

The Time-Course of Processing

Novel Metonymy

A Self-Paced Reading Study

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Abstract

The current paper presents a self-paced reading experiment investigating the processing time-course of unfamiliar metonymy relying on context that is either permanent (such as Producer-for-product metonymy) or circumstantial (i.e. Reference Transfer). Reading Time results for both metonymy types show significant differences from a Nonsensical control condition, but do not show significant differences from matched literal controls. These results replicate findings that novel Producer-for-product metonymy, when supported by robust context, does not elicit significantly greater processing cost than literal control conditions. The current study extends this finding to Circumstantial metonymy.

Introduction

A complete theory of language comprehension requires an understanding of how speakers make use of various types of information (e.g. syntactic, semantic, pragmatic) as it becomes available in order to build meaning online. A standard view on language comprehension posits that syntactic processes build structured utterances, and semantic interpretation relies on combining lexical representations based on their position in syntactic structure (e.g. Montague 1970). More recent views of language, particularly those informed by experimental evidence of online human language processing, question the assumptions implicit in early linguistic theories about the one-to-one relationship between syntactic structure and meaning composition.

Certain linguistic phenomena, such as various forms of “enriched composition,” (Pustejovsky 1995; Jackendoff 1997) offer areas of investigation that are particularly pertinent to the study of language processing. Enriched composition is a term that is used to describe utterances for which a felicitous interpretation requires speakers to utilize information not simplistically represented in the utterance’s surface form.

One form of enriched composition is metonymy, a process that consists of the use of one entity to refer to a related entity (Lakoff 1987). In recent years, growing interest in figurative language has led to several studies on the processing of metonymy and metaphor (e.g. Lai et al. 2009). The current study compares the processing time-course of Producer-for-product metonymy, which is licensed by a stable relationship between producers and their products (e.g. Frisson and Pickering 2007), and the more

circumstantial form of metonymy that has been referred to as Reference Transfer (e.g. Nunberg 1995).

Background

Figurative language and polysemy

Metonymy has traditionally been described in terms of “figurative language,” a category of nonliteral linguistic phenomena that also includes metaphor and idioms (Lakoff 1987; Dirven and Porings 2002). Various analyses have been proposed in the literature to account for the means by which speakers interpret lexical items that are associated with both a literal and a nonliteral interpretation. Perhaps the most widespread model stems from the *literal first hypothesis*, which asserts that comprehension of nonliteral language requires first rejecting a literal interpretation. This hypothesis has as its basis semantic theories within the philosophy of language. For instance, Grice (1975) put forth principles of communication stipulating that speakers must first determine the literal meaning of an utterance, then compare this meaning to a conceptualization of the speaker’s intentions in uttering it in order to reject the literal interpretation and arrive at a nonliteral meaning.

Swinney (1979) tested the hypothesis of literal-first models on a lexical level by examining the means by which listeners resolve lexical ambiguities using a cross-modal lexical decision task. In cross-modal lexical decision tasks, subjects are auditorily presented with a stimulus sentence containing a lexical ambiguity (a polysemous word), then at a specific point they are asked to perform a lexical decision task for a visually presented word that is semantically related to one of the senses of the polysemous word. In contrast to the predictions of the literal first hypothesis, Swinney (1979) found that, immediately after the ambiguity, lexical decisions were facilitated for visual words related to both meanings of the ambiguity. Four words later, however, only visual words related to the contextually appropriate meaning were facilitated. These findings have been interpreted as indication that multiple meanings of a polysemous word are available simultaneously when the word is encountered by the parser.

Processing of sentences containing nonliteral phrases also serve to refute the predictions made by the literal first hypothesis. For instance, Brisard et al. (2001) present Reading Time evidence on the processing of novel metaphor. The authors report that when figurative utterances are imbedded within sufficient context to warrant a figurative interpretation, the additional costs that have been observed in association with processing nonliteral language in isolation disappear.

Enriched Composition

Enriched composition refers to interpretive processes that require the use of information that is not provided by the individual lexical entries in an utterance (Jackendoff 1997). A felicitous interpretation of such utterances requires the speaker to rely on the composition of multiple lexical items in order to compose meaning.

For instance, the phenomenon of aspectual coercion (e.g. Pustejovsky 1995, Jackendoff 1997, Pinango et al 2006) consists of an incongruency between a predicate and its modifier. Consider, for example, (1):

(1) John jumped for an hour.

Here the output of the individual lexical items yields an anomalous interpretation, yet utterances like (1) are judged as acceptable by native speakers (e.g. Pinango, Zurif and Jackendoff 1999). In order to parse such sentences, speakers must make use of additional information that is not explicitly specified in the individual lexical items or the syntactic structure of the utterance in order to build an acceptable conceptual representation, i.e. that John jumped *repeatedly* for an hour. Numerous types of enriched composition have been used experimentally to provide insight into the processing of natural language (e.g. McElree et al. 2001).

Metonymy is also a form of enriched composition, in that arriving at a metonymic interpretation of an utterance requires the parser to rely on information that is not specified by the individual items in order to compose a valid meaning. For this reason, the processing of metonymy provides a potentially fruitful point of investigation into the means by which speakers construct meaning online.

Metonymy and reference transfer

Various types of metonymy have been classified in the literature based on the entities and relationships that are involved (Eckardt, R. 1999; Panther and Radden 1999). For instance, Place-for-event metonymy is the use of a location to refer to a salient event that is associated with it (Frisson and Pickering 1999). An example of Place-for-event metonymy is given in (2).

(2) “A lot of Americans protested during Vietnam.” (Frisson and Pickering 1999, p. 1367)

The principle underlying systematic types of metonymy like Place-for-event, which rely on a speaker’s knowledge of the relationships that exists between the two types of entities, is spelled out by Lakoff (1987):

Given an ICM [idealized cognitive model, which is Lakoff’s term for the structural organization of knowledge] with some background condition (e.g. institutions are located in places), there is a “stands-for relation that may hold between two elements *A* and *B*, such that one element of the ICM, *B*, may stand for another element, *A*. (Lakoff 1987, p. 78)

In the case of place-for-event metonymy, *B* = the place (e.g. the country Vietnam) and *A* = the event (e.g. the war that occurred in the country Vietnam).

Prior research into the processing of familiar metonymy has shown that the nonliteral sense of such utterances is highly accessible. Frisson and Pickering (1999) examined the ability of native speakers to interpret familiar metonymical versus literal senses of words, such as “Vietnam,” and found no additional processing cost associated with the familiar metonymical sense (e.g. *Americans protested during Vietnam*) compared with the literal sense (e.g. *I hitchhiked around Vietnam*).

More recently, Frisson and Pickering (2007) revisited the processing of metonymy to investigate the ability of speakers to interpret novel metonyms. Using Eye-

Tracking, the authors investigated processing of familiar versus novel metonymical senses of a word, with and without supporting context. They presented subjects with short texts consisting of two sentences: the first sentence presented a context and the second sentence introduced the metonymy (or literal control). The context sentence for the metonymy condition supported a metonymic interpretation by presenting an individual and describing him or her as a Producer of some kind (such as an author), thereby presenting a salient relationship between the two entities. The context for the literal control condition instead introduced the individual and then provided information about him or her that was unrelated to the licensing relationship.

Frisson and Pickering's (2007) results showed that, without supporting context, processing novel metonyms was more costly than processing familiar metonyms. When the novel metonyms were preceded by a robust supporting context, however, such as a sentence that introduces a suitable relationship between the argument and the referent to license the metonym, there was no longer additional cost associated with processing novel versus familiar metonymy.

Frisson and Pickering (2007) have interpreted their findings as evidence that speakers are able to process novel senses of a word using context as needed by applying a systematic rule regarding the kinds of relationships that can license metonymical exchange. In the case of the Producer-for-product metonymy type that the authors tested, this would consist of a rule that if a name refers to an entity who is a producer, that name can be used to refer to the products associated with the producer:

“English has metonymic rules (or heuristics) that allow places to stand for events, places for institutions, parts for wholes, and producers for products. For example, the place-for-event rule allows the name of a place (e.g. Vietnam) to refer to a salient event that occurred there (the Vietnam War), and the producer-for-product rule allows the name of a producer (e.g. Dickens) to refer to his or her characteristic product (Dickens' writings)” (Frisson and Pickering 2007, p. 597).

Another type of stands-for relationship between linguistic entities that has been described in the literature is that of Reference Transfer (Nunberg 1979), here referred to

as Circumstantial metonymy. Like more systematic forms of metonymy, such as Producer-for-product metonymy, Circumstantial metonymy also involves one lexical item being used to refer to a saliently related lexical item. However, the mechanism of Circumstantial metonymy cannot be explained as the application of a systematic rule regarding specific relationships because the relationships between entities that provide contextual support for the transfer are highly varied and context-dependent. Take, for instance, the sentence in (3), from Nunberg (1979):

(3) The ham sandwich is sitting at table 20 (Nunberg 1979, p. 149).

The entity being referred to here as “the ham sandwich” is of course not an actual sandwich, but the individual who ordered the sandwich. The relationship between the sandwich and the sandwich-orderer is sufficiently salient as to license a metonymical use of one to refer to the other only in the type of contextual setting where this type of utterance would be heard, i.e. a diner or restaurant.

Like the relationship between a sandwich and sandwich-orderer, the salience of the relationship between entities in Circumstantial metonymy is not a permanent or systematic feature of either entity. For instance, other individuals may order ham sandwiches, and the individual being referred to here may order other types of dishes. Therefore the temporary circumstance in which a sentence like (3) is uttered determines whether or not it can be felicitously interpreted; once that circumstance has passed, the relationship that would license the metonymy also no longer exists.

The transient nature of such relationships poses interesting questions for the study of the processing of metonymy. Though regular forms of metonymy, like Producer-for-product, could potentially be lexicalized and stored as permanent rules, such transient relationships as license Circumstantial metonymy cannot be stored as lexical-semantic rules, and must instead rely on a systematic mechanism of associating an argument. The systematicity with which speakers are able to compute this association indicates that the representation of context within the speaker’s Conceptual Structure is highly systematic.

Recently, Schumacher (2011) investigated the electrophysiological correlates of Circumstantial metonymy. As in the design used by Frisson and Pickering (2007),

Schumacher used sentence pairs in which the first sentence presents the context and the second sentence triggers the metonymy or literal control. However the context presented in the first half of each item introduced a relationship between the two entities that is not a permanent feature of either entity.

For example, a patient in a hospital may be referred to by his malady, but the patient and the malady are not permanently linked – that is, the patient will either heal or die. In fact, as Schumacher (2011) notes, native speaker intuitions regarding acceptable metonymical uses of maladies in a hospital setting even indicate that chronic, permanent illnesses are less acceptable as warranting a transfer of reference. For example, speakers might judge (4a) below as more acceptable than (4b):

(4a) In a hospital, a nurse tells the doctor: “The cancer in room 2 is feeling dizzy.”

(4b) In a hospital, a nurse tells the doctor: “The appendicitis in room 2 is feeling dizzy.”

In response to stimuli containing novel Circumstantial metonymy, Schumacher (2011) found a late positivity peaking at 500-800 milliseconds. The author notes that various forms on enriched composition, such as argument structure updating, also have been shown to elicit a late positivity, and interprets the presence of a late positivity for processing Circumstantial metonymy as evidence that this is a largely pragmatic operation.

The processing of metonymy

Schumacher’s (2011) view that the linguistic mechanism underlying Circumstantial metonymy is a pragmatic operation highlights a discrepancy in the literature regarding the linguistic mechanisms that subserve these two types of metonymy. The processing of producer-for-product metonymy has been described in terms of the application of a lexical-semantic rule based on the speaker’s knowledge of a specific relationship (e.g. Frisson and Pickering 2007), whereas Circumstantial metonymy has been interpreted as a largely pragmatic operation (e.g. Nunberg 1995, Egg 2004, Schumacher 2011).

An alternate view is that these two types of stands-for relationships between related entities both rely a common mechanism, which is the process of assigning an argument to a referent. These views make opposing predictions as to the processing of different types of metonymy. If the two processes rely on different mechanisms, they would be expected to be characterized by significant differences in processing time-course. If, however, they rely on a common mechanism, the two should reveal a common pattern. The current study seeks to test the predictions regarding the processing of metonymy by revealing potential similarities and differences in the distribution of processing cost associated with these two different types of metonymy.

It is possible that any effects of additional cost observed for processing the metonymy condition versus the literal control would be more distributed for Circumstantial metonymy than for Producer-for-product metonymy. This possibility is based the results of a recent study in our lab using functional magnetic resonance imaging to investigate the processing of the same stimuli used in the current study. The results of this fMRI experiment, which were presented in a talk by the author at the Experimental Psycholinguistics Conference (Madrid, Spain, November 7-9 2012), showed that both types of metonymy elicited activation in largely overlapping prefrontal regions. However the effects emerged at different times for the different metonymy types: whereas for the Producer-for-product metonymy, the significantly greater activation associated with processing the metonymy items appeared during a small crucial window beginning at the metonymical use of the name (the trigger), the activation observed for processing Circumstantial metonymy items appeared only at the level of the entire sentence.

This difference suggests that while both producer-for-product metonymy and circumstantial metonymy appear to rely on a common neural network, the processing may show a slight difference in temporal distribution.

Experiment

General Method: Self-Paced Reading

The current study uses a Self-Paced Reading paradigm to compare the Reading Times (RTs) of processing novel metonymical and matched literal control items. In a

self-paced reading experiment, the subject must move through each experimental item at his or her own pace. Measurements are gathered for the amount of time that each word within an item remains on screen before the subject continues to the next word by pressing the spacebar.

Some early research into the processing time course of various types of figurative language have used global Reaction Time measurements for complete sentences (e.g. Gibbs 1984), but such coarse measurements may be unable to detect the small effects that differentiate the processing of statements that are both acceptable and differ only in the amount of cost associated with their interpretation. The use of word-by-word measurements, as in a Self-Paced Reading paradigm, allow the detection of the exact location of an effect, including where it begins to emerge and how long it persists (Dascal 1989).

Participants

Twenty-three native speakers of American English recruited from the study body of Yale University (13 female, age range 18 – 30 years, mean age 21 years) participated in the study. The data for one subject were excluded from analysis due to a technical failure, leaving a total of twenty-two subjects. All participants were right-handed, had no history of neurological disease or brain injury, and had normal or corrected-to-normal vision. All participants gave their written informed consent in accordance with the guidelines of the Human Subjects Committee of Yale University and were paid ten dollars for their participation.

Materials

A total of 230 experimental items were used. Metonymy and literal control experimental materials were divided into two different Types: 100 Producer-for-product experimental items, and 100 Circumstantial items. Items in each type consisted of 50 item pairs, with each pair containing a metonymy item and a matched literal control. All items contained 22 words or less. In a few cases, matched pairs consisted of an unequal total number of

words when a corresponding matched phrase consisted of two words in one condition and one word in the matched control sentence (e.g. the Noun Phrase “that man” matched to a NP consisting of a proper name). These were presented in a single window during testing.

Items within each pair were matched for number of words, valence, approximate number of characters, whether the metonymy or control was preceded by a preposition or a verb, and syntactic complexity within the crucial window (from the preposition or verb until the end of the sentence).

Each item was divided into two parts: the first half provided the context, and the second half introduced the metonymy or literal control. For the Producer-for-product type, the items were split into two separate sentences along these lines, with the first sentence presenting the context and the second sentence containing the metonymy or literal control. For the Circumstantial metonymy type, in order to provide the most natural environment possible for the Circumstantial items, the context portion of the item introduced a quote by identifying the location and the interlocutors in the present tense, which was then followed by a colon. The metonymy or literal control was then presented in quotation marks. A total of 33 original Reference Transfer items were created within these requirements.

For the Producer-for-product type, we used as our basis a portion of the materials presented by Frisson and Pickering (2007), a total of 48 experimental items from the Context-Supported and Context-Literal Novel Metonymy conditions. All items were edited from their original versions to contain 22 words or fewer, and they were matched for number of words within each pair. As our subject pool consisted of American university students, the materials were edited to be acceptable to native speakers of American English. All names were modified to be at least 8 characters long and were required to be easily pronounceable by American English speakers. An additional 6 triads were created in a similar style as the modified items and meeting the same stipulations outlined above, making a total of 30 original pairs for the Product-for-Producer Metonymy type.

In order to allow an additional level of contrast, 30 Nonsensical items were created by combining the first half of a Circumstantial metonymy item with the second

half (quote) of a different metonymy item. The context in these Nonsensical items was incompatible with a valid interpretation of the metonymy presented in the quote.

Following norming, the highest-rated items in both types were minimally modified to create a total of 50 experimental items per metonymy type, per Condition, for a total of 200 metonymy items. Table 1 provides examples of matched pairs for Metonymy and Literal experimental items in each metonymy type (Producer-for-product, Circumstantial), and an example Nonsensical item.

Table 1

Example items for each type (Producer-for-Product Metonymy; Circumstantial Metonymy) and condition (Metonymy or matched Literal control)

Type	Condition	Example Sentence
Product-for-producer Metonymy	Metonymy	Nowadays, most college students read the poems Martin Wickstrom wrote about England. They usually get to read Wickstrom when they are freshmen.
	Literal	Nowadays, most college students learn about martin Wickstrom and his unusual life. They sometimes get to meet Wickstrom when he gives lectures.
Circumstantial Metonymy	Metonymy	In a seafood restaurant, one waiter says to another: “The clam chowder at Table 3 ordered a glass of wine.”
	Literal	In a seafood restaurant, one waiter says to another: “The blonde lady at Table 3 ordered a glass of wine.”
Nonsensical		In a crowded Emergency Room, one nurse says to another: “The clam chowder at Table 3 ordered a glass of wine.”

Norming pretest

Norming was conducted using a separate group of 18-30 year-old native speakers of American English. Subjects were asked to rate experimental items on a scale of 1-5 in response to the question, “Does this sentence make sense?”

The 33 Circumstantial metonymy experimental items were divided into 9 norming surveys in combination with an additional contrast that was not used in the present study. Each survey was rated by 6 subjects who were not compensated, for a total of 54 norming participants. For Circumstantial metonymy, we compared ratings for Metonymy items to ratings for Nonsensical items, in which the context was explicitly incompatible with a relationship that would license the metonymical expression. We did not include Circumstantial metonymy literal control items in norming, as these items differed from their matched metonymy counterparts only in a single word or phrase and were expected to be at least as acceptable as metonymy items.

Subjects showed a significant effect of context (mean rating Nonsensical = 1.78/5; mean rating Metonymy = 4.53/5; $P < 0.001$). All Circumstantial Metonymy items received at least an average rating of 4.25 out of 5.

The Producer-for-Product items were split between two surveys in combination with another set of experimental items that was not used in this experiment. Each item was rated by 10 subjects who received compensation of \$5 for their participation, for a total of 20 norming participants. There was no statistically significant difference in the average ratings of the metonymy conditions versus literal matched control items (mean rating Metonymy = 4.49/5; mean rating Literal = 4.4/5; $P = 0.603$).

Design

Unique Self-Paced Reading Scripts were created for each participant. Prior to creating the scripts, each experimental item pair was randomly split between two sections, such that one item in each matched pair would be presented in section 1 of the study, and the other item in the matched pair would be presented in section 2. The presentation of the two sections alternated, so half of participants saw section 1 prior to section 2, and the other half of participants saw section 2 prior to section 1.

The remaining items in each of the two scripts were then pseudo-randomized for each subject, such that no two items of the same matched pair, or of the same base (i.e. minimally altered versions of the same item), would appear consecutively.

In order to ensure that subjects were reading and understanding the sentences, participants were asked to answer comprehension questions after approximately 78% of

item (180 out of a total of 230 experimental items) by pushing either the left or right “shift” key on a keyboard. Comprehension questions were spaced randomly across the total script. The questions were presented in their entirety on the screen and remained onscreen until the subject indicated their response. In order to prevent any systematic bias, half of the comprehension questions had an expected answer of “yes” and half had an expected answer of “no.” Approximately half of the questions queried the first half of the item (i.e. context), and the other half of the questions queried the second half of the item.

For those 50 items that did not have a question, a screen appeared with the text “Please take a moment, then press the SPACEBAR when you are ready to continue.” The items not followed by a question were distributed randomly throughout the experiment.

Procedure

Before the experiment started, participants were instructed orally and in writing about relevant aspects of the experimental procedure. During the experiment, they were seated in a comfortable chair in front of a computer screen in a darkened room. The experimental items appeared on the screen one at a time.

Stimuli were presented in a standard noncumulative moving-window self-paced reading paradigm using E-Prime software. For each item, a number of dashes representing the words in the item first appeared on the screen without revealing the actual words themselves. Participants could thus assess the length of sentences without being able to anticipate the exact nature of their contents. The participants’ task was to proceed through the sentence one word at a time by pressing the spacebar on a keyboard. Each time the spacebar was pressed, a new word would appear and the previous word would disappear.

Participants were told to read through the entire sentence in this manner, maintaining a reasonable reading speed and ensuring that they were able to understand all items. They were informed that they would be asked comprehension questions after most sentences to ensure that they were reading and understanding the stimuli.

Prior to testing, subjects completed a practice session comprised of five example sentences similar to those in the test materials. This was to ensure that subjects understood the paradigm and were comfortable with the task before beginning. Subjects were required to answer all comprehension questions in the practice session correctly before being allowed to begin the experiment.

Results

Behavioral Results

Subjects' correct answers to the comprehension questions were recorded individually. Subjects answered the majority of questions correctly, with an average score of 95%. Responses showed a significant effect of sensicality ($P = 0.033$). Within sensical conditions (i.e. all Metonymy items and Literal controls), a significant effect of condition was also observed ($P < 0.01$). Table 2 shows average correct responses by condition.

Table 2

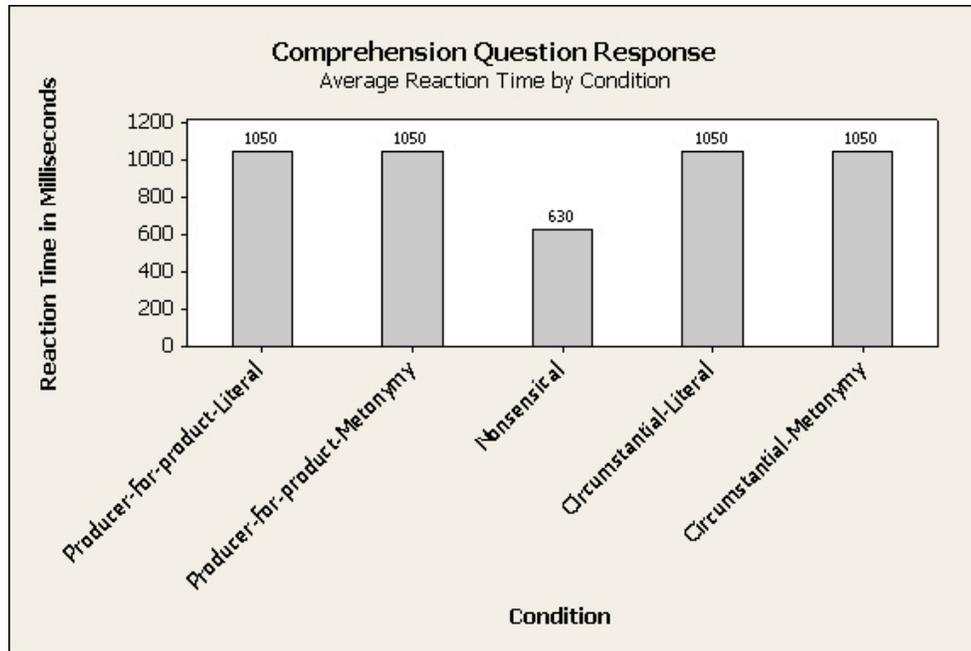
Mean correct responses to comprehension questions, by condition and type.

Type	Condition	Percent Correct
Product-for-producer Metonymy	Metonymy	97.14%
	Literal	93.80%
Circumstantial Metonymy	Metonymy	96.47%
	Literal	92.09%
Nonsensical		96.50%

Reaction Time for answering questions also showed significant effects of sensicality ($P = 0.01$) in that subjects took significantly less time to answer questions following Nonsensical items than sensical items. Within sensical items, there was no effect of condition observed in Reaction time ($P = 0.24$). Reaction Time data for behavioral responses is summarized in Figure 1.

Figure 1

Mean Reaction Times to comprehension questions, by condition and type.



Reading Time Results

Each subject's Reading Times were analyzed using a General Linear Model. Reading times were compared between metonymy and literal control for the critical word and surrounding words in each matched pair. For both metonymy condition, this was measured at five locations: the critical word (cw), plus or minus two words: cw-2, cw-1, cw, cw+1, cw+2. This allowed us to check reading times before the metonymy trigger or literal control (an effect was not predicted here) and compare them to the reading times from the metonymy trigger or literal control onward (an effect of condition was predicted here). Examples of the words measured at each location for each type are provided in Table 3.

For the Producer-for-product metonymy condition, the critical word was always the second instantiation of the proper name. For the Circumstantial Metonymy condition,

the critical word was measured as the point in the sentence at which a literal interpretation would no longer be valid.

Table 3

Sample of word-by-word comparison for analysis of Reading Times

Type	Condition	CW-2	CW-1	CW	CW+1	CW+2
Product-for-producer	Metonymy	to	read	Wickstrom	when	they
Metonymy	Literal	to	meet	Wickstrom	when	he
Circumstantial	Metonymy	at	table 3	ordered	a	glass
Metonymy	Literal	at	table 3	ordered	a	glass
Nonsensical		at	table 3	ordered	a	glass

Statistical analysis of Reading Time (RT) results was done using a General Linear Model. Table 4 shows the RTs for the five conditions tested at the five windows included in comparison. Pairwise comparison between all sensical metonymy conditions and the Nonsensical condition showed a significant effect of sensicality, which emerged at CW-2 and remained significant throughout the following windows. However, there was no significant difference in RTs for sensical and Nonsensical condition at the location of critical word. (CW-2: $P < 0.001$; CW-1: $P < 0.001$; CW: $P = 0.971$; CW+1: $P = 0.001$; CW+2: $P < 0.001$).

Comparison between RTs for the Circumstantial metonymy and literal conditions did not show a significant effect of condition at any window, nor did comparisons between the Producer-for-product metonymy and literal conditions (all $P > 0.05$).

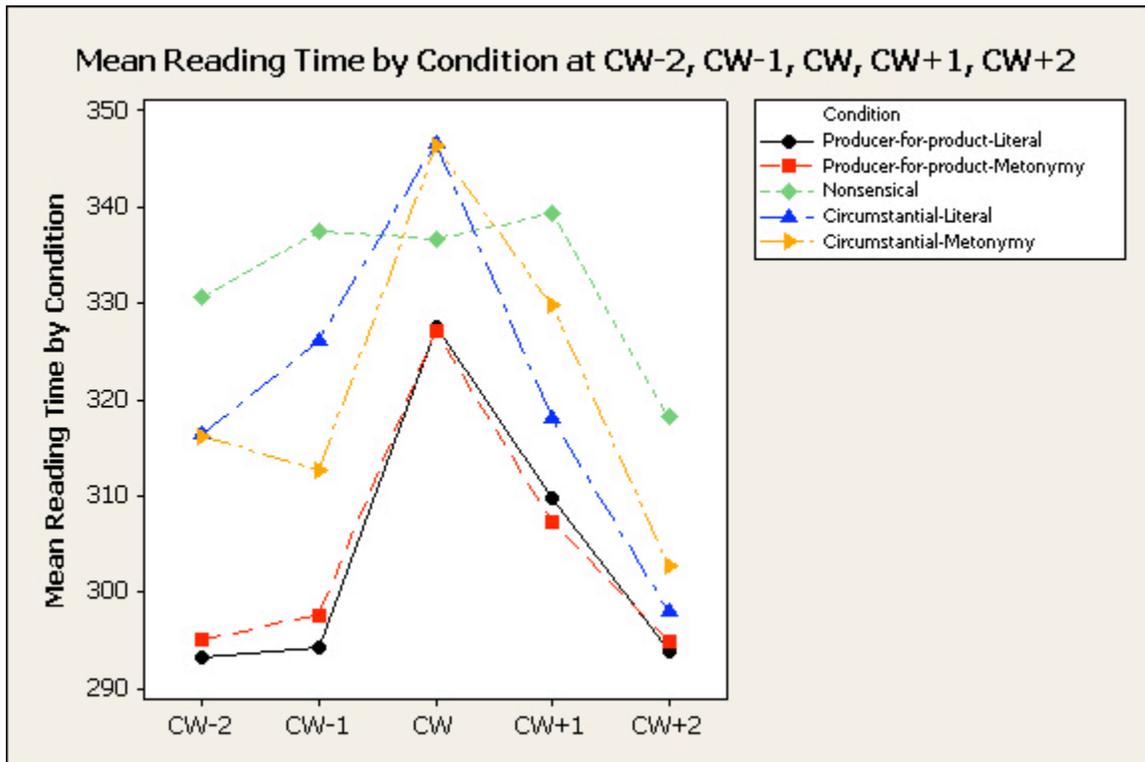
Table 4

Reading Times (Milliseconds) and Standard Deviations at compared windows
 Critical Word-2, Critical Word-1, Critical Word, Critical Word +1, and Critical Word +2

	CW-2		CW-1		CW		CW+1		CW+2	
Condition	Mean	StDev								
<i>Producer-for-product Metonymy</i>										
literal	293.24	85.74	294.35	91.85	327.53	138.76	309.75	86.67	293.81	98.59
metonymy	295.09	90.76	297.68	100.03	327.09	132.89	307.28	93.68	294.9	98.44
<i>Circumstantial metonymy</i>										
literal	316.32	139.98	326.17	155.47	346.6	215.81	318.02	130.94	297.96	106.38
metonymy	316.19	158.72	312.73	142.18	346.28	209.87	329.74	174.69	302.78	100.24
<i>Nonsensical</i>										
	330.61	165.17	337.42	174.12	336.63	155.26	339.26	166.76	318.17	129.57

Figure 2

Graph of Reading Times (Milliseconds) by Condition at compared windows
 Critical Word-2, Critical Word-1, Critical Word, Critical Word +1, and Critical Word +2



Discussion

The results reported here show that Reading Times for both Producer-for-product metonymy and for Circumstantial metonymy do not differ significantly from literal controls. These findings replicate previous investigations of metonymy showing that, when supported by robust context, utterances containing novel Producer-for-product metonymy do not elicit significantly greater processing cost than familiar metonymy items or literal controls (e.g. Frisson and Pickering 2007). The results here indicate that this may also be the case for Circumstantial metonymy.

It is possible that the reasons for a lack of effect are due to factors outside of the scope of this data. For instance, the critical word compared in the Circumstantial metonymy condition does not always clearly consist of a single word (such as a name, as in the Producer-for-product metonymy items). Rather, Circumstantial metonymy is licensed through the incongruent combination of several lexical items. For this reason, speakers may begin to build a metonymical interpretation of an utterance before the absolute trigger is reached, or may continue to compose meaning based on additional lexical items following the critical word. Consider, for example, the Circumstantial metonymy item in (5):

(5) In a seafood restaurant, one waiter says to another: “The clam chowder at Table 3 ordered a glass of wine.”

Though a metonymical interpretation of the Noun Phrase “the clam chowder” is irrefutably demanded by the semantic restrictions of the verb “ordered” (i.e. the requirement for an animate subject who would be capable of ordering), other features of the quotation, such as the fact that the NP “the clam chowder” appears in the subject position of the sentence, could indicate the possibility of a metonymical interpretation prior to this point. Effects of any additional processing cost for these items could therefore be diffused over several words and not detectible in Reading Time measurements.

Another possibility is of course that there is not a significantly greater overall cost of processing metonymy, either of the Circumstantial type or of the Producer-for-product type, when embedded within a robust context. Native speakers are routinely able to interpret these kinds of utterances, and our norming test ratings show that overall they are seen as acceptable. Assigning arguments to referents based on the salient properties of entities within the surrounding context is a necessary aspect of language use, therefore it is possible that this process does not engender a cost that is visible at the level of Reading Time measurements.

Though no effect was observed for metonymy conditions when compared with literal controls, an effect of sensicality was observed. Reading Times for the Nonsensical items were significantly longer than those for all sensical conditions, beginning from several words prior to the critical word. This is likely due to the fact that the inappropriateness of the quotation given the context that preceded it would have generally been apparent long before the presentation of the metonymy.

The overall Reading Times for Circumstantial metonymy items were somewhat higher than those for Producer-for product items in both metonymy and literal control conditions. This could potentially be due to a greater processing load required by reading a quote, or to an effect of the naturalness of reading these types of utterances. Alterations in the method of how subjects encounter the stimuli, such as hearing them uttered as part of a dialogue by multiple interlocutors or as part of a short film clip, present interesting future directions of research that could illuminate these possibilities.

Conclusion

The goal of the present study was to investigate the time-course of processing novel permanent and circumstantial metonymy when supported by context. Reading time results suggest that the processing cost associated with Circumstantial metonymy and Producer-for-product metonymy do not differ significantly from matched literal control items.

The relevance of how humans interpret metonymy and other kinds of figurative language has numerous applications. The capacity to build meaning for instances of

enriched composition draws on a variety of cognitive capacities, such as having a suitable Theory of Mind for one's interlocutor. Deficits in the processing of figurative language have been observed in certain patient populations, such as in individuals with William's Syndrome (Annaz et al. 2009; Carta et al. 1986). Our understanding of cognition as it pertains to these disorders and their relationship to the cognitive capacities subserving enriched composition, can therefore also potentially be informed by research in unimpaired speakers into the mechanism underlying these processes.

The relationships that govern the means by which native speakers construct meaning for various types of enriched composition rely not only on exclusively linguistic mechanisms, but also on conceptual mechanisms that are visible to the language system. In this way, investigating metonymy allows a glimpse into the conceptual space from which language gains meaning. The acceptability of novel Circumstantial metonymy as a whole indicates that the conceptual system underlying language, rather than being a black box of unknown "thought," is an organized space governed by knowledge of how the world works. This model of language is integrated into, rather than separate from, other cognitive systems.

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