

THE TIME COURSE OF DISCOURSE PRIMING IN THE INTERPRETATION OF
CONCEPTUAL COMBINATIONS

A Thesis

by

RANDY EARL SAPPINGTON

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

August 2005

Major Subject: Psychology

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ABSTRACT

The Time Course of Discourse Priming in the Interpretation of Conceptual
Combinations. (August 2005)

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Chair of Advisory Committee: Dr. Heather Bortfeld

People often create novel lexical expressions to efficiently communicate their thoughts to others. Noun-noun phrases, also known as conceptual combinations, serve as an example of these novel expressions. Most of the research on conceptual combination has focused on structural features of the phrases. However, other research has demonstrated that discourse context can also influence how these phrases are interpreted. Across two experiments, we demonstrate that discourse context has a greater influence on how people interpret these combinations than does a structural level manipulation. We also examine the strength of this contextually based-effect over a series of time delays. The findings from this study indicate that, while structural features of a given conceptual combination influence how that combination is interpreted, the discourse surrounding the novel combination plays a more influential role in the resulting interpretation. The influence of context is more pronounced than has been suggested in much of the research on conceptual combination.

DEDICATION

I dedicate this work to my grandmother, Vera Mae Sappington (1923 – 2000), who always encouraged me in my academic pursuits.

ACKNOWLEDGEMENTS

There are several people who I would like to thank for their efforts in developing this thesis. First, I am in debt to my committee chair, Dr. Heather Bortfeld for her recommendations and revisions to this work. I would also like to thank my committee members, Dr. Steve Smith and Dr. Shari Kendall for their comments and revisions during the writing of this thesis. Lastly, for their countless hours of running experiments and coding data, I would like to thank my directed individual study students (485s) Melissa Bonar, Kelly Carrier, Debby Hargett, Carley McAnally, Andrew Snyder, Scott Ungaro, and Ambree Vickers.

Some rise, some fall, some climb to get to Terrapin...

– Robert Hunter

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INTRODUCTION

Well, if crime fighters fight crime and fire fighters fight fire, what do freedom fighters fight? (Carlin, 1990)

Language users often take advantage of lexical shortcuts to express a complex message more efficiently. George Carlin's comedic observation illustrates the flexible nature of these shortcuts in figurative language. In the first two examples he provides, the *fighter* is battling *against* the concept used to describe what kind of fighter the person is (e.g. a fire fighter is a person who fights fires), but the third phrase, *freedom fighters*, describes fighters who are fighting *for* freedom rather than a person fighting *against* freedom. Just as people are able to easily produce these creative lexical shortcuts to express a nuanced concept, they are also capable of quick and efficient interpretations of these phrases. Researchers have offered several explanations for how people are able to form and interpret these novel phrases with ease, including how these phrases develop (Bowdle & Gentner, 2005), how structure guides their interpretation (Murphy, 1996, 1997), and how discourse context helps decode them (Chaffin, 1997; Cook & Myers, 2003).

Discourse context, the expositional phrases surrounding an unfamiliar term, has been identified as an important factor in how people disambiguate many creative forms of language. Indeed, there is ample evidence of the influence of discourse context on language comprehension in other domains.

This thesis follows the style of *Experimental Psychology*.

In the case of narratives, discourse context can affect the comprehension of a word by facilitating lexical access itself or by facilitating integration of the concept introduced by that word with the preceding text. Techniques such as eye-tracking and event-related potentials are allowing increasingly fine-grained analysis of the time course of language comprehension. What is becoming clear from this research is that contextual information is influential early in the processing of spoken and written language, and that discourse acts as a lens to focus comprehension on one specific sense rather than leave readers and listeners blind to the meaning the speaker or writer wishes to express. For example, a recent study demonstrated that semantic structure and surrounding context were equally important in the comprehension of focal concepts in narrative discourse (Cook & Myers, 2003). These researchers found that if prior context supported an interpretation of a concept that would normally be considered inappropriate, the semantic *appropriateness effect* was overridden by the contextual information. In another study (Myers, Cook, Kambe, Mason, & O'Brien, 2000), in which both the semantic and episodic availability of information necessary for comprehending a sentence was manipulated, normally strong semantic effects could be eliminated entirely when information useful to comprehension was highly elaborated several sentences earlier in the text. Such elaboration is detailed and episodic in nature; it is not comparable to the semantic associations elicited by a single word.

The influential effect of discourse context has also been recognized by researchers interested in how people assign meaning to novel words. For example, Chaffin (1997) suggests that people are aware of the context in which a target word appears, but how they use this context depends on how familiar they are with the word. When people in this study saw a familiar word in context, they tended to use an event-based strategy to define the target word, in which they chose a definition that was consistent with the context. However, when participants were given a low-familiarity or novel word, participants only used the definition of the word rather than using the surrounding context to refine a definition. In another study, people spent more time reading a discourse that was informative about a novel word than a discourse that used familiar words (Chafin, Morris, and Seely, 2001). While supporting the argument that people use the surrounding context to derive the meaning of a novel word, this finding also suggests that people might use two separate processes depending on whether the discourse contains novel or familiar words.

The effect of discourse context on language comprehension has recently been added to the rapidly-expanding volume of research using fMRI (Xu, Kemeny, Park, Frattali, & Braun, 2005). In this study, participants were presented with single words, sentences, and narrative passages adapted from Aesop's fables. Results provide evidence that while the presentation of a single word activates perisylvian cortices, areas of the cerebral cortex typically activated in language processing, more complex, narrative-like stimuli not only

increased the blood oxygenation levels in those perisylvian regions, but also activated areas of the brain not normally associated with language processing, including subcortical regions such as the hippocampus and the amygdala. Additionally, right hemisphere activation, usually associated with cognitive processes such as inference making and conceptual association was most robust during presentation of the discourse-like stimuli. This finding suggests an important difference between the brain activity necessary to make sense of a single word and that necessary to work through words linked together as a meaningful whole. This difference highlights the importance of discourse context in evoking emergent properties of figurative language – properties that would not normally be associated with a term in the absence of such context.

While there is evidence for a difference between how the brain processes different levels of lexical complexity (e.g. single words, sentences, and narratives), what is less well understood is how other important factors such as word order, word similarity, and other semantic aspects of language interact with higher level narrative features. Discourse is just one of many factors examined in research concerning the production and comprehension of figurative language. Bortfeld & McGlone (2001) argued that while the linguistic structure of the figurative phrase has some bearing on its interpretation, this interpretation varies enormously from context to context. Some researchers have suggested that phrases have “careers” (Bowdle & Gentner, 2005), a notion intended to characterize how the meanings associated with novel phrases develop over

time. This focus on the development of metaphors suggests that when people are given a novel metaphor (e.g. a mind is a kitchen), they process the metaphor as a simile, which compares the base term to the target term, but as a novel metaphor becomes more conventionalized through repeated use (e.g. a soldier is a pawn), people form a semantic relationship between the base term and the target term of the metaphor which leads to categorization of the base term as a member of the same category to which the target term belongs. Other research suggests that the metaphorical knowledge developed through prior experience (Gibbs, 1992), the conceptual similarity between the component concepts of the figurative phrase (Murphy, 1996, 1997), and salient or familiar uses of a figurative phrase (Giora, 1997, 2002) can all affect a person's comprehension of that phrase. In addition to the difficulty associated with determining which factors are important in figurative language comprehension, some of the words in figurative phrases (e.g. idioms) may not have a literal connection to the meaning they wish to express. An example of this is the idiomatic phrase *kick the bucket*. Through experience, English speakers know that this phrase is an idiomatic reference to the act of dying, yet none of the words in the phrase are literally semantically associated with death. Other phrases make more transparent relationships to the figurative meanings (e.g. the idiomatic phrase *easy as pie* compares the ease of a task to the ease of eating a piece of pie). Gibbs and Nayak (1989) demonstrated that some idioms are flexible such that a change in syntax does not affect the interpretation of the target figurative phrase,

but others, such as *kick the bucket*, do not tolerate such syntactic manipulations. These sources of variability in figurative language highlight the difficulty inherent in studying anything but the most literal language.

While noun-noun combinations are a form of figurative language that is not as complex as most other forms of figurative language, the study of these combinations is similarly fraught with difficulty. By studying these noun-noun pairs or *conceptual combinations*, researchers can exert a level of experimental control that more complex figurative phrases, such as metaphors and idioms, make much more difficult. Like other forms of figurative language, conceptual combinations can be lexicalized (e.g. *student evaluation*) and novel (e.g. *paper equipment*). Furthermore, among novel combinations, some phrases can be quite literal in their intended interpretation (e.g. the term *onion tears* describes the tears one cries when they cut an onion) while others might require contextual experience for a clear interpretation (e.g. a *festival town* could be a town that holds a festival or a town that is formed by a festival patrons). A good example of a recently lexicalized conceptual combination is the term *soccer mom*. Over time and through use, the term *soccer mom* has come to refer to a mother who transports her children to and from soccer practice via some large vehicle such as a station wagon, a minivan, or a sports utility vehicle. One would have difficulty deriving the interpretation of *soccer mom* from the knowledge base associated with the words *soccer* or *mom*. This is because other inferences are also drawn from the expression that would not normally be attributed to either of

the two constituent words. For example, a *soccer mom*'s willingness to transport her children to and from soccer games (e.g. an event that promotes physical fitness) suggests that this is a person who is invested in the welfare and development of her children. Her ownership of a large vehicle suggests a certain socioeconomic status. Many additional attributes are called to mind through the use of this term based on cultural knowledge or membership. These inferences are the result of people's knowledge of what *soccer* and *mom* are, as well as the culturally-based semantic knowledge of properties associated with each of these terms in combination. The term *soccer mom* and its current conventional interpretation are a good example of how emergent properties not associated with either constituent word in the pair have become associated with the words in combination.

A growing body of research has focused on how people interpret conceptual combinations, focusing specifically on the structural aspects of the combinations (e.g. Wilkenfeld & Ward, 2001, Estes, 2003, Gagné & Shoben, 2002, Wisniewski, 1996, Wisniewski & Love, 1998). This work has isolated several characteristics that appear to determine how people generally interpret a conceptual combination, given no additional contextual biases. These include such structural characteristics as the order of the words in the combination (Gagné, 2000), the similarity of the two concepts (Wilkenfeld & Ward, 2001), and the spatial alignment of the constituent concepts in relation to one another (Wisniewski & Middleton, 2002). While such structural issues have dominated

much of the research on these phrases, there is a growing body of data indicating the overriding influence of the surrounding context on interpretations of these expressions (Gerrig & Murphy, 1992, Gerrig & Bortfeld, 1999; Gagné & Spalding, 2004). However, these studies have not investigated the interaction of the structural features of the phrases with the surrounding discourse context. The present study will compare a particular structural approach, the CARIN theory, as proposed by Gagné and her colleagues (Gagné & Shoben, 1997, Gagné 2000, Gagné, 2001, Gagné & Shoben, 2002) and a discourse context-based approach (Gerrig & Murphy, 1992, Gerrig & Bortfeld, 1999) to determine which is more influential in guiding people's interpretation of conceptual combinations.

The *Competition Among Relations in Nominals* (CARIN) theory (Gagné & Shoben, 1997, Gagné, 2000, Gagné, 2001, Gagné & Shoben, 2002) focuses on the semantic relationships formed between the constituent words of the combination and how people are able to establish the meaning of the phrases based on these relations. This diverges from other structure-based theories of conceptual combination that rely on the semantic similarity of the constituent words of the phrase. However, CARIN is similar to other structural theories of conceptual combination in that the semantic relationships proposed are based solely on the two words in the combination rather than the semantic relationships between the words in the combination and terms outside the combination (e.g. the surrounding discourse context). CARIN predicts that

participants will give widely different interpretations for the same phrases based on the relations they have experienced prior to the interpretation of a conceptual combination. This prediction stems from CARIN's competition element, in which relations of combinations compete to become the dominant interpretation for the phrase. Relations that express an interpretation that is more consistent with the interpreter's existing knowledge of the constituent concepts are more strongly activated and, thus, lead people to a default interpretation for the phrase.

To test relations, Gagné and her colleagues have used a priming procedure in which one of the nouns in the priming combination is also part of the target combination. Gagné and her colleagues have used this repetition of a noun from the priming combination to the target combination as an effective method for controlling the activation of a specific relation. In addition to using the priming combination to control which relations are activated, this method of priming relations has provided an understanding of the structural contributions that constituent nouns bring to the combination. Results from this research suggest that priming using a repeated modifier noun facilitates relation priming more readily than a repeated head noun. The head noun of a combination plays a role in the evaluation of the plausibility of the relations suggested by the modifier, but it does not play a role in the initial activation of those relations (Gagné & Shoben, 2002).

While this priming effect indicates how people may interpret these combinations in isolation, a growing body of evidence supporting the

disambiguating effects of discourse context on novel lexical expressions is also relevant. Results from Gerrig and Murphy (1992) suggest that people are able to understand a unique conceptual combination by integrating the combination with the surrounding discourse context to form a plausible interpretation. In this series of experiments the researchers were able to demonstrate that not only are people able to derive a meaning of a conceptual combination from an explicit discourse context, but they are able to retain this meaning for use in a delayed memory task by presenting the discourse context to participants and asking them true/false questions concerning the intended interpretation of the target combination. In a later study, Gerrig and Bortfeld (1999) provide further evidence of the degree to which novel conceptual combinations are disambiguated by accompanying discourse contexts. Instead of using a structural aspect of the combination to influence interpretation, these researchers were able to demonstrate how context can radically influence the way a person interprets conceptual combinations by placing the target combinations in biasing contexts. In this study, a series of vignettes was constructed, each of which biased a typical or a novel interpretation of a target conceptual combination. Although novel interpretations were harder to understand, the results clearly demonstrated that discourse context is necessary for inducing an innovative interpretation of conceptual combinations. Furthermore, recent research suggests that people tend to provide interpretations of conceptual combinations that are congruent with the discourse

in which participants first encountered the target conceptual combination (Bortfeld, Sappington, Smith, & Hull, submitted for publication, 2005). This effect lasts for as long as two days after only a brief initial exposure to the biasing discourse. These results indicate that, particularly in the case of novel interpretations, discourse context guides interpretation. Repeated exposure to such contextually guided interpretations ultimately points to the way that novel interpretations of figurative phrases are disseminated among a larger cultural group.

While discourse context has been established as an important factor in the interpretation of conceptual combinations, whether variable amounts of context lead to differential levels of comprehension is unclear. Data from Gagné and Spalding (2004) suggest that a structural prime containing one of the words in the same position as in the target conceptual combination has just as much influence on the interpretation of that combination as a more elaborate discourse context. While this finding takes both discourse context and structural theories into account, it does not provide an account of the relative influence of structure and discourse context on interpretations, nor does it establish the time course of the influence of these characteristics on people's interpretations. The current study seeks to determine the relative influence of structural priming and discourse priming over various periods of time on interpretation.

EXPERIMENT 1

The purpose of Experiment 1 is to investigate the immediate effects of structural priming and discourse priming on conceptual combination interpretation. For the purposes of this study, context-consistent interpretations, interpretations that are semantically similar to the priming material, will be used to measure the influence of the priming methods on interpretation of the target conceptual combination. In this experiment, the two test conditions, structural priming (i.e. CARIN) and discourse priming (i.e. discourse context), were compared against a control condition of no priming.

Method

Participants. Sixty Texas A&M undergraduate students participated in this study in exchange for credit to fulfill a class requirement.

Materials. Twelve conceptual combinations of the 36 combinations used by Gagné and Shoben (2002) were randomly selected for use in this study.

Definition pages for the neutral condition contained the twelve selected conceptual combinations and a response fields for participants to define the combinations. A series of sentences containing conceptual combinations that have the same modifier as the target combination was presented to participants in the structural priming condition (See Appendix B for a complete list of these sentences). A series of vignettes containing at least one reference to each of the words in the target combination and the target conceptual combination was created for the discourse priming condition (See Appendix C for a complete list

of these vignettes). All primes used in this experiment biased a sub-dominant interpretation of the target conceptual combinations.

Procedure. Participants were randomly assigned to one of three conditions. In the neutral condition, participants were instructed to provide the first definition they could think of for the 12 target combinations. Participants in the structural priming condition were presented with a task adapted from Gagné and Shoben (2002, Experiment 2) in which participants read a series of study sentences that contained the sub-dominant prime of the target conceptual combination.

Participants were asked to flip the page over when they had completed reading the sentences. These papers were collected, and participants were presented with a distractor task that contained twelve words from the sentences and twelve words that were not in the study sentences. None of these words were part of the priming conceptual combinations. Participants were instructed to circle the words that had appeared on the previous page of study sentences. This manipulation check tests the memory of the participant to insure that they read the sentences, and acts as a distractor task between the presentation of the priming combination and the target combination. Once participants had completed this task, the responses were collected and participants were given a page containing the twelve target conceptual combinations. Participants were asked to define the twelve target combinations.

Participants in the discourse priming condition were presented with reading packets that contained vignettes describing the target conceptual combinations.

Participants in this condition first read the vignettes, then rated how well they understood each vignette on a Likert-type scale from 1 “I don’t understand any of this” to 10 “I understand this completely”. Participants were instructed to place the reading packet face down to indicate that they had finished reading and rating their understanding of the vignettes. These reading packets were collected, and participants were presented with a distractor task that contained twelve words from the vignettes and twelve words that were not in the vignettes. None of the words taken from the vignettes were part of the target combination. Participants were instructed to circle the words that had appeared in the vignettes from the reading packet. After completing this distractor task, participants were asked to define the target conceptual combinations.

Coding. Two lab assistants, blind to the procedure of this experiment, coded the data into dominant, sub-dominant, or other categories. Dominant and sub-dominant interpretations were based the norms gathered in the neutral condition of this experiment. Raters were in agreement for 92.3% of the responses. All disagreements on interpretations were resolved through consensus between the primary investigator and the raters. Interpretations that did not adhere to either of these interpretations were coded into the other category. The results section of this experiment will focus on the dominant and sub-dominant responses only. This coding strategy was used for all experiments discussed in this study.

Results

All tests of significance performed in this study used an alpha level of .05 unless otherwise indicated. All subject analyses will be indicated with the number 1 (e.g. $F1$, $t1$), and all item analyses will be indicated with a number 2 (e.g. $F2$, $t2$). For this study, the most frequent definition for each combination in the neutral condition was used as the dominant interpretation for the combination, and the second most frequent definition provided for each combination was used as the sub-dominant interpretation. See Appendix A for the dominant and sub-dominant responses for each item and the percentage of responses these interpretations represented. Figures 1a and 1b show the percentage of dominant and sub dominant responses in the participant and item analyses.

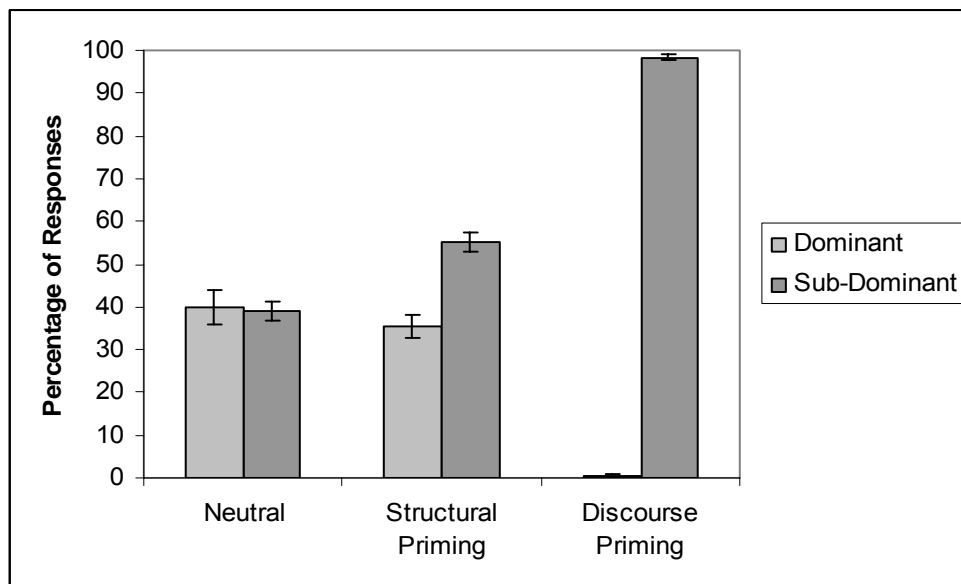


Figure 1a: Percentages of responses for Experiment 1 participant analysis

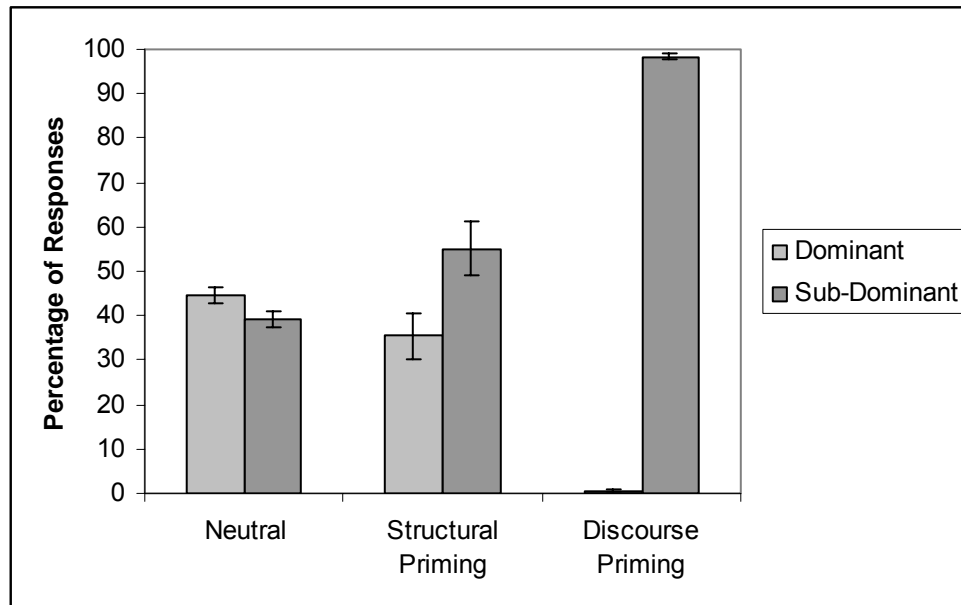


Figure 1b: Percentages of responses for Experiment 1 item analysis

Omnibus one-way ANOVAs show a priming effect for sub-dominant interpretations in both participant ($M = 7.70$, $SEM = 0.41$; $F_1(2, 57) = 274.05$, $MSE = 0.99$, $partial \eta^2 = 0.91$, $p < 0.01$) and item analyses ($M = 12.83$, $SEM = 0.43$; $F_2(2, 33) = 69.34$, $MSE = 6.50$, $partial \eta^2 = 0.81$, $p < 0.01$). When compared to the baseline neutral condition ($M = 4.7$, $SEM = 0.26$), there was a distinct increase in the frequency of sub-dominant interpretations in the structural priming condition ($M = 6.6$, $SEM = 0.27$; $t_1(19) = 4.45$, $p < 0.01$) and in the discourse priming condition ($M = 11.8$, $SEM = 0.09$; $t_1(19) = 23.71$, $p < 0.01$). Item analyses also showed this difference between the neutral condition ($M = 7.83$, $SEM = 0.37$) for the structural priming condition ($M = 11.00$, $SEM = 1.21$; $t_2(11) = 3.80$, $p < 0.01$) and the discourse priming condition ($M = 19.67$,

SEM = 0.14; $t_2(11) = 8.48, p < 0.01$), which indicates that the priming materials are able to evoke a specific interpretation.

Overall, participant analyses of the structural priming and discourse priming conditions indicate that both structural and discourse priming are effective in inducing an out-of-context sub-dominant interpretation (M = 7.70, SEM = 0.13) over an out-of-context dominant interpretation (M = 3.03, SEM = 0.19, $t_1(59) = 6.44, p < 0.01$). This priming effect for sub-dominant interpretations (M = 6.60, SEM = 0.27) over dominant interpretations (M = 4.25, SEM = 0.32) was present in the structural priming condition ($t_1(19) = 4.24, p < 0.01$) as well as discourse priming (M = 11.9, SEM = 0.09 for sub-dominant interpretations, M = 0.05, SEM = 0.05 for dominant interpretations; $t_1(19) = 95.52, p < 0.01$). This effect also held for the item analysis for discourse priming (M = 19.67 SEM = 0.14 for sub-dominant interpretations, M = 0.08, SEM = 0.08 for dominant interpretations; $t_2(11) = 101.47, p < 0.01$) but was not present in the item analysis for structural priming (M = 11.00, SEM = 1.21 for sub-dominant interpretations, M = 7.08, SEM = 1.06; $t_2(11) = 1.82, p = 0.10$) suggesting that all of the items did not contribute to the effect seen in the participant analysis for structural priming. Since the same target combinations were used in the structural priming and discourse priming, this finding indicates that the discourse priming material (i.e. a discourse context) is more effective at facilitating a specific interpretation for a target conceptual combination. Table 1a and table

1b are a summary of the means and standard errors for the participant and item analyses.

Table 1a. Means and standard errors for Experiment 1 Participant Analysis

Interpretation Type	Priming Condition		
	Neutral	Structural Priming	Discourse Priming
Dominant	4.80 (0.48)	4.25 (0.32)	0.05 (0.05)
Sub-Dominant	4.70 (0.26)	6.60 (0.27)	11.8 (0.09)

Table 1b. Means and standard errors for Experiment 1 Item Analysis

Interpretation Type	Priming Condition		
	Neutral	Structural Priming	Discourse Priming
Dominant	8.91 (0.40)	7.08 (1.06)	0.08 (0.08)
Sub-Dominant	7.83 (0.37)	11.00 (1.21)	19.67 (0.14)

While both structural priming and discourse priming demonstrated a biasing effect compared to the neutral condition in which participants were not exposed to any priming material prior to interpretation of the target conceptual combinations, participants in the discourse priming condition ($M = 11.8$, $SEM = 0.09$) produced more interpretations that matched the interpretation biased in the priming material than participants in the structural priming condition ($M = 6.60$, $SEM = 0.27$; $t_1(19) = 19.44$, $p < 0.01$). This difference was also present in the item analysis ($M = 11.00$ $SEM = 1.21$ for structural priming, $M = 19.67$ $SEM = 0.14$ for discourse priming; $t_2(11) = 6.01$, $p < 0.01$). This increase in interpretations matching the interpretation biased by the priming material

suggests that while structural priming is able to influence one's interpretation of a given conceptual combination, discourse priming has a much stronger influence on the interpretation of a noun-noun combination.

Discussion

Results from Experiment 1 offer evidence supporting the notion that a discourse prime (i.e. discourse context) can have a strong influence on conceptual combination interpretation. That is, both structural primes and discourse primes biased participants' interpretations of a target conceptual combination, but discourse primes showed a more robust biasing effect. This finding is consistent with other findings indicating that discourse context is an important factor in disambiguating novel lexical terms. These data also indicate that there is a distinct difference between the influence of an discourse prime such as discourse context and that of a structural prime such as a similar noun-noun combination.

Experiment 1 provides evidence of the respective influences of structural and discourse primes on conceptual combination, but it does not address the question of how robust these effects are over time. If discourse priming and structural priming of conceptual combination interpretation are no different, as claimed by Gagné and Spalding (2004), then the sense biased by a structural prime should be retained for the same amount of time as one influenced by an discourse prime. Thus, the purpose of Experiment 2 is to investigate this time course of sense retention across the two forms of priming.

EXPERIMENT 2

While findings from Experiment 1 demonstrate that there is a difference between the influences of structural priming and discourse priming on conceptual combination interpretation, it does not address how long these two respective priming strategies continue to influence people's interpretations of those combinations. If the influences of structural and discourse priming are different, then one would expect to observe this difference when there is a time delay between the presentation of the priming material and interpretation of the target conceptual combination. That is, there should be a greater retention for interpretations primed with discourse priming material over an extended time delay versus the same combination primed with a structural priming material.

Method

Participants. One hundred eight (108) Texas A&M undergraduate students participated in this study in exchange for credit to fulfill a requirement for an introductory psychology course

Materials. In addition to the target combinations and primes used in Experiment 1, two new non-verbal distractor tasks were added for Experiment 2. These tasks were included in all structural and discourse priming conditions that were also part of a time delay in Experiment 2.

Procedure. Participants were randomly assigned to either a structural priming group (i.e. two word combinations priming the sub-dominant interpretation of the target conceptual combinations) or an discourse priming group (i.e. discourse

context biasing the sub-dominant interpretation of the target conceptual combinations). Within these two groups, participants were randomly assigned to 3 distinct time delay conditions: immediate, same-day delay, and two-day delay. The immediate condition was a replication of the procedure from Experiment 1. The same-day condition was similar to the immediate condition, but included two non-verbal filler tasks. These non-verbal tasks were given immediately following the distractor task in both priming conditions. After completing these filler tasks, participants were asked to define the 12 target conceptual combinations. The two-day condition used the same materials as the same day condition, but the administration of the materials was spread across two experimental sessions spread across two days. In both priming conditions, participants read the priming material, completed the distractor task, and completed one of the two non-verbal filler tasks. Once participants had completed the non-verbal filler task, they were asked to come back two days later. When the participants returned, they were given the other non-verbal filler task. This second filler task was followed by the definition sheet containing the 12 target conceptual combinations.

Results

A 2 (priming type) x 3 (time delay) between subjects design was used in both the participant and item analyses. Results from these analyses indicate that there is an interaction between priming type and time delay in both the participant analysis ($M = 12.62$, $SEM = 0.38$; $F_1(2, 102) = 7.68$, $MSE = 2.28$, $\text{partial } \eta^2 =$

0.13 $p < 0.01$) and the item analysis ($M = 12.55$, $SEM = 0.37$; $F_2 (2, 22) = 4.98$, $MSE = 5.27$, $\text{partial } \eta^2 = 0.31$ $p < 0.01$). This finding suggests that there is a change in the frequency of sub-dominant interpretations over the course of the three time delay conditions. There was a significant effect for priming in both the participant analysis ($M = 12.61$, $SEM = 0.64$; $F_1 (1,102) = 131.52$, $MSE = 2.28$, $\text{partial } \eta^2 = 0.56$, $p < 0.01$) and the item analysis ($M = 12.56$, $SEM = 0.64$; $F_2 (1,11) = 44.86$, $MSE = 10.03$, $\text{partial } \eta^2 = 0.80$, $p < 0.01$), which indicates that the structural and discourse priming conditions successfully primed the sub-dominant interpretation for the target conceptual combinations. There was also a significant effect for delay in the participant analysis ($M = 12.61$, $SEM = 0.53$; $F_1 (2, 102) = 19.93$, $MSE = 2.28$, $\text{partial } \eta^2 = 0.28$, $p < 0.01$), which indicates that there was a change in the frequency of sub-dominant interpretations over the three experimental time delays. The time delay effect was also present across items ($M = 12.56$, $SEM = 0.53$; $F_2 (2, 17) = 15.24$, $MSE = 1.36$, $\text{partial } \eta^2 = 0.58$, $p < 0.01$). These effects provide evidence that retention for the biased interpretation changes over the course of time. Figures 2a and 2b show the percentages of sub-dominant responses for the structural priming and discourse priming conditions.

Both priming types were successful in biasing an out-of-context sub-dominant interpretation over an out-of-context dominant interpretation across the three experimental time delays. This bias was most apparent in the immediate time delay condition for discourse priming ($M = 11.28$, $SEM = 0.28$ for sub-

dominant interpretations, $M = 0.11$, $SEM = 0.07$ for dominant interpretations; $t_1(17) = 45.42$, $SE = 0.25$, $p < 0.01$) and for structural priming ($M = 7.17$, $SEM = 0.38$ for sub-dominant interpretations, $M = 4.22$, $SEM = 0.11$ for sub-dominant interpretations; $t_1(17) = 3.73$, $p < 0.01$). This effect remains strong for the same-day condition for discourse priming ($M = 10.83$, $SEM = 0.32$ for sub-dominant interpretations, $M = 0.72$, $SEM = 0.23$ for dominant interpretations; $t_1(17) = 19.56$, $p < 0.01$) and structural priming ($M = 6.67$, $SEM = 0.41$ for sub-dominant interpretations, $M = 4.22$, $SEM = 0.38$ for dominant interpretations; $t_1(17) = 3.24$, $SE = 0.76$, $p < 0.01$). The biasing effect remains present in the two-day delay for discourse priming ($M = 7.94$, $SEM = 0.36$ for sub-dominant interpretations, $M = 3.11$, $SEM = 0.38$ for dominant interpretations; $t_1(17) = 6.80$, $p < 0.01$) and structural priming ($M = 6.22$, $SEM = 0.41$ for sub-dominant interpretations, $M = 4.56$, $SEM = 0.41$ for dominant interpretations; $t_1(17) = 2.16$, $p = 0.04$). These findings indicate that both discourse and structural priming are capable of biasing a sub-dominant interpretation for up to two days after a brief exposure to the priming materials. Item analyses for discourse priming show this same effect in the immediate condition ($M = 17.00$, $SEM = 0.25$ for sub-dominant interpretations, $M = 0.17$, $SEM = 0.11$ for dominant interpretations; $t_2(11) = 62.20$, $SE = 0.27$, $p < 0.01$), same-day condition ($M = 16.25$, $SEM = 0.28$ for sub-dominant interpretations, $M = 1.08$, $SEM = 0.19$ for dominant interpretations; $t_2(11) = 35.82$, $SE = 0.42$, $p < 0.01$), and the two-day condition ($M = 11.92$, $SEM = 0.94$ for sub-dominant interpretations, $M = 4.67$,

SEM = 1.04 for dominant interpretations; $t(11) = 3.75$, SE = 1.94, $p < 0.01$).

However, the item analyses for structural priming did not show this same effect in the immediate (M = 10.83, SEM = 1.15 for sub-dominant interpretations, M = 6.33, SEM = 1.15 for dominant interpretations; $t(11) = 1.97$, $p = 0.07$), same-day (M = 10.00, SEM = 1.21 for sub-dominant interpretations, M = 6.33, SEM = 1.02 for dominant interpretations; $t(11) = 1.83$, $p = 0.09$), or two-day conditions (M = 9.33, SEM = 1.13 for sub-dominant interpretations, M = 6.83, SEM = 1.11 for dominant interpretations; $t(11) = 1.17$, $p = 0.27$), which suggests that, for structural priming, not all of the items were contributing to the lasting biasing effect.

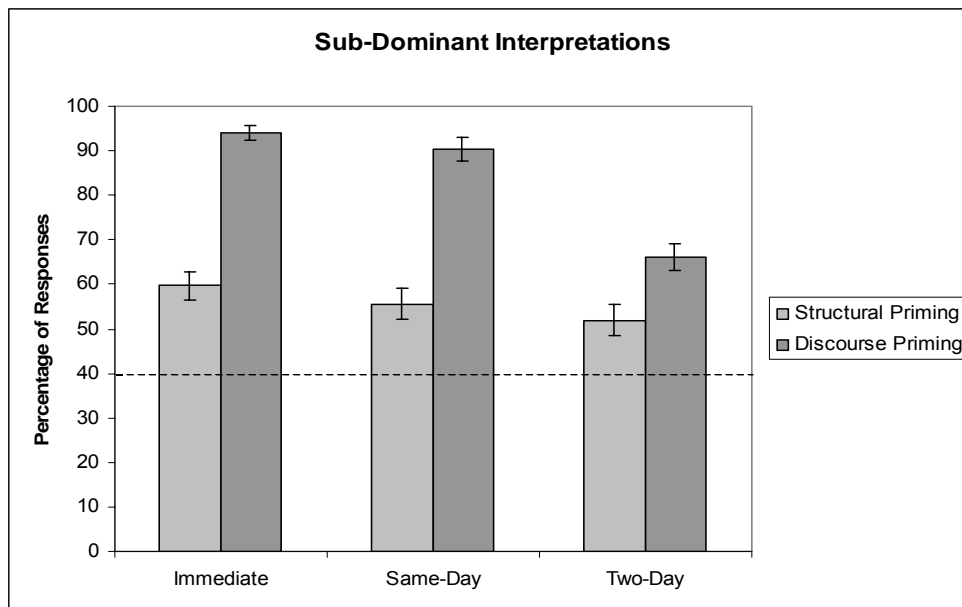


Figure 2a. Percentages of sub-dominant responses for Experiment 2 participant analysis. *Note:* baseline percentage indicated by dashed line.

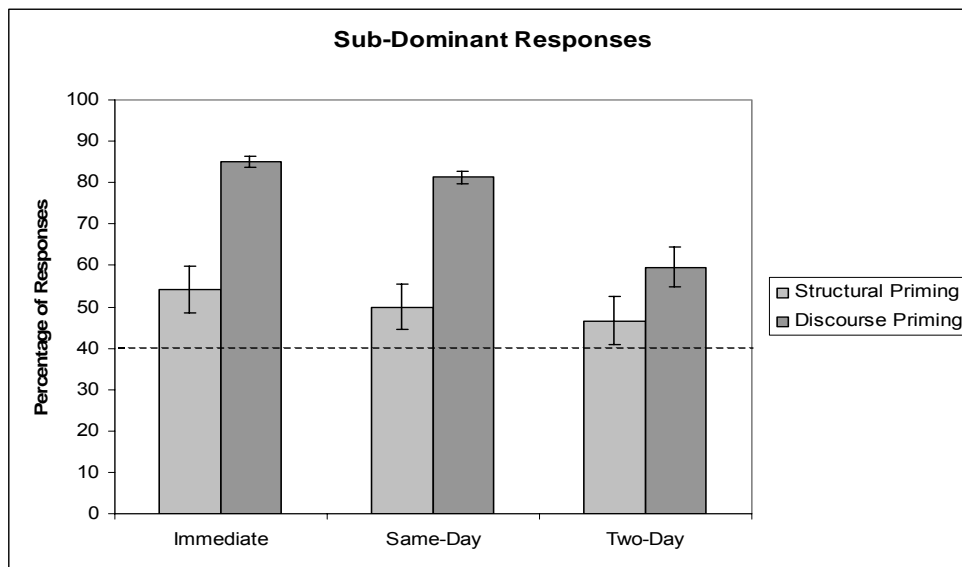


Figure 2b. Percentages of sub-dominant responses for Experiment 2 item analysis *Note:* Baseline percentage indicated by dashed line.

In addition to these findings, post hoc analyses using paired-sample t-tests also indicate that context-consistent interpretations decreased as the time delay between presentation of the biasing contexts and interpretation of the target conceptual combination increased. A significance level of $p = .017$ was used to correct for family-wise error in all of the post-hoc tests. Overall, there was a reduction in the frequency of sub-dominant interpretations over the time delay conditions for discourse priming ($M = 11.28$, $SEM = 0.21$ for the immediate condition, $M = 7.94$, $SEM = 0.36$ for the two-day delay condition; $t(17) = 10.31$, $p < 0.01$), but this effect was not present for structural priming ($M = 7.17$, $SEM = 0.38$ for the immediate condition, $M = 6.22$, $SEM = 0.42$ for the two-day time delay; $t(17) = 1.56$, $p = 0.14$). This finding suggests that discourse priming and

structural priming have two separate time courses for retention of the interpretation they bias. Whereas structural priming shows a steady, non-significant drop in the frequency of context consistent interpretations from the immediate time delay ($M = 7.17$, $SEM = 0.38$) to the same-day delay ($M = 6.67$, $SEM = 0.41$; $t_1(17) = 0.86$, $p = 0.40$) and from the same-day delay ($M = 6.67$, $SEM = 0.41$) to the two-day delay ($M = 6.22$, $SEM = 0.42$; $t_1(17) = 0.82$, $p = 0.43$), discourse priming shows a steady drop in retention from immediate ($M = 11.28$ $SEM = 0.21$) to same-day ($M = 10.83$ $SEM = 0.32$; $t_1(17) = 1.22$, $p = 0.24$), but shows a significant reduction in context-consistent interpretations from the same-day delay ($M = 10.83$ $SEM = 0.32$) to the two day delay ($M = 7.94$ $SEM = 0.36$; $t_1(17) = 7.82$, $p < 0.01$). Item analyses reflect this finding in structural priming ($M = 10.83$ $SEM = 1.15$ for the immediate condition, $M = 10.00$ $SEM = 1.21$ for the same-day condition, $M = 9.33$ $SEM = 1.13$ for the two day condition; $t_2(11) = 1.16$, $p = 0.27$) and in discourse priming ($M = 17.00$ $SEM = 0.25$ for the immediate condition, $M = 16.25$ $SEM = 0.28$ for the same-day condition, $M = 11.92$ $SEM = 0.94$ for the two day condition; $t_2(11) = 5.37$, $p < 0.01$) suggesting that all items contributed to this effect. Table 2a and table 2b are a summary of the means in the participant and item analyses.

Table 2a. Means and standard errors for Experiment 2 participant analysis

Priming Material	Immediate		Same-Day		Two-Day	
	Dominant	Sub-Dominant	Dominant	Sub-Dominant	Dominant	Sub-Dominant
Structural Priming	4.22 (0.43)	7.17 (0.38)	4.22 (0.38)	6.67 (0.41)	4.56 (0.41)	6.22 (0.41)
Discourse Priming	0.11 (0.07)	11.28 (0.28)	0.72 (0.23)	10.83 (0.32)	3.11 (0.38)	7.94 (0.36)

Table 2b. Means and standard errors for Experiment 2 item analysis

Priming Material	Immediate		Same-Day		Two-Day	
	Dominant	Sub-Dominant	Dominant	Sub-Dominant	Dominant	Sub-Dominant
Structural Priming	6.33 (1.15)	10.83 (1.15)	6.33 (1.02)	10.00 (1.21)	6.83 (1.11)	9.33 (1.13)
Discourse Priming	0.17 (0.11)	17.00 (0.25)	1.08 (0.19)	16.25 (0.28)	4.67 (1.04)	11.92 (0.94)

In addition to the differences in the time courses of retention for discourse priming and structural priming, there were differences in the frequencies of context-consistent interpretations between discourse priming and structural priming in the immediate ($M = 11.28$ $SEM = 0.28$ for discourse priming, $M = 7.17$, $SEM = 0.38$ for structural priming; $t_1(17) = 9.63$, $p < 0.01$), same-day ($M = 10.83$, $SEM = 0.32$ for discourse priming, $M = 6.67$ $SEM = 0.41$ for structural priming; $t_1(17) = 8.68$, $p < 0.01$), and two-day ($M = 7.94$, $SEM = 0.36$ for discourse priming, $M = 6.22$, $SEM = 0.41$ for structural priming; $t_1(17) = 3.02$, $p < 0.01$) time delay conditions. These significant differences support the finding from Experiment 2 that while both structural priming and discourse priming are

capable of biasing people's interpretations of conceptual combinations, discourse priming is more influential on the interpretation of a subsequent combination. These differences were reflected in the item analyses of the immediate ($M = 17.00$, $SEM = 0.25$ for discourse priming, $M = 10.83$, $SEM = 1.15$ for structural priming; $t(11) = 5.99$, $p < 0.01$) and same-day ($M = 16.25$, $SEM = 0.28$ for discourse priming, $M = 10.00$, $SEM = 1.21$ for structural priming; $t(11) = 5.67$, $p < 0.01$) time delay conditions, but the effect was not present in the two-day delay ($M = 11.92$, $SEM = 0.94$ for discourse priming, $M = 9.33$, $SEM = 1.13$ for structural priming; $t(11) = 2.40$, $SE = 1.07$, $p = 0.03$) indicating that not all of the items in the two-day time delay contributed to the difference demonstrated by the participant analysis.

Discussion

The results from Experiment 2 indicate that while both structural priming and discourse priming affect conceptual combination interpretation, discourse priming is more robust in retention of the interpretation suggested by the context. This finding supports the hypothesis that structural priming and discourse priming have different influences on comprehension of a conceptual combination. This is indicated by the different time courses of retention for the biased interpretation for the target conceptual combination even though the same interpretation was biased in the structural and discourse priming conditions. Specifically, discourse priming not only biases a particular sense

more frequently than a structural prime, but the priming effect remains more influential over the course of time. .

Results from Experiment 2 also offer additional evidence to support the claim from Experiment 1 that there is a significant difference in the frequency of context consistent interpretations derived from an discourse prime such as discourse and that of a structural prime such as priming conceptual combination presented before interpretation of the target conceptual combination. This effect is most pronounced in the same-day and two-day time delays where participants, regardless of priming condition, were only given a brief exposure to the priming material before providing interpretations to the target conceptual combinations. The significant differences illustrated in the post-hoc tests at these delay conditions are evidence that discourse is playing a much larger role than is suggested by structural theories of conceptual combination interpretation.

CONCLUSION

The results presented in this study demonstrate that people's interpretation of conceptual combinations is not only guided by the structure of the combinations themselves, but also by the contextual cues provided in the discourse surrounding the combinations. Experiment 1 tested the immediate effects of structural priming and discourse priming on conceptual combination interpretation. Participants in Experiment 1 were more likely to provide a context-consistent interpretation when the target conceptual combination was primed with another combination in discourse context than if the combination was primed simply with another combination sharing structural features. Furthermore, interpretations biased with an discourse prime were sustained for a longer period of time than those biased with structural priming materials, as demonstrated in Experiment 2.

The present study does not address the enormous range of possible interpretations for any one conceptual combination. In Experiment 1, dominant and sub-dominant interpretations were defined as the two interpretations that people gave most often for each of the 12 target combinations when no priming material was presented prior to interpretation. This definition led to subtle differences between the dominant and sub-dominant interpretations. Evidence from this study indicates that discourse and noun-noun combinations can be used to prime a distinction between those subtle differences, but it does not address the effectiveness of discourse or noun-noun combination for biasing a

rare interpretation of a conceptual combination. Rare interpretations, in the context of the normative data from Experiment 1, are interpretations that very few people would provide as a definition for the target conceptual combination. If the priming materials used in this study could be used to prime people to give a rare interpretation to a target conceptual combination, it would demonstrate that people take cues from their context (e.g. priming material) to make their interpretations of novel lexical terms such as conceptual combinations.

Other lexical structures, such as metaphor, rely on discourse context to disambiguate their specific meanings. Gerrig and Healy (1983) demonstrated that people use general knowledge about the target and base terms when interpreting metaphors. Participants in this study interpreted the metaphors more quickly when the metaphorical contexts were a good match of what they describe (e.g. *The night sky was filled with drops of molten silver*) than when the context was a bad match for the object they were describing (e.g. *The night sky was filled with drops of molten resin*). In both the good match and bad match metaphors, the phrases were understood more quickly when context was introduced prior to rather than following the metaphor. This finding offers empirical support for the claim that people rely heavily on context to derive the specific meanings implied by novel metaphors (Gibbs & Gerrig, 1988).

Some researchers have referred to the various stages of meaning phrases represent as the phrases' *careers* (Gentner, Bowdle, Wolf, & Boronat, 2001; Bowdle & Gentner, 2005). The term indicates a developmental

progression that begins with the initial use of the term to convey a novel sense. According to Gentner and her colleagues, comprehension of such initially novel senses progresses through a series of increasingly conventionalized stages, given increased exposure and use. Results from their studies indicate that people use a comparison strategy for interpreting novel metaphors (e.g. A mind is [like] a kitchen), but switch to a relational interpretation as the metaphor becomes more conventional (e.g. A soldier is [like] a pawn). This finding is consistent with other research on how people learn the meanings for novel words (Chaffin, 1997).

In their discussion of the “career” of metaphor, Bowdle and Gentner (2005) also discuss *dead metaphors*, or metaphors that have lost a semantic connection with the base concept. *Dead₁ metaphors* contain base terms that evoke two representations that are not semantically linked. The base terms in *dead₁ metaphors* have multiple meanings, but because one sense has been more widely used than the other (e.g. *culture* as a term to refer to societies of people versus *culture* as a term to refer to a growth preparation such as a mold culture grown in a Petri dish). *Dead₂ metaphors* are metaphors whose original base concept no longer exists. The authors point to the term *blockbuster* as an example of one of these base terms. Today, the term *blockbuster* is used to refer to commercially successful films in theatres, but a *blockbuster* was originally the term used to describe a large bomb capable of destroying a city block (Bowdle & Gentner, 2005). The loss of culturally available contextual

biasing for initial interpretations in favor of new interpretations explains how such phrases go through progressive shifts in meaning. There are informative parallels between this characterization of how the meanings of metaphors evolve and the results from the experiments reported here.

Discourse priming in the form of discourse context might also be useful in reviving *dead metaphors*. As demonstrated in this study, discourse context can be used to bias the interpretation of a novel conceptual combination. Such phrases are frequently adopted into the language as a kind of fixed phrases. Conceptual combinations not only allow people to make lexical shortcuts to express meaning more concisely, but they also allow people to introduce new senses to the lexicon that would not have been expressed with a single phrases otherwise. For example, the term *soccer mom* is currently defined as a mother that transports her children to and from soccer practice. Neither *soccer* nor *mom* could elicit this interpretation alone. These emergent properties (Wilkenfeld & Ward, 2001) are properties attributed to the combination that cannot be attributed to the constituent nouns of the combination. Structural theories of conceptual combination have difficulty explaining these emergent properties because they rely heavily on the associated properties of the constituent nouns. The surrounding discourse context offers people a resource that they can use to derive these meanings. Gerrig and Gibbs (1989) suggest that people use the emergent property aspect of conceptual combination and other creative

expressions of language to explain novel concepts that would be inexpressible by using the existing lexicon.

There are several different directions research in conceptual combination interpretation could take given the results from this study. For instance, the conceptual combinations used in this study were combinations that have not become a part of the lexicon. Thus, another way one might investigate the effect of discourse context on conceptual combination interpretation might be to use discourse to bias a new meaning for conceptual combinations that have already been integrated into the lexicon. Although Gentner and Bowdle (2005) caution that dead metaphors should be processed as categorizations only, the evidence provided in the current study suggests that a discourse context can be used to make a rare sense of a term more plausible. Length of this “career” could be altered by the type of priming material used to bias a particular sense just as different types of priming show different patterns of sense retention in the set of studies described here.

Most of the research in conceptual combination interpretation has used adult participants as interpreters of novel combinations. Although there is a large body of work outlining the conceptual development of children (see Farrar, Raney, & Boyer, 1992, Keil, Smith, Simons, & Levin, 1998, Levine & Carey, 1982, Sarnecka & Gelman, 2004), few studies have investigated conceptual combination interpretation with regard to language development in children. Such research could give researchers insight into both linguistic and conceptual

development. In particular, it would help determine if the findings reported here characterize not only how adults makes sense of novel phrases, but also children develop the ability to make sense of such phrases.

The results presented in this study indicate that people's interpretations of conceptual combinations are based on the context in which people encounter the combination. While both discourse and structural priming strategies are effective in biasing a specific interpretation for a conceptual combination, discourse shows a much stronger biasing effect that spans a longer period of time. Findings from this study also indicate that people use the meaning implied by the constituent words of the combination as well as meaning implied by the surrounding context to derive their interpretations of conceptual combinations.

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APPENDIX A

DOMINANT AND SUBDOMINANT INTERPRETATIONS AND PERCENTAGES

OF RESPONSES WITH NO PRIMING MATERIAL PRESENT

Carpenter Toy

Dominant – A toy made by a carpenter. (50%)

Sub-Dominant – A toy for a carpenter. (45%)

Factory Chemical

Dominant – A chemical product of a factory. (50%)

Sub-Dominant – A chemical that is used in a factory. (45%)

Juvenile Story

Dominant – A story made/written for juveniles. (40%)

Sub-Dominant – A story made/written by a juvenile. (35%)

Clay Machine

Dominant – A machine that makes clay. (45%)

Sub-Dominant – A machine made out of clay. (40%)

Funeral Dish

Dominant – A dish (ie food) prepared for a funeral. (40%)

Sub-Dominant – A dish (ie the plate) made for a funeral. (35%)

Porch Wood

Dominant – Wood that is lying on a porch. (55%)

Sub-Dominant – Wood that is used to make a porch. (45%)

Adolescent Doctor

Dominant – A doctor for adolescents. (50%)

Sub-Dominant – A doctor that is an adolescent. (45%)

Chocolate Book

Dominant – A book about chocolate. (40%)
Sub-Dominant – A book made of chocolate. (35%)

Money Student

Dominant – A student that studies money (i.e. economics major). (40%)
Sub-Dominant – A student that always has money (i.e. rich). (35%)

Paper Tree

Dominant – Tree that is made of paper. (45%)
Sub-Dominant – Tree that will be used to make paper. (40%)

Pickle House

Dominant – House made of pickles. (30%)
Sub-Dominant – Storage house for pickles. (25%)

Meat Train

Dominant – Train made of meat (e.g. linked sausages). (50%)
Sub-Dominant – Train that transports meat. (45%)

APPENDIX B

STRUCTURAL PRIMING STIMULI

(TARGET COMBINATION IN PARENTHESES)

Adolescent Student (Adolescent Doctor)

The middle school principal told the incoming 7th Grade class in their orientation, "As an adolescent student, our expectations are that you are responsible for your own schoolwork."

Chocolate Egg (Chocolate Book)

Jan liked Easter morning because she could eat a giant chocolate egg and her parents didn't stop her.

Clay Tool (Clay Machine)

Many ancient people in Europe used a clay tool to do anything from cooking to grooming.

Funeral Music (Funeral Dish)

On his deathbed, Jeff said that he wanted *Box of Rain*, *St. Stephen*, and *The Eleven* as his funeral music.

Porch Swing (Porch Wood)

Grandpa always doled out his life lessons while rocking on his old porch swing.

Carpenter Hammer (Carpenter Toy)

Standard equipment for all of the day laborers on a construction site includes a carpenter hammer.

Meat Trey (Meat Train)

Zoë used the meat pan to carry several pieces of chicken breasts, hamburger patties, and a couple of beefsteaks to the grill.

Factory Equipment (Factory Chemical)

There were several large machines among the factory equipment.

Juvenile Complaint (Juvenile Story)

The older members of the jury were tired of Lucy's juvenile complaint about their indecision.

Money Parent (Money Student)

Lee's money parent always made sure he had plenty of cash for gas and concert tickets.

Paper Clip (Paper Tree)

Since there were no staples in the stapler, Ed used a paper clip to bind his report.

Pickle Fork (Pickle House)

In Southern Mississippi, locals use a pickle fork to reach the pickles at the bottom of the jar.

APPENDIX C

DISCOURSE PRIMING STIMULI

Carpenter Toy

On their day off, Dayton and Chip, both wood workers, were playing with a new set of tools. They used many gadgets such as a laser level to fit windows to wall openings, a tape measure that could record measurements, and a sonic hammer. The carpenter toy they liked the most was the laser level.

Factory Chemical

Gina worked for the Ener-Cell battery company. As part of her job, she was in contact with battery fluid daily. Gina recently quit the job because she was diagnosed with a rare form of cancer. She believed the factory chemical played a key role in the formation of this cancer.

Juvenile Story

For a recent movie, Director Jones needed a realistic vignette for why one of his characters was not doing her homework. Several entries were submitted including accounts from a pre-school child, a juvenile in middle school, and one from Director Jones' own daughter. After looking through the stories, Director Jones settled on the juvenile story.

Clay Machine

Ancient man was able to do many things for which we do not give them credit. In Ancient China, for example, artisans sculpted gears from thick mud that were used to make one of the world's first mechanical timepieces.

This provided archeologists with evidence of the first clay machine in history.

Funeral Dish

As a tradition in the l'oka tribe, Baba had to create some artifact for his father to take with him into the next life. On the day of the burial, Baba placed a commemorative plate in his father's tomb. All who saw it agreed that the funeral dish was so elegant, that even death would not dare to take it from him.

Porch Wood

Harry, the contractor the Harts hired to build the outdoor area on their luxury home, suggested that they use teak as opposed to pre-treated pine.

Natural termite resistance and the beautiful discoloration after weathering were two factors that played a role in the Harts' decision to use teak as their porch wood.

Adolescent Doctor

Few children were as privileged as Dr. Charlie Hitchcock. He graduated from high school at such a young age that most of his peers were still working on their ABCs. Not yet old enough to vote, this adolescent doctor is poised to be this year's Nobel Prize winner in physiology.

Chocolate Book

The selection at Warren's candy store not only satisfied the sweet tooth, but also inspired the mind. There were candy cell phones with jellybean buttons for children on the go, a gingerbread guitar whose strings were made of licorice, and a chocolate book for the quintessential bookworm.

Money Student

Years ago, Paul Scott won the state lottery, and he now appears to be content to go to school forever. He already has degrees in English, Architecture, and Sociology. Although the professors think he needs to move on to the outside world, they concede that the money student can go to school as long as he can pay tuition.

Paper Tree

A convenient setting for a pulp mill is to have as adjacent forest from which to cut pulpwood. After the lumber companies cut down trees usable for plywood, Cherry Mills Company goes to the forest and marks any tree they deem mature enough to be a paper tree.

Pickle House

Condiments Inc., a distributor of condiments to restaurants across the world, stores its products in the outbuildings of an old plantation. The root cellar is now the mustard storage facility, the shed is filled with ketchup bottles, but the pickle house, which is loaded with cases of pickle jars, is the only building that retained its original function.

Meat Train

In the mid-1800s, there was a large demand for low-cost beef east of the Mississippi River. Cowboys were critical in meeting that demand. They were responsible for driving cattle to key rail stations from which the cattle could be loaded onto an eastward bound meat train.

VITA

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EDUCATION

M.S. (Psychology) August 2005	Texas A&M University Advisor: Heather Bortfeld
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ABSTRACTS

Bortfeld, H., Sappington, R., Smith, S.M., & Hull, R.G. Sense Retention and Conceptual Combination. CogSci 2004

POSTERS

Bortfeld, H., Sappington, R., Smith, S.M., & Hull, R.G. Conceptual Combination in Context. Presented the 44th Annual Meeting of the Psychonomic Society, Vancouver, B.C. (November 2003)

Bortfeld, H., Sappington, R., Smith, S.M., & Hull, R.G. Sense Retention and Conceptual Combination. Presented at The Society for Text and Discourse (August 2004)

Bortfeld, H., Sappington, R., Smith, S.M., & Hull, R.G. Sense Retention and Conceptual Combination. Presented at CogSci 2004 (August 2004)

Bortfeld, H., Sappington, R., Smith, S.M., & Hull, R.G. Sense Retention and Conceptual Combination. Armadillo Conference 2004 (October 2004)

GRANTS & AWARDS

Student Research Week Poster Competition (2004): Cash Prize Award \$200.00

SERVICE

Volunteer at KEOS – A community radio station in Bryan/College Station, TX