *arouse*, Ellis and Frey (2009) noted that it was the least common prosodic verb in their materials, only appearing in the corpus 310 times (compared to over 5000 instances of *cause*). Our own analysis of the Corpus of Global Web-Based English (GloWbE; Davies, 2013) also showed that *arouse* was the least common prosodic verb in our stimulus set (2,671 instances of *arouse* as a verb, compared to the next lowest – 12,314 instances of *emphasize* as a verb). The infrequency with which this verb appears in natural language may limit the impact of its semantic prosody – frequent co-occurrence is at the heart of semantic prosody, suggesting that its influence increases with the frequency of the pairing of a prosodic word with a valenced context.

There were additional main effects of less theoretical relevance. Positive prosody valence pairs were seen as being more positive ($M = 4.79$, $SE = .06$) than negative prosody valence pairs ($M = 3.48$, $SE = .08$): $F(1, 99) = 254.52$, $p < .001$, $\eta_p^2 = .72$ for the main effect. Also, prosodic words were seen as being more negative ($M = 3.95$, $SE = .06$) than non-prosodic words ($M = 4.33$, $SE = .08$): $F(1, 99) = 28.01$, $p < .001$, $\eta_p^2 = .22$.

Sentiment analysis of outcomes. We computed the average sentiment of the words appearing in positive prosodic outcomes (and matched non-prosodic synonyms) and negative prosodic outcomes (and matched non-prosodic synonyms). We then conducted a 2 (word:

prosodic, non-prosodic) x 2 (prosody valence: positive, negative) within-subjects analysis of variance on the mean sentiment of these outcomes⁶.

Similar to how participants rated the valence of their outcomes, participants also completed sentence fragments using valenced words in line with semantic prosody found in the fragment, as seen in the significant two way interaction of word and semantic prosody valence, $F(1, 97) = 142.94, p < .001, \eta_p^2 = .60, 95\% \text{ CI } [0.86, 1.20]$. Looking at the simple effect of semantic prosody at each level of valence, when fragments contained words with positive semantic prosody, participants used more positive words in their outcomes ($M = 6.21, SE = .05$) than when the fragments contained matched non-semantically prosodic synonyms ($M = 5.77, SE = .07$): $t(97) = 5.10, p < .001, r = .46, 95\% \text{ CI } [0.19, 0.44]$ for the simple effect. However when fragments contained words with negative semantic prosody, participants used more negative words in their outcomes ($M = 3.79, SE = .11$) than when the fragments contained matched non-semantically prosodic synonyms ($M = 5.41, SE = .11$): $t(97) = 11.65, p < .001, r = .76, 95\% \text{ CI } [0.95, 1.34]$ for the simple effect. Thus, participants not only rated their outcomes in line with semantic prosody, but they also produced outcomes with sentiment that aligns with semantic prosody.

There were additional main effects of less theoretical relevance. Positive valence pairs were seen as being more positive ($M = 5.99, SE = .04$) than negative valence pairs ($M = 4.60, SE = .09$): $F(1, 97) = 193.17, p < .001, \eta_p^2 = .67, 95\% \text{ CI } [1.19, 1.59]$ for the main effect of valence. Also, words that contained semantic prosody were seen as being more negative ($M = 5.00, SE = .06$) than words with no semantic prosody ($M = 5.59, SE = .06$): $F(1, 97) = 57.39, p < .001, \eta_p^2 = .37, 95\% \text{ CI } [0.43, 0.74]$ for the main effect of semantic prosody.

⁶ Two participants responded with outcomes for a cell which contained no words that matched the normed words of Warriner et al. (2013), resulting in missing data. Therefore, we only analyzed the data of the 98 participants who supplied at least one codeable outcome for each cell.

Discussion

In sum, semantic prosody can have a robust effect on judgment. Words with semantic prosody elicited more valenced evaluations of outcomes and more valenced word use in line with their semantic prosody than synonyms with no semantic prosody. This conclusion holds for words with positive as well as negative semantic prosody.

Summary of effects across studies

Table 9 summarizes the size of the effects across our studies. As a proof of concept, the studies consistently demonstrate an effect of semantic prosody on the evaluation of ambiguous outcomes. However, the variability in the effect sizes across studies suggests as of yet unknown moderating conditions.

Table 9. Summary of effect sizes in ambiguous contexts across studies

Study and description	Effect size
1a effect of semantically prosodic verb (cause) on outcome valence	$\varphi = .25$
1b effect of semantically prosodic verb (cause) on outcome valence	$\varphi = .14$
2 effect of semantically prosodic verb (cause) on self-generated outcome valence	$r = .72$
3 effect of semantically prosodic verb (cause) on... outcome valence likelihood estimate	$r = .56$ $r = .53$
4 effect of 5 positive semantically prosodic words on self-generated outcome valence effect of 4 negative semantically prosodic words on self-generated outcome valence	$r = .74$ $r = .80$

Note. Effect size conventions for φ and r are .1 = small, .3 = medium, and .5 = large.

Studies 1a and 1b suggest that semantic prosody has a larger than “small” effect, sometimes approaching a “medium” sized effect, on evaluations of ambiguous medical outcomes. However, Study 3 demonstrated a large effect of semantic prosody on political judgments. We have no empirical evidence for why the effect size increased in this study, although we suspect that within the political domain, specifically with regard to job creation, *cause* and *produce* strongly collocate with negative and positive outcomes, respectively. Future research may fruitfully explore how collocational profiles within different contexts may interact with contextual cues to magnify or curtail the effect of semantic prosody.

Finally, studies 2 and 4 demonstrated very large effects of semantic prosody on the valence of self-generated outcomes. Sentiment analyses in both studies showed that participants generated valenced outcomes in line with the semantic prosody used in the sentence fragment. Thus, this large effect is likely due to outcomes both being completed with valenced words by participants (instead of ambiguous words) and then additionally being interpreted in a semantic prosody-consistent manner, magnifying effects. In either case, these studies show that semantic prosody can exert a potentially profound influence of on the inferred valence of related outcomes.

General Discussion

Can semantic prosody affect evaluative inferences? Our experiments provide a persuasive proof of concept and affirm that semantic prosody can indeed color evaluative judgment. The semantic prosody of the verb *cause* affected evaluative inferences about the described outcome, resulting in more negative assessments of outcomes that are *caused* rather than *produced* (studies 1 to 3). Furthermore, semantic prosody elicited both positive and negative evaluations of

outcomes across a set of different prosodic verbs (study 4). It is also noteworthy that semantic prosody colored judgments across multiple domains, spanning evaluations of health outcomes (studies 1a and 1b), sentence fragment completion (study 2 and study 4), and sociopolitical judgments (study 3). The obtained results provide convergent evidence that typical co-occurrences of a word can generate expectations of valence which then affect evaluative inferences.

Similar to other social cognitive phenomena, semantic prosody most strongly influences evaluative inferences about ambiguous targets. Evaluations of ambiguous outcomes showed stronger prosody effects than evaluations of unambiguous outcomes (Study 1b). Similarly, semantic prosody exerted more influence on impression formation when an actor's intentions were ambiguous or neutral than when they were unambiguously positive or negative (Study 2). This parallels the general observation that accessible knowledge exerts more influence when the target is ambiguous (e.g., Higgins et al., 1977) and/or little other diagnostic information about the target is available (e.g., Bless, Schwarz, & Wänke, 2003). However, unlike other contextual influences on judgment, semantic prosody has escaped the attention of judgment researchers. As the present findings illustrate, semantic prosody is a potentially powerful factor in impression formation, judgment, and decision making that deserves close attention in future research.

Our results also have important implications for the field of semantic prosody. Although semantic prosody has been widely documented in natural language (Louw, 1993; Stubbs, 1995; Partington, 2004), some noted a lack of evidence that the semantic prosody of a word predicts a reader's *interpretation* of valence in novel contexts (cf. Hunston, 2007; Stewart, 2010; Whitsitt, 2005). Our experimental results show that semantic prosody can indeed exert a causal influence on readers' inferences about valence, which are reflected in explicit valence judgments and

related inferences. Moreover, native speakers completed sentence fragments in a manner that makes them consistent with valence patterns of co-occurrence (Study 2 and Study 4). Thus, evidence for a causal influence of semantic prosody is no longer lacking.

Like all research, our studies come with limitations. Most notably, our studies are limited to nine semantically prosodic words, curtailing the generalizability of the conclusions. This limited number of words reflects that there are no definitive lists of semantically prosodic words. One list (Kjellmer, 2005; drawn upon by Ellis & Frey, 2009) catalogs the 20 most positive and 20 most negative verbs according to their collocational context. Unfortunately, nearly half the words on this list are seen as having valence at their core meaning, which rendered them unsuitable for the present studies. For instance, the word “grant” is on the list and is said to be strongly positive, but it inherently means something positive (only things that are wanted are granted). Of the words on Kjellmer’s (2005) list without a valenced core meaning, we utilized 43% in our studies. Our stimuli are often-cited exemplars in the study of semantic prosody (*cause*, Stubbs, 1995, cited 460 times, and *commit*, Partington, 1998, cited 547 times) and are representative of the words studied in the linguistic literature on semantic prosody.

More important, using this limited set of semantically prosodic words we found effects of semantic prosody on wide variety of judgments through multiple methods. Thus, the current studies provide a valuable proof of concept that the semantic prosody of words *can* influence readers’ inferences and evaluative judgments. Hopefully, linguists will continue to refine techniques for extracting semantically prosodic words, resulting in more comprehensive lists that allow for a broader assessment of the impact of semantic prosody on judgment and decision making.

In sum, words that have neither an explicit evaluative meaning nor an evaluative connotation when rated in isolation can nevertheless affect evaluative judgment through their semantic prosody. Words that predominantly occur in negatively (positively) valenced contexts, and hence have semantic prosody, can impose that valence onto a new context. While much remains to be learned about the underlying process, the current studies document the existence of semantic prosody effects and highlight their relevance for research into judgment and decision making.

CHAPTER IV

A model of inferring meaning

Humans seem to effortlessly and efficiently infer the meaning of statements in their native language. However, uncovering the processes that drive meaning interpretation has been neither an effortless nor efficient endeavor for scientists. Many different factors guide the meaning that people take away from statements, all of which theories of language must plausibly and parsimoniously model. Mental lexicon theories of language comprehension suggest that humans possess a mental store from which stable meanings are retrieved (Katz & Fodor, 1963; Fodor, 1975; Jackendoff, 2002; Aitchison, 2012); however, studies showing the situated nature of meaning interpretation suggest that words meanings are not stable and are instead highly sensitive to context (Seidenberg & MacDonald, 2006; Beckner et al., 2009; Elman, 2011; Smith & Semin, 2007; Casasanto & Lupyan, 2015).

The prior three chapters described three different contextual factors that alter the meaning derived from statements. Chapter 2 demonstrated that metaphoric framing of cancer as an enemy suggests to people that limiting risky behaviors is an ineffective prevention strategy. Chapter 3 showed that the incidental experience of heaviness produces the intuition that a book is important, which guides how a book synopsis is interpreted. Finally, Chapter 4 provided evidence that the typical affective context of a word (i.e., its semantic prosody) affects the meaning that people ascribe to it.

A catalogue of factors that affect meaning

Despite their differences, language-focused fields (e.g., cognitive linguistics, psycholinguistics, computational linguistics, lexicography, etc) and situated social cognition can combine to greatly inform our understanding of how people infer the meaning of words and statements. Each perspective identifies critical factors at different levels of analysis that contribute to the process of meaning-making. Linguistics perspectives often focus on how readers resolve ambiguity in determining the meaning of single words by drawing upon attributes of the word (i.e., word-level factors), attributes of the word's immediate context (i.e., sentence-level factors), or attributes of the word's superordinate context (i.e., text-level factors). As language is at the heart of these disciplines, context is most often operationally manipulated via words and grammatical constructions. As such, these perspectives lend considerable insight into how language itself affects meaning interpretation but do not address the question of how situated mental processes that are independent from language affect the process.

On the other hand, research on socially situated cognition investigates how reasoning and judgment are dependent upon situations and contexts. While meaning interpretation is not specifically the focus of this research, situations can activate mental states in a person (reader-level factors) that affect judgment and reasoning by changing the meaning of stimuli. As such, this perspective sheds light on how situations affect meaning interpretation but do not address the question of how language contributes to the process.

Thus, these two perspectives complement each other, and taken together, may provide a more complete picture of how meaning is interpreted. Language-based disciplines show the role of linguistic context while situated social cognition shows the role of situational context. The

following section presents a model that consolidates the processes from various disciplines that contribute to meaning interpretation.

Table 10. Word-level factors on meaning interpretation

Factor	Example finding	Relevant reports
Phonemes	<i>Bouba</i> is interpreted as a round object while a <i>kiki</i> is a sharp object.	Kohler (1947) Maurer, Pathman, & Mondloch (2006) Lupyan & Casasanto (2015) Topolinski, Maschmann, Pecher, & Winkielman (2014)
Highly accessible lexical meaning	<i>Bird</i> is interpreted as a winged flying animal that lays eggs.	Katz & Fodor (1963) Fodor (1975) Jackendoff (2002) Aitchison (2012) Kilgarriff (1997) MacDonald & Seidenberg (2006)
Collocation and semantic prosody	<i>Endocrination</i> is interpreted as being a negative outcome when it preceded by the word <i>caused</i> .	McKoon & Ratcliff (1992) Ellis, Frey, & Jalkanen (2009) Durrant & Doherty (2010) Ellis & Frey (2009) Hauser & Schwarz (2016) Hoey (2005) Landauer & Dumais (1997)

Word-level factors

At the most basic level, aspects of an individual target word to be interpreted can affect what meaning people infer. Table 10 displays such word-level factors in meaning interpretation. Note that words can affect the meaning of statements in multiple ways. First, a word may impose a meaning that is associated with the word itself (e.g., the word *bird* activating thoughts of birds). Second, words may also impose meanings on other words, especially ambiguous other words. For example, the word *changes* can refer to a variety of meanings, but the meaning of prior words, such as *I hate the changes*, can constrain possible meanings for *changes* to things that are evaluatively negative.

Generative theories suggest that words link to context-independent meanings stored in a mental lexicon (Katz & Fodor, 1963; Fodor, 1975; Jackendoff, 2002; Aitchison, 2012). While other theories suggest there is no mental lexicon (Elman, 2011) and no single “stored meaning” (Casasanto & Lupyan, 2015), most language theorists agree that common patterns of word usage point to an often-inferred meaning for many words. As such, words can be expected to cue meanings that are typically associated with their use. These meanings may be more stable for some concepts than others; for instance, words referring to concrete concepts that are seldom utilized in metaphors (e.g. *broom*) may have more stable meanings than words referring to abstract concepts (e.g., *fairness*; Barsalou, 1982; Prinz, 2002). Probabilistic information may also determine what meaning is interpreted, such that readers may infer that a word means what it most often meant in prior encounters with it (MacDonald & Seidenberg, 2006). Regardless, to some extent, words can be presumed to activate a meaning that is derived from the associated meaning from prior encounters with the word, although that meaning may be dependent upon an individual’s unique history of experiences with that word (Kilgarriff, 1997). Classic theories of semiotics may refer to this meaning as the denotative meaning of a word (Lyons, 1977).

However, other factors also create meanings that are seldom seen in or inferred to reside within lexicons. Collocation and semantic prosody create meaning derived from textual co-occurrence of a word with other words in everyday language. Collocation refers to word to word co-occurrence (Firth, 1957): for example, *picture* commonly follows the word *mental* (Durrant & Doherty, 2010). Semantic prosody refers to word to valence context co-occurrence (Sinclair, 1991; Louw, 1993): negative words (*accident*, *alarm*, *concern*) commonly follow the word *cause* (Stubbs, 1995). Some posit that a word’s collocational profile is the primary source of semantic knowledge (Landauer & Dumais, 1997); nevertheless, research suggests that a word’s

collocational profile and semantic prosody are activated upon encountering the word (Hoey, 2005). Significant priming effects occur in lexical decision tasks for collocating word pairs (McKoon & Ratcliff, 1992; Ellis, Frey, & Jalkanen, 2009; Durrant & Doherty, 2010) while significant priming effects also occur in affective priming tasks for positive and negative nouns that follow semantically prosodic verbs (Ellis & Frey, 2009). Additionally, semantic prosody affects the interpretation of affectively-ambiguous words. Participants infer that *endocrination of abdominal lipid tissue* (a fictional medical outcome) and a politician's *changes* are negative when they are *caused* (a verb with negative semantic prosody; Hauser & Schwarz, 2016). Thus, people seem to interpret words by the contexts in which they typically reside, such that collocations and semantic prosody are activated upon encountering a word.

Finally, phonological aspects of words also guide meaning interpretation. Researchers have documented sound-to-meaning correspondences between numerous phonemes and meanings. Both children and adults consistently identify nonsense words containing rounded vowels (*bouba*) as describing round shapes and nonsense words with sharp vowels (*kiki*) as describing sharp shapes (Kohler, 1947; Maurer, Pathman, & Mondloch, 2006). These sound-to-meaning correspondences also affect category learning (Lupyan & Casasanto, 2014). Additionally, mouth muscle movements involved in the production of speech also guide affective associations of nonsense words. Words with mouth articulation movement of front-to-back (*benoka*) are preferred over words with mouth articulation movement of back-to-front (*kenoba*) because front-to-back mouth movement is associated with approach (e.g., eating and swallowing) and back-to-front mouth movement is associated with avoidance (e.g., spitting out; Topolinski, Maschmann, Pecher, & Winkielman, 2014). Thus, even non-word, phonological

aspects that couldn't possibly link to mentally-stored meanings affect the interpreted meaning of statements.

At most basic level of a statement, individual words contribute to meaning in various ways. Phonetic properties of words can convey meaning, but it is important to note that this is less important for understanding how humans infer the meaning of the majority of the statements they encounter, as most statements contain conventional, recognizable words. Words themselves activate meanings, although the meaning that is activated may depend upon a variety of factors (e.g., the concreteness/abstractness of the word, a person's history of meaning inferences for the word, etc). And, the typical context that a word appears in is also activated when that word is encountered. While mental lexicon theories posit stable mental representations that are retrieved when a word is encountered, there is ample evidence at the level of individual words that historical context and sub-word level factors are important for meaning inferences. Furthermore, the upcoming sections illustrate how the context surrounding a given word plays a considerable role in the inferred meaning of that word.

Table 11. Sentence-level factors on meaning interpretation

Factor	Example finding	Relevant reports
Probabilistic aspects of words and constructions	<i>Mandools</i> is interpreted as involving locative action in the sentence <i>it mandools across the ground</i> because the construction frequently uses verbs of locative action.	Seidenberg & MacDonald (1999) MacDonald & Seidenberg (2006) Ellis, O'Donnell, & Romer (2015) Beckner et al. (2009) Hare, Elman, Tabaczynski, & McRae (2009) McRae, Spivey-Knowlton, & Tanenhaus (1998)
Verb aspect	People described with past imperfect verbs (<i>Keith was sipping his coffee</i>) are seen as being more intentional than people described with past perfect verbs (<i>Keith sipped his coffee</i>).	Ferretti, Kutas, & McRae (2007) Kehler, Kertz, Rohde, & Elman (2008) Hart & Albarracin (2011)
Linguistic category	Descriptions of persons that use abstract adjectives (<i>John is helpful</i>) are seen as more informative, and the person's qualities are more enduring, than descriptions that use concrete verbs (<i>John helps</i>).	Semin & Fiedler (1991) Maass, Salvi, Arcuri, & Semin (1989)
Metaphoric framing	Limiting risky behaviors seem less effective at preventing cancer when cancer is metaphorically framed as a hostile enemy.	Hauser & Schwarz (2015a) Landau, Meier, Keefer (2010) Thibodeau & Boroditsky (2011) Morris, Sheldon, Ames, & Young (2007)
Contextual associations between words	<i>Proud</i> is more positive when it describes a person presented in a favorable context (<i>Person X is proud, happy, and intelligent</i>) vs an unfavorable context (<i>Person X is proud, boring, and rude</i>).	Hamilton & Zanna (1974) Zanna & Hamilton, (1977) Clark (1973) Rumelhart (1979) Merrill, Sperber, & McCauley (1981)

Sentence-level factors

While words clearly affect meaning, larger aspects of the sentences that contain these words (e.g., grammar, phrasing, verb tense, semantic context, etc) play an even more critical role

in interpreting the meaning of words. Table 11 displays such sentence-level factors in meaning interpretation. Words seldom appear in isolation but rather occur within a context, and those contexts inform the meaning we make of statements.

Probabilistic aspects of words and constructions play a large role in meaning inferences for a given word. For instance, many verbs can take multiple senses (transitive – *The man collected baseball cards*; intransitive – *The leaves collected in the gutter*) or multiple voices (active – *The cop arrested the man*; passive – *The man arrested by the cop was loitering*). However, the context surrounding these words imposes constraints and guides what meaning is inferred. Because causal agents are likely to act upon objects, *collected* is interpreted in the transitive sense when subject is a causal agent (e.g., *the children collected rocks*). On the other hand, because inanimate concepts are unlikely to act upon objects, *collected* is interpreted in the intransitive sense when the subject is an inanimate object (e.g., *The rainwater collected in the bucket*; Hare, Elman, Tabaczynski, & McRae, 2009). Similarly, *arrested* is interpreted in the active voice when the subject is a likely agent (e.g., *the cop arrested...*) and is interpreted in the passive voice when the subject is a likely object (e.g., *the criminal arrested...*; McRae, Spivey-Knowlton, & Tanenhaus, 1998).

Context can also suggest probabilistic cultural knowledge. In the sentence *The man bought a tie with tiny white diamonds*, readers are likely to infer that tiny white diamonds are a decorative aspect of the tie rather than the means through which the tie was purchased (cf. *The man bought a tie with a check*) because, in most cultures, people are unlikely to exchange rare gems for neckwear (MacDonald & Seidenberg, 2006). Similarly, because of prior cultural experience with what shoppers and lifeguards tend to save, the phrase *the shopper saved* creates

expectations of money while the phrase *the lifeguard saved* creates expectations of people (Bicknell, Elman, Hare, McRae, & Kutas, 2010).

Finally, grammatical constructions can also lend probabilistic information regarding meaning by virtue of their typical use. For instance, in the sentence *It mandools across the ground*, readers are likely to infer that *mandools* is a verb involving some sort of locative action similar to *walk* or *move* because locative action verbs typically occupy the verb spot in the construction (Ellis, O'Donnell, & Romer, 2015). Quite simply, familiarity with language provides probabilistic information about the roles that words play within constructions and sentences, such that the context surrounding a word constrains the probable meanings of that word.

Verb aspect also plays a critical role in what meaning is interpreted from a statement. A past perfect verb implies that an action is completed (e.g., *he ran to the store*), while a past imperfect verb emphasizes the ongoing nature of the action (e.g. *he was running to the store*). These aspects guide what meaning is interpreted from words themselves. Imperfective verbs (e.g., *was skating*) prime thematically-consistent locations (e.g., *arena*) while perfective verbs (e.g., *had skated*) do not (Ferretti, Kutas, & McRae, 2007). Ambiguous pronouns are interpreted as referring to the actor in a previous sentence with an imperfect verb (e.g., *Bob was handing Keith the tool. He [Bob]...*”; Kehler, Kertz, Rohde, & Elman, 2008). And verb aspect of person descriptions also affects the impressions people form of other persons. People described with past imperfect verbs (e.g., *Keith was sipping his coffee*) are seen as being more intentional than people described with past perfect verbs (e.g., *Keith sipped his coffee*; Hart & Albarracin. 2011). The aspect of verbs contextualizes inferences about their likely associations and conveys nuanced information about people.

Similarly, the words used to describe people have marked effects on the inferences we make about those people. Descriptions of persons often call upon many different classes of verbs and adjectives to convey information about the person. Interestingly, these structures convey different information about how enduring and informative attributes of the other person are. For instance, descriptions of persons that use abstract adjectives (e.g., *John is helpful*) are seen as more informative, and the person's qualities are seen as more enduring, than descriptions that use concrete verbs (e.g., *John helps*; for a review, see Semin & Fiedler, 1991). Additionally, the use of these structures is often reflective of stereotypes; people tend to use abstract adjectives to describe desirable in-group members and use concrete verbs to describe undesirable out-group members (Maass, Salvi, Arcuri, & Semin, 1989).

Similar to the effect of thematic associations between words, multiple words can combine to create frames that affect the meaning that is interpreted from a text. Metaphoric framing is one such example. Metaphoric frames structure thinking of abstract target domains in terms of more concrete source domains (Lakoff & Johnson, 1980; Landau, Meier, & Keifer, 2010). For instance, when cancer is metaphorically framed as an enemy, attributes of enemies (the source domain) are brought to bear on thinking about cancer (the target domain). Since limitation is not a common way of fighting enemies, this framing undermines the perceived effectiveness of limiting risky behaviors as a way to prevent cancer (Hauser & Schwarz, 2015a). Other research has shown that metaphorically framing stocks as agents (e.g., *The Dow climbed higher today*) leads participants to infer that price trends will continue (Morris, Sheldon, Ames, & Young, 2007), and metaphorically framing crime as a beast causes participants to infer that punitive measures would be effective (Thibodeau & Boroditsky, 2011).

Simple semantic associations between words can also color words with affective tones. If a word can frequently occur in different contexts with different meanings, then the presence of those contexts can shape the inferred meaning of the word. For instance, people judge a trait adjective such as *proud* as being more positive when it describes a person presented in a favorable context (e.g., *Person X is proud, happy, and intelligent*) rather than a person presented in an unfavorable context (e.g., *Person X is proud, boring, and rude*; Hamilton & Zanna, 1974; Zanna & Hamilton, 1977). Furthermore, different core features (i.e., meanings) for the word *piano* are activating depending on the context; *music* is activated when the context suggests playing it (e.g., *The man played the piano*) while *heaviness* is activated when the context suggests moving it (e.g., *The man moved the piano*; Merrill, Sperber, & McCauley, 1981). Literal and metaphorical meanings are also determined via context (Clark, 1973; Rumelhart, 1979). For instance, the phrase *your car is warm* most likely refers to the temperature of the car, while the phrase *your grandmother is warm* most likely refers to the friendly demeanor of the grandmother. Thus, semantic associations with context words can guide what features of a given word are highlighted.

Humans learn language from exposure to the statements and utterances of others. As these statements place words into context, it seems obvious that the adjacent words and constructions that surround a given word are critical to determining the meaning of that word. Context words and constructions place probabilistic constraints upon the potential meanings of a word. Verb aspect implies information about the nature of an event. Linguistic categories relate information about a person's characteristics. Metaphoric framing brings attributes of unrelated concepts to bear upon target words. And contextual associations between words determine what features of target word are highlighted. While mental lexicon theories posit that words link to

stable stored representations, the ample evidence highlighted here demonstrates how words have wide ranges of meaning, and sentence-level context is critical to selecting the appropriate one.

Table 12. Text-level factors on meaning interpretation

Factor	Example finding	Relevant reports
Text genre	<i>Cause</i> has less negative connotations in scientific reports than in news articles.	Swales (1990) Holmes (1997) Groom (2005)
Text position	<i>Fresh</i> emphasizes novelty of events (rather than resources) when in beginning of news articles.	O'Donnell, Scott, Mahlberg, & Hoey (2012) Hoey & O'Donnell (2015)

Text-level factors

While aspects of the text adjacent to a word can affect its interpretation, features of the entire text in which a word resides can affect what meaning is associated with a word. Table 12 displays such text-level factors in meaning interpretation. Even though there is currently little (but growing) research on such factors, they echo a similar theme from the prior sections – namely, words tend to occur within certain contexts which inform their meaning.

The genre of a text can alter the interpreted meaning of a given word. Genres identify the typical structure and tendencies within a given text. For instance, the introduction section of a research article typically goes from general to specific while vice versa for fiction. Recipes tend to present information within chronological order while technical reports posit problems and solutions (Swales, 1990). A word or phrase may appear with equal frequency in different genres, but have different purposes and collocational profiles within each (Kilgarriff, 1997). These text genre tendencies place words into a context that informs their meaning (Swales, 1990; Holmes, 1997; Groom, 2005). For example, because scientific articles are concerned with cause-effect relationships, the word *cause* might only specify a connection between a construct and an

outcome in this literature. However, because newspaper articles are concerned with informing readers on negative consequences, the word *cause* might have more a more negative connotation in this literature because of its association with predominantly negative outcomes.

New research is also beginning to uncover how the position of a word within a text (i.e., whether it appears near the beginning or end of a text) can constrain the possible meanings of that word. Because texts within a genre all tend to follow a similar thematic pattern from beginning to end (Swales, 1990), the position of a word within the text is important for understanding what meaning that word conveys (Hoey & O'Donnell, 2015). For instance, within newspaper articles the word *fresh* tends to occur in the beginning of the article with a metaphorical meaning predominantly relating to the novelty of an event (e.g., *fresh controversy*, *fresh blow*) rather than referring to the novelty of a food or resource (e.g., *fresh fruit*, *fresh water*; O'Donnell, Scott, Mahlberg, & Hoey, 2012). Thus, the position of a word within a text can have implications for its inferred meaning.

The texts within which words appear have implications for the inferred meanings of words. Because different genres place words in different contexts, words naturally take on different meanings across genres. And because texts within a genre tend to follow a certain thematic pattern from the beginning to the end of a text, the position of the word within a genre-specific text serves a purpose that constrains its meaning. Text-level factors demonstrate another way in which patterns of language use determine how context contributes to meaning.

Table 13. Reader-level factors on meaning interpretation

Factor	Example finding	Relevant reports
Incidental states and mindsets		
Category accessibility	Character who is ambiguously hostile in vignette seems more hostile when hostility is rendered accessible in prior task.	Higgins, Rholes, & Jones (1977) Srull & Wyer (1979)
Sensory states with metaphoric relevance	Supportive information about importance of book is interpreted as being more indicative of importance when book is heavy and participant is thinking elaboratively.	Chandler, Reinhard, & Schwarz (2012) Hauser & Schwarz (2015b) Williams & Bargh (2008) Acerman, Nocera, & Bargh (2009)
Processing fluency	Statements like <i>Osorno is a city in Chile</i> seem more true when perceptually fluent.	Reber & Schwarz (1999) Weaver, Garcia, Schwarz, & Miller (2007) Schwarz, Sanna, Skurnik, & Yoon (2007) Song & Schwarz (2009)
Emotions	Other people seem more responsible for a negative situation when participant is angry while uncontrollable situational forces seem more responsible when participant is sad.	Keltner, Ellsworth, & Edwards (1993)
Conversational norms		
Category labels	When asked how successful they have been in life, respondents report higher success when the scale runs from -5 to +5 rather than from 0 to 10.	Schwarz, Knauper, Hippler, Noelle-Neumann, & Clark (1991) Schwarz, Grayson, & Knauper (1998)
Scale range	When asked how often they felt really annoyed, participants given low-frequency scales recall more high-intensity annoyance experiences than participants given high-frequency scales.	Schwarz, Strack, Muller, & Chassein (1988) Schwarz, Hippler, Deutsch, & Strack (1985)

Prior question context	Participants oppose a fictitious <i>Data Sharing Act</i> when the prior question refers to the government's mass collection of citizens' private emails and browsing history.	Strack, Schwarz, and Wänke (1991) Hauser, Sunderrajan, Natarajan, & Schwarz (2016)
Motivations	Articles in favor of or opposed to capital punishment are less persuasive when they counter participant's pre-existing attitudes	Lord, Ross, & Lepper (1979) Kunda (1990) Boroditsky & Ramscar (2002)
Level of processing	Individuals who think elaboratively (vs heuristically) are more persuaded by strong arguments and more dissuaded by weak arguments	Cacioppo & Petty (1982) Petty & Cacioppo (1986) Bless, Bohner, Schwarz, & Strack (1990)

Reader-level factors

Situated social cognition research often demonstrates how aspects of a person's situation affect his/her judgments and decisions (Smith & Semin, 2004; Smith & Semin, 2007; Schwarz, 1994). Those situational factors often affect judgment by altering the mental representation that is derived from text. Table 13 displays such reader-level factors in meaning interpretation. Note that these factors need not be evoked by aspects of related words and statements; while some of them can be operationally manipulated this way, they can also be manipulated via exposure to unrelated words, statements, and stimuli. Therefore, I label these reader-level factors because they are situational factors that activate mental states in the reader that then contextualizes the meaning interpreted from words and statements.

Incidental states and mindsets. Many states and mindsets that a person holds while reading text are incidental to the words being read. That is, they are not produced by the text and should have no relevance to it or how it is interpreted. However, decades of research have

demonstrated that these states and mindsets actually do affect the mental representations formed from text.

Conceptual accessibility describes the level of activation of a particular concept in a person's mind. Recently activated concepts are more accessible and are on the mind more than non-recently activated concepts. Interestingly, highly accessible concepts guide the inferred meaning of statements that are relevant to the accessible concept. For instance, participants infer that a character who is ambiguously hostile in a vignette is actually more hostile when hostility is rendered accessible in prior unrelated word-stem completion task (Srull & Wyer, 1979). This hallmark social cognition effect has guided decades of research (Bargh, 2006), and importantly demonstrates that what is on the mind affects what we infer.

Sensory states with metaphoric relevance have similar effects on inferences of meaning. Metaphors often link abstract concepts to concrete domains, and some argue that all abstract thought is inherently metaphorical (Lakoff & Johnson, 1980). Recent research has demonstrated that incidental sensory states can activate metaphorically-linked abstract concepts, affecting judgement in a similar manner as conceptual accessibility does (for reviews, see Landau, Meier, & Keifer, 2010; Meier, Schnall, Schwarz, & Bargh, 2012). For instance, as importance is often described as physical heaviness (e.g., *his opinion carries weight*), the physical sensation of heaviness also conveys information about importance. Supportive information about the importance of a book is interpreted as being more indicative of its importance when the book is heavy (Chandler, Reinhard, & Schwarz, 2012) and when participants are thinking elaboratively (Hauser & Schwarz, 2015b). Analogous studies have shown that participants interpret personality profiles to be more friendly when feeling the sensory state of warmth (Williams & Bargh, 2008), participants see an interaction as being more difficult when feeling rough textures

(Ackerman, Nocera, & Bargh, 2009), and participants infer that an employee is more rigid in negotiations when feeling tactile hardness (Ackerman, Nocera, & Bargh, 2009).

Processing fluency also affects the mental representations that are derived from text. Processing fluency refers to the metacognitive ease or difficulty in mental processing that occurs while someone is reading statements and making judgments (Schwarz, 2004). Readers draw upon this feeling of ease or difficulty to make inferences about the meaning conveyed by a statement. For instance, statements like *Osorno is a city in Chile* seem more false when figure-ground contrast makes them difficult to read and perceptually disfluent (Reber & Schwarz, 1999). Recipes also seem more difficult when presented in a difficult-to-read font (Song & Schwarz, 2008) and food additives seem more dangerous when they are difficult to pronounce (Song & Schwarz, 2009). Metacognitive ease or difficulty contextualizes the inferences derived from statements.

Finally, emotions clearly affect how people interpret ambiguous situations and statements. It is commonly assumed that a bad mood may carry over and cause a person to see ambiguous events more negatively (e.g., other drivers may seem more “aggressive”). While research has shown many ways that positive or negative moods may affect judgments (for a review see Schwarz, 2012), incidental emotions themselves also affect how people interpret statements. For instance, participants induced to feel angry see other people as being more responsible for a negative situation in a vignette whereas participants induced to feel sad see uncontrollable situational forces as being more responsible (Keltner, Ellsworth, & Edwards, 1992). Because anger involves appraisals of other-agency and sadness involves appraisals of situational-agency, these emotions direct attention to these respective factors in the vignette, creating different interpreted meanings and prompting these differential attributions of blame.

Conversational norms. In everyday life, conversations follow a cooperation principle (Grice, 1975). Listeners assume that speakers are informative, relevant, and clear, and listeners draw upon contextual aspects of words and statements to make inferences about meaning (for reviews see Clark & Clark, 1977; Schwarz, 1994, 1996). For instance, Grice's maxim of quantity states that people only give as much information as is needed in a conversation and no more (Grice, 1975). In a conversation between two people, one may remark that he lives downtown. In the context of the conversation and Grice's maxims, the listener will likely conclude much from that simple utterance, inferring that the speaker has a residence in the downtown neighborhood of the current city in which they are having a conversation. This maxim allows context to contribute much to the meaning of statements.

While these norms are most applicable to conversations, they have been extensively studied in the context of survey design. These same conversational norms are brought to research settings, as research participants consider all elements of written materials to be relevant to their task. These elements include formal features of questionnaire design, from scale format to graphics and question wording. As a result, many technical aspects of questionnaires become a source of information that respondents systematically use to make sense of what is asked of them (for reviews, see Conrad, Schober, & Schwarz, 2014; Schwarz, 1994, 1996).

One such effect demonstrates that category labels change the meaning inferred from the response options for a question. When asked how successful they have been in life, respondents report higher success when the 11-point scale runs from -5 (not at all successful) to +5 (extremely successful) rather than from 0 (not at all successful) to 10 (extremely successful). In the bipolar -5 to +5 format, participants infer that ratings from -5 to -1, the lower half of the scale, correspond to the presence of life failures while the unipolar 0 to 10 format covers only

differential degrees of success (Schwarz, Knauper, Hippler, Noelle-Neumann, & Clark, 1991).

These different scale labels convey different meanings, and because life failures are less common than a lack of success, these scale labels produce different responses.

Another Gricean effect demonstrates that scale ranges also convey information about the intended meaning of ambiguous concepts within questions. Participants asked how often they felt “really annoyed” must determine what type of annoying events the researcher is interested in: major events that happen rarely (e.g., a loss of income) or minor events that happen daily (e.g., traffic on one’s commute)? Participants draw upon scale ranges for clarification. When given low frequency scales ranging from *several times a year* to *less than once every 3 months*, participants interpret the question as asking about major, rare annoying events and recall more annoying events compared to those given high frequency scales ranging from *several times a day* to *less than once a week* (Schwarz et al., 1988). Scale ranges provide context that guide the interpreted meaning of questions.

Finally, in line with Grice’s maxim of relevance, participants also draw upon prior questions to infer the meaning of ambiguous questions (Strack, Schwarz, and Wänke, 1991). In a recent study, participants were more likely to oppose a fictitious Data Sharing Act when the prior question referred to the government’s mass collection of citizens’ private emails and browsing history rather than when the prior question referred to Google’s decision to grant users control over their personal data (Hauser, Sunderrajan, Natarajan, & Schwarz, 2016). Participants assume that researchers are asking questions that logically cohere, drawing upon the prior question to interpret the meaning of the Data Sharing Act and associating it with a negative meaning in one case and a positive meaning in another.

Motivations. A person's motivations and goals can alter the meaning he/she interprets from a statement. Motivations drive a person to achieve a desired end state and are often used to explain the reasoning behind a person's behavior (Ryan & Deci, 2000). However, reasoning can also be motivated and biased in order to achieve desired conclusions. A person's motivations can direct processing of information in ways that alter the meaning that is interpreted. For instance, Lord, Ross, and Lepper (1979) asked participants who were either for or against the death penalty to read articles that were in favor of or opposed to capital punishment. Participants found articles less persuasive when they ran counter to their pre-existing attitude toward the death penalty. Other studies have documented numerous domains where desired outcomes motivate people to reach different meanings from reading the same text (for a review, see Kunda, 1990).

Progress towards goals can also affect what meaning is interpreted. The phrase *next Wednesday's event has been rescheduled and moved forward two days* can be interpreted in two ways. One interpretation assumes that individuals move forward toward the future, which suggests the event moves forward into the future to Friday. Another interpretation assumes that future events come toward the person in the present, which suggests that the future event moves forward toward the present to Monday (Boroditsky, 2000). People's progress toward their goals affects what they interpret "forward" to mean. People who have moved forward to their goal by almost reaching the end of a long lunch line are more likely to respond Friday to the rescheduling question than people who are at the back of the lunch line (Boroditsky & Ramscar, Study 2, 2002). Additionally, people with travel goals who had either just arrived or were about to depart from an airport are more likely to respond Friday than people with receiving goals who were waiting to pick up passengers (Boroditsky & Ramscar, Study 3, 2002). Thus, goals and motivations can change how you interpret the meaning of words and statements.

Processing style. The processing style that a person uses to engage with a text can affect what meaning is interpreted. Research has examined dual process models for how less processing (heuristic, peripheral, type 1) vs more processing (elaborative, central, type 2) can alter the conclusions that people draw from messages (Petty & Cacioppo, 1986; Chaiken, 1987; Kahneman, 2011). In general, individuals who think elaboratively (vs heuristically) are more persuaded by strong arguments and more dissuaded by weak arguments (Petty & Cacioppo, 1986). Importantly, many different variables can influence what kind of processing a person will adopt. Some people tend to enjoy thinking elaboratively while others don't (Cacioppo & Petty, 1982). Personally-involving issues tend to evoke more elaborative thinking (Petty & Cacioppo, 1979). Negative moods tend to evoke more elaborative processing of messages (Bless, Bohner, Schwarz, & Strack, 1990). Regardless of the source of processing style, people who think elaboratively often draw different meanings about text information than people who think heuristically.

Summary. Some models of language comprehension posit that words produce mental states in the reader which then constrain the mental states that future words can produce in a recurrent loop (Elman, 2004; 2011). Theories of situated social cognition posit similar dynamic relations between mental states and stimuli. The mind is adapted to respond to situations and environments, and as such, cognitive processes are more situation-specific than previously acknowledged (Smith & Semin, 2004; 2007). As such, situations can prompt mental processes (reader-level factors) which alter the way in which stimuli (including words) are interpreted. States and mindsets that are tangential to a given text can nonetheless impact how it is interpreted. Conversational norms cause comprehenders to infer more information than a given statement provides. Motivations can change what information people focus on in statements and

affect the meaning they infer from them. And the processing style that a person reads a statement with can change the conclusions they draw from it. These reader-level factors affect the meaning of words and the conclusions of statements, and they are products of situated social cognition. Because the mind is adapted to respond to situations, contextual information that may not be relevant to the text itself has the capacity to alter a person's mental processes, which affects the meaning that they interpret from statements.

Implications of the model

The combination of literatures showing contextually-sensitive meaning bears strongly upon the debate of how humans infer the meaning of words and statements. While many share the assumption that word meaning is stored in a mental lexicon and retrieved when a word is encountered (Katz & Fodor, 1963; Fodor, 1975; Aitchison, 2012), the above model catalogs ample evidence from both language comprehension and socially-situated judgments that contextual information affects the mental representations that are derived from reading statements. Mental lexicon theories are limited by their premise that the full range of contextually-sensitive meanings of words would reside within the information store (for a review, see Elman, 2011). For such a theory to be true, additional qualifications would need to be made to determine how the growing list of contextual factors could be contained and modeled within the lexicon and have sensitivity to online context. While this is of course possible and such models have been proposed (e.g., Jackendoff, 2002), these revised theories would require that mental lexicons contain much more information than is traditionally assumed to reside in a mental lexicon – collocations, verb aspect, sensory states, and conversational norms would all need to be elements contained within our mental dictionary's representation of a single word's range of contextually-sensitive meanings. A more parsimonious theory would be one that

includes context-sensitivity as a focal feature of language rather than as a nuisance deserving qualification, such as the dynamic systems models of language comprehension (for overviews of such models, see Elman, 2004; Elman, 2011). Such models suggest that words act as stimuli that activate mental associations rather than acting as cues for memory retrieval. These mental associations which comprise meaning-making are constrained by prior context and are updated as more stimuli are encountered. In essence, words may not act as direct references to meaning, but rather, they may act as clues to meaning (Rumelhart, 1979). The situation has as much power to determine the meaning of a statement as the words used to comprise the statement itself. Similar to the idea that attitudes may be constructed ad hoc (Schwarz, 2007), conceptual meaning may also be something that is constructed by the reader in response to words, contexts, and transient mental states (for a review, see Casasanto & Lupyan, 2015).

Altogether, the model proposes a conceptual framework demonstrating that the human mind is highly sensitive to context and situations. In contrast to nativist theories of language acquisition (Chomsky, 1957; 1965; 1988; Pinker, 2007), many of the factors suggest that language acquisition is not entirely inborn but instead involves learning and mapping words and phrases to contexts and situations. Words and constructions are learned by seeing the contexts in which they reside and knowing the circumstances of their use (Hoey, 2005, Ellis et al., 2015; Beckner et al., 2009). Understanding a word's meaning involves comprehending the whole range of meanings of that word given the constraints of contextual words (Seidenberg & MacDonald, 1999; MacDonald & Seidenberg, 2006) and situations (Swales, 1990) and knowing the constraints that the word imposes upon other words as well. Therefore, it is no surprise that newer models of language comprehension eschew the assumption that word meanings are retrieved from a static dictionary but instead endorse the assumption that words activate mental

states which are informed by context and which constrain the action of upcoming words (Elman 2004; 2011). These factors show that situational information is at the heart of language, as it founds the basis of word learning and constrains the possible meanings of words in language comprehension.

The model also incorporates situational factors outside of language that demonstrate the contextually-sensitive nature of human reasoning. Motivations, goals, emotions, accessible concepts, norms, processing style – all of these factors influence reasoning by tuning it to the situations and considerations which are relevant for a person in a given situation. These same constructs also influence the interpretation of meaning as it is ultimately another phenomenon which calls upon reasoning, especially when disambiguating ambiguous words. In sum, reasoning is not dependent upon static abstract processes but rather is highly sensitive to context and situations. Language and reasoning share a sensitivity to context that suggest it is a fundamental aspect of the human conceptual system and human functioning.

Interestingly, this emphasis on the context-sensitivity of reasoning is actually somewhat radical within social cognition, a field that is more cognitive than social (Zajonc, 1980). Many studies in the field assume that words and stimuli have a static meaning which all participants have access to. However, this overlooks the complex interdependencies between context and language. Social psychology is rife with studies where people make different judgments on the basis of the same information. Participants may have pre-existing attitudes that change their judgments or a problem may be framed in a way that guides judgment in a certain direction. Sometimes, these effects are framed as people paying attention to the “wrong” information or displaying some sort of non-optimal bias in their judgment. But these interpretations fail to appreciate that words and statements take on different meanings because of their

interdependence with contextual features of the situation and the reader. In these situations, people may not be making different judgments on the basis of the same information because these contextual features create different meanings. A person opposed to capital punishment may take away a different meaning from a news article on the subject because of his beliefs. People may be risk-seeking under loss framing because such a framing conveys only information about losses, which people are motivated to avoid. Reasoning is attuned to context when interpreting the meaning of information. Therefore, context may not only factor in at later stages when people are making their judgment. Instead, it may also play a role earlier in an earlier process of judgment, when people are making sense of the information presented to them. Akin to motivated perception (Balcatis, 2016), these processes may produce different judgments not because they change what people see as being important to the judgment, but instead because they fundamentally change what people see.

The model also has implications for common methodologies in social psychology. Many text-processing applications operate on the basis that words have a static, stable meaning. These programs exist for the purpose of summarizing properties of free text responses (such as LIWC – Pennebaker, Boyd, Jordan, & Blackburn, 2015; and sentiment analyses & opinion mining – Pang & Lee, 2008). Many of these applications work by extracting individual words from free-response text and linking them to the words’ rating of interest. For instance, if a text contains the word “angry,” then an application may add a tally to the “negative affect” score for the text because the word is assumed to express some level of negativity. Many different word-norming dictionaries have been built for this purpose of documenting the underlying position of these words on many different dimensions, including affect (Mohammad & Turney, 2013; Warriner, Kuperman, & Brysbaert, 2013; Bradley & Lang, 1999; Tausczik & Pennebaker, 2010), arousal

(Warriner, Kuperman, & Brysbaert, 2013), concreteness (Brysbaert, Warriner, Kuperman, & 2014), dominance (Warriner, Kuperman, & Brysbaert, 2013), and many other dimensions (for the most recent dictionaries of LIWC, see Pennebaker, Boyd, Jordan, & Blackburn, 2015). However, the now obvious issue for these word-norming dictionaries is that they rely upon the flawed assumption that these words have a static meaning that is shared among all language users. Furthermore, by only assessing the dimensions of individual words, these processes fail to model the complex interdependences between words within texts (such as verb aspect, collocation, and semantic prosody). Finally, these tools fail to account for the situation; LIWC would likely classify the writer of the Wikipedia article on anger management as being extremely high in negative affect simply because of the presence of anger-related words. As we know that context and situations are crucial elements of meaning, these tools may not be reliable indices of measuring these attributes.

Additionally, the observation that word meaning is context-sensitive has important implications for the current replication movement in psychology. Many researchers, concerned over the reproducibility of the psychology studies, have conducted large-scale efforts to conduct replications of prior studies (Open Science Collaboration, 2015, but also see Gilbert, King, Pettigrew, & Wilson, 2016). In these replications, researchers attempt mirror the procedures, materials, and stimuli of the original studies in order to see how robust they are. However, these replication efforts often fail to account for the context-sensitivity of words and statements, introducing confounding factors to the design that makes drawing conclusions about the reproducibility of such results meaningless. For instance, Doyen, Klein, Pichon, and Cleeremans (2012) famously failed to replicate the results a study by Bargh, Chen, and Burrows (1996) which showed that American undergraduates walked slower down a hallway after exposure to

elderly-related prime words. However, stereotypes of the elderly are different (for example, less frequent) in today's English discourse than in the English discourse of participants from 1991, suggesting that associations between elderly-related adjectives and slow walking speed are likely less strong. Furthermore, the Doyen et al (2012) replication was conducted using elderly-related French adjectives, which are far less frequent in French than in English, on French undergraduates, who have fundamentally different stereotypes of elderly people (Ramscar, 2015). Quite simply, replication efforts often fail to account for how the meaning of words changes over time and across situations. Words become more or less frequent or appear in different contexts over time, giving them different meaning associations. Therefore, modern replications that utilize even the exact materials of the original study may fail to produce the same interpreted meaning due to the contextually-sensitive nature of word meaning.

Conclusion

On the whole the evidence provided shows how human reasoning is highly sensitive to context and tuned to situations. Inferring the meaning of words draws upon a large number of contextual cues operating at various levels of analysis (word-level, sentence-level, text-level, and reader-level). Word meanings can change drastically from one context to the next; predominant meanings in one context can be infrequent in another and vice versa. Humans must have a contextually-sensitive cognitive system to be able to execute this one faculty that is uniquely human: production and comprehension of complex language. This same context-sensitivity is also a feature of situated social cognition, tuning cognitive processes to the affordances and constraints of the situation. Context, which it is linguistic or social, provides and constrains, and our adaptive cognitive system adjusts reasoning to account for it.

Appendix

Table A1. Word statistics for semantically prosodic words in Chapter IV.

	attain	get
Most frequent right noun collocates within 4 (Davies, 2008)	goals, status, goal, level, degree, levels, objectives, power, success, knowledge	people, job, lot, money, way, car, attention, things, time, chance
Orthographic neighbors	0	14
Frequency as verbs (COCA, Davies, 2008)	5,743 (12 per mil)	1,317,745 (2,837 per mil)
Mean coded definition valence	2.0	2.0
Mean sentiment analysis definition valence	6.0	6.0
Synonymy agreement with paired word	95%	85%
	lack	not have
Most frequent right noun collocates within 4 (Davies, 2008)	skills, power, resources, knowledge, experience, ability, confidence, support, sense	time, access, money, power, right, effect, resources, information, opportunity
Orthographic neighbors	12	16 (not), 12 (have)
Frequency as verbs (COCA, Davies, 2008)	24,086 (52 per mil)	45,012 (97 per mil)
Mean coded definition valence	1.9	2.0

Mean sentiment analysis definition valence	5.7	5.6
Synonymy agreement with paired word	95%	100%

	restore	bring back
Most frequent right noun collocates within 4 (Davies, 2008)	order, confidence, balance, power, health, faith, sense, democracy, government, peace	memories, panel, life, boil, food, samples, days, people, sense, species
Orthographic neighbors	0	3 (bring), 9 (back)
Frequency as verbs (COCA, Davies, 2008)	16,407 (35 per mil)	2,143 (5 per mil)
Mean coded definition valence	2.3	2.2
Mean sentiment analysis definition valence	5.2	5.5
Synonymy agreement with paired word	100%	100%

	lend	loan
Most frequent right noun collocates within 4 (Davies, 2008)	money, support, hand, credence, credibility, name, air, legitimacy, institutions, voice	money, \$, campaign, dollars, car, government, company, copy, books, businesses
Orthographic neighbors	10	6
Frequency as verbs (COCA, Davies, 2008)	10,271 (22 per mil)	1,210 (3 per mil)
Mean coded definition valence	2.0	2.0
Mean sentiment analysis definition valence	6.3	6.1

Synonymy agreement with paired word	100%	100%
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	emphasize	stress
Most frequent right noun collocates within 4 (Davies, 2008)	importance, need, role, point, nature, aspects, education, development, fact, skills	importance, need, role, point, fact, education, students, nature, people, work
Orthographic neighbors	0	0
Frequency as verbs (COCA, Davies, 2008)	24,179 (52 per mil)	13,752 (30 per mil)
Mean coded definition valence	2.0	1.9
Mean sentiment analysis definition valence	5.9	5.5
Synonymy agreement with paired word	95%	95%

	cause	produce
Most frequent right noun collocates within 4 (Davies, 2008)	death, problems, damage, pain, cancer, trouble, concern, disease, effect, harm	results, effects, images, produces, electricity, goods, weapons, tons, amounts, films
Orthographic neighbors	1	1
Frequency as verbs (COCA, Davies, 2008)	24,282 (52 per mil)	32,021 (69 per mil)
Mean coded definition valence	1.9	2.0
Mean sentiment analysis definition valence	5.4	5.8
Synonymy agreement with paired word	90%	100%

	encounter	happen upon
Most frequent right noun collocates within 4 (Davies, 2008)	problems, resistance, people, difficulties, problem, life, opposition, students, world, day	situation, house, campsite, work, woman, winter, wings, wife, view, trail
Orthographic neighbors	0	0
Frequency as verbs (COCA, Davies, 2008)	15,983 (34 per mil)	85 (0.2 per mil)
Mean coded definition valence	2.0	2.0
Mean sentiment analysis definition valence	5.8	5.6
Synonymy agreement with paired word	80%	95%

	commit	engage in
Most frequent right noun collocates within 4 (Davies, 2008)	suicide, crime, crimes, murder, acts, act, troops, murders, perjury, people	activities, behavior, activity, behaviors, sex, dialogue, kind, conversation, practices, process
Orthographic neighbors	1	0 (engage), 6 (in)
Frequency as verbs (COCA, Davies, 2008)	34,721 (74 per mil)	9,755 (21 per mil)
Mean coded definition valence	2.0	2.0
Mean sentiment analysis definition valence	5.8	5.4
Synonymy agreement with paired word	95%	85%

	arouse	evoke
Most frequent right noun collocates within 4 (Davies, 2008)	suspicion, interest, curiosity, suspicions, feelings, ire, emotions, concern, attention, people	memories, images, sense, response, image, feelings, feeling, responses, emotions, world
Orthographic neighbors	1	0
Frequency as verbs (COCA, Davies, 2008)	3,099 (7 per mil)	6,148 (13 per mil)
Mean coded definition valence	2.2	2.0
Mean sentiment analysis definition valence	6.0	5.8
Synonymy agreement with paired word	95%	100%

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