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# Metaphor Comprehension: From Comparison to Categorization

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## Abstract

In this paper, we explore the relationship between metaphor and polysemy. We begin by discussing how novel metaphoric mappings can create new word meanings in the form of domain-general representations. Turning next to consider the implications of this view for the on-line comprehension of figurative language, we suggest that there is a shift from comparison processing to categorization processing as metaphors are conventionalized. Finally, we describe a series of experimental findings that support the proposed account.

## Introduction

Metaphors establish mappings between concepts from disparate domains of knowledge. For example, in the metaphor *The mind is a computer*, an abstract entity is described in terms of a complex electronic device. It is widely believed that metaphors are a major source of knowledge change, and a great deal of research has examined how metaphors can enrich and illuminate concepts that would otherwise remain vague or ambiguous. However, there have been far fewer explorations of a second generative function of metaphors – namely, lexical extension. In this paper, we will discuss (1) how novel metaphoric mappings can create new word meanings in the form of domain-general representations, and (2) how these new meanings may be applied during the comprehension of conventional metaphors. Before turning to these issues, however, it is necessary to consider the nature of metaphoric mappings in greater depth.

## Metaphor and Analogy

Metaphors are traditionally viewed as comparisons between the target (a-term) and the base (b-term). According to many early models, metaphors are understood by means of a simple feature-matching process (e.g., Miller, 1979; Or-

tony, 1979; Tversky, 1977). However, more recent versions of the comparison view have assumed that metaphors act to set up correspondences between partially isomorphic conceptual structures rather than between sets of independent properties (e.g., Gentner, 1983; Indurkha, 1987; Kitay & Lehrer, 1981; Lakoff & Johnson, 1980; Verbrugge & McCarrell, 1977). In other words, metaphor can be seen as a species of analogy.

We will use Gentner's (1983) *structure-mapping theory* to articulate the processes that may take place during metaphor comprehension. Structure-mapping theory assumes that interpreting a metaphor involves two interrelated mechanisms: alignment and projection. The alignment process operates in a local-to-global fashion to create a maximal structurally consistent match between two representations that observes *one-to-one mapping* and *parallel connectivity* (Falkenhainer, Forbus, & Gentner, 1989). That is, each object of one representation can be placed in correspondence with at most one object of the other representation, and arguments of aligned relations are themselves aligned. A further constraint on the alignment process is *systematicity*: Alignments that form deeply interconnected structures, in which higher-order relations constrain lower-order relations, are preferred over less systematic sets of commonalities. Once a structurally consistent match between the target and base domains has been found, further predicates from the base that are connected to the common system can be projected to the target as *candidate inferences*.

According to structure-mapping theory, metaphors often convey that a system of relations holding among the base objects also holds among the target objects, regardless of whether the objects themselves are intrinsically similar. Thus, the metaphor *Socrates was a midwife* highlights certain relational similarities between the individuals – both help others produce something – despite the fact that the arguments of these relations are quite different in the target

and base domains: Socrates helped his *students* produce *ideas*, whereas a midwife helps a *mother* produce a *baby*. The centrality of relations during metaphor comprehension has been confirmed by a number of studies. For example, people's interpretations of metaphors tend to include more relations than simple attributes, even for statements that suggest both types of commonalities (e.g., Gentner & Clement, 1988; Shen, 1992; Tourangeau & Rips, 1991). Further, Gentner & Clement (1988) found that the relationality of people's interpretations of metaphors was positively related to the judged aptness of these same metaphors.

### Metaphor and Polysemy

Like analogies, metaphors can lend additional structure to problematic target concepts, thereby making these concepts more coherent. However, this is not the only way in which metaphors can lead to knowledge change. Metaphors are also a primary source of polysemy – they allow words with specific meanings to take on additional, related meanings (e.g., Lakoff, 1987; Lehrer, 1990; Miller, 1979; Nunberg, 1979; Sweetser, 1990). For example, consider the word *roadblock*. There was presumably a time when this word referred only to a barricade set up in a road. With repeated metaphorical use, however, *roadblock* has also come to refer to any obstacle to meeting a goal (as in *Fear is a roadblock to success*).

How do metaphors create new word meanings? One recent and influential proposal is that such lexical extensions are due to stable projections of conceptual structures and corresponding vocabulary items from one (typically concrete) domain of experience to another (typically abstract) domain of experience (e.g., Lakoff, 1987; Lehrer, 1990; Sweetser, 1990). On this view, the metaphoric meaning of a polysemous word is understood directly in terms of the word's literal meaning.

We wish to consider an alternative account of the relationship between metaphor and polysemy – one that follows naturally from viewing metaphor as a species of analogy. Research on analogical problem solving has shown that the alignment of two relationally similar situations can lead to the induction of domain-general problem schemas that can be applied to future situations (e.g., Gick & Holyoak, 1983; Novick & Holyoak, 1991; Ross & Kennedy, 1990). We believe that similar forces are at work during metaphor comprehension. The central idea is that the process of structural alignment allows for the induction of metaphoric categories, which may in turn be lexicalized as secondary senses of metaphor base terms (Bowdle, 1998; Bowdle & Gentner, 1995, in preparation; Gentner & Wolff, 1997).

When a metaphor is first encountered, both the target and base terms refer to specific concepts from different semantic domains, and the metaphor is interpreted by (1) aligning the two representations, and (2) importing further predicates from the base to the target, which can serve to amplify the target representation. As a result of this mapping, the common relational structure that forms the basis of the metaphor interpretation will increase in salience relative to nonalignable aspects of the two representations. If the

same base term is repeatedly aligned with different targets so as to yield the same basic interpretation, then the highlighted system may become conventionally associated with the base as an abstract metaphoric category. At this point, the base term will be polysemous, having both a domain-specific meaning and a related domain-general meaning. We will refer to this proposed evolution as *the career of metaphor hypothesis*. (For related proposals, see Holyoak & Thagard, 1995; Murphy, 1996).

### Implications for Metaphor Comprehension

Research on metaphor comprehension often treats metaphor as an undifferentiated type of figurative language. However, a number of theorists have recently argued that metaphor is pluralistic, and that the manner in which a metaphor is comprehended may depend on its level of conventionality (e.g., Blank, 1988; Blasko & Connine, 1993; Giora, 1997; Turner & Katz, 1997). Our account of the relationship between metaphor and polysemy is in line with these claims. Specifically, we believe (1) that the process of conventionalization is essentially one of a base term acquiring a domain-general meaning, and (2) that this representational shift will be accompanied by a shift in mode of processing.

These ideas are illustrated in Figure 1, which shows how novel and conventional metaphors differ on the career of metaphor view. *Novel metaphors* involve base terms that refer to a domain-specific concept, but are not (yet) associated with a domain-general category. For example, the novel base term *glacier* (as in *Science is a glacier*) has a literal sense – “a large body of ice spreading outward over a land surface” – but no related metaphoric sense (e.g., “anything that progresses slowly but steadily”). Novel metaphors are therefore interpreted as comparisons, in which the target concept is structurally aligned with the literal base concept. However, metaphoric categories may arise as a byproduct of this comparison process.

In contrast to novel metaphors, *conventional metaphors* involve base terms that refer both to a literal concept and to an associated metaphoric category. For example, the conventional base term *blueprint* (as in *A gene is a blueprint*) has two closely related senses: “a blue and white photographic print in showing an architect's plan” and “anything that provides a plan.” Conventional base terms are polysemous, and the literal and metaphoric meanings are semantically linked due to their similarity. Conventional metaphors may therefore be interpreted either as comparisons, by matching the target concept with the literal base concept, or as categorizations, by seeing the target concept as a member of the superordinate metaphoric category named by the base term.

There is, however, reason to expect that comparison and categorization processing will not be favored equally for conventional metaphors. Let us assume that both meanings of a conventional base term are activated simultaneously during comprehension, and that attempts to map each representation to the target concept are made in parallel. Which of these mappings wins will depend on a number of factors, including the context of the metaphor and the

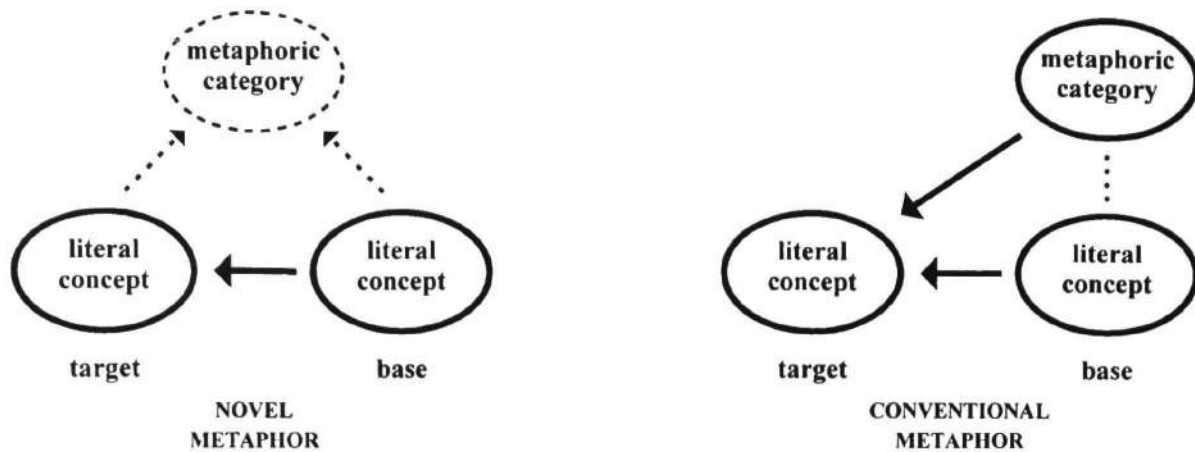


Figure 1. Novel and conventional metaphors.

relative salience of each meaning of the base term (Giora, 1997; Williams, 1992). All else being equal, however, aligning a target with a metaphoric category should be computationally less costly than aligning a target with a literal base concept. This is because metaphoric categories will be informationally sparser than the literal concepts they were derived from. Thus, the domain-general meaning of a conventional base term should be applied more rapidly than the domain-specific meaning, and conventional metaphors will more likely be interpreted as categorizations than as comparisons.

In sum, the career of metaphor hypothesis predicts that as metaphors become increasingly conventional, there is a shift in mode of processing from comparison to categorization (Bowdle, 1998; Bowdle & Gentner, 1995, in preparation; Gentner & Wolff, 1997). This is consistent with a number of recent proposals, according to which the interpretation of novel metaphors involves sense creation, but the interpretation of conventional metaphors involves sense retrieval (e.g., Blank, 1988; Blasko & Connine, 1993; Giora, 1997; Turner & Katz, 1997). On the present view, the senses retrieved during conventional metaphor comprehension are abstract metaphoric categories.

As described above, the career of metaphor hypothesis is related to an emerging alternative to comparison models of metaphor – namely, the position that metaphor is a species of categorization (e.g., Glucksberg & Keysar, 1990; Glucksberg, McGlone, & Manfredi, 1997; Honeck, Kibler, & Firment, 1987; Kennedy, 1990). On this view, the literal target and base concepts of a metaphor are never directly compared. Rather, the base concept is used to access or derive an abstract metaphoric category of which it represents a prototypical member, and the target concept is then assigned to that category. We suggest that this account is reasonably apt for conventional metaphors, but is incorrect for novel metaphors. Novel metaphors can only give rise to metaphoric categories once the original target and base concepts have been structurally aligned, and such categories do not initially contribute to the meaning of these metaphors.

### Evidence: The Metaphor/Simile Distinction

We now review some recent studies we have conducted that offer support for the processing claims made by the career of metaphor hypothesis. Central to the logic of these studies was the distinction between metaphors and similes.

Nominal metaphors (figurative statements of the form *X is Y*) can often be paraphrased as similes (figurative statements of the form *X is like Y*). For example, one can say both *The mind is a computer* and *The mind is like a computer*. This linguistic alternation is interesting because metaphors are grammatically identical to literal categorization statements (e.g., *A sparrow is a bird*), and similes are grammatically identical to literal comparison statements (e.g., *A sparrow is like a robin*). Assuming that form typically follows function in both literal and figurative language, metaphors and similes may tend to promote different comprehension processes. Specifically, metaphors should invite classifying the target as a member of a category named by the base, whereas similes should invite comparing the target to the base. This makes the metaphor-simile distinction a valuable tool for examining the use of comparison and categorization processing during figurative language comprehension.

In one set of experiments, we gave subjects novel and conventional figuratives phrased as both metaphors and similes, and asked them which form they preferred for each statement (Bowdle, 1998; Bowdle & Gentner, 1995, in preparation). We consistently found that the simile form was overwhelmingly preferred for novel figuratives, but that there was a move towards the metaphor form for conventional figuratives. This supports the career of metaphor hypothesis – if conventionalization results in a processing shift from comparison to categorization, then there should be a corresponding shift at the linguistic level from the comparison (simile) form to the categorization (metaphor) form.

In a second set of experiments, we collected subjects' comprehension times for novel and conventional figuratives phrased as either metaphors or similes (Bowdle, 1998;

Bowdle & Gentner, 1995, in preparation). We consistently found an interaction between conventionality and grammatical form – novel figuratives were comprehended faster as similes than as metaphors, whereas conventional figuratives were comprehended faster as metaphors than as similes. Again, this supports the career of metaphor hypothesis. If novel figuratives are processed strictly as comparisons, then novel similes should be easier to comprehend than novel metaphors. This is because only the simile form directly invites comparison. At the same time, if conventional figuratives can be processed either as comparisons or as categorizations due to the polysemy of their base terms, then conventional metaphors should be easier to comprehend than conventional similes. The metaphor form invites categorization, and will therefore promote a relatively simple alignment between the target and the abstract metaphoric category named by the base. The simile form invites comparison, and will therefore promote a more complex alignment between the target and the literal base concept.

### Experiment: In Vitro Conventionalization

The studies reviewed above support the claim that there is a processing shift from comparison to categorization as metaphors are conventionalized. However, because these experiments simply contrasted novel and conventional figurative statements, they do not address one of the central tenets of the career of metaphor hypothesis – namely, that it is the initial process of comparison that brings about this shift. According to the career of metaphor hypothesis, a metaphoric category is derived as a result of highlighting the common relational structure of the target and the literal base concept. If the same abstraction is derived repeatedly in the context of a given base term, then it will become lexicalized as a secondary sense of that term. In the present experiment, we directly tested these ideas. We examined whether subjects who saw multiple examples of novel similes using the same base term would derive an abstract schema and associate it with the base term. In essence, we aimed to speed up the process of conventionalization from years to minutes. We expected that after repeated comparisons involving a novel base, further figurative statements using the base will behave less like comparisons and more like categorizations. Specifically, we predicted a shift in preference from the simile form to the metaphor form.

The experiment was divided into two phases. In the study phase, subjects received triads of novel similes using the same base term. The first two similes in each triad contained different target terms but were similar in meaning. The third simile had a blank line in place of a target term. For example, a subject might receive the following set of novel similes:

- (a) *An acrobat is like a butterfly.*
- (b) *A figure skater is like a butterfly.*
- (c) \_\_\_\_\_ *is like a butterfly.*

Subjects were asked to consider the meaning of the first two statements carefully, and then to provide a target for the third statement that would make it similar in meaning to the

first two. We hypothesized that this procedure would promote conventionalization of the novel base terms.

In the test phase, subjects received novel and conventional figuratives in both the comparison (simile) form and the categorization (metaphor) form, and were asked to indicate the strength of their preference for one form versus the other. The key manipulation was that some of the novel figuratives in the test phase used base terms previously seen in the triads of novel similes, along with a new target term (e.g., *A ballerina is (like) a butterfly*). Our prediction was that subjects' preference for the metaphor form should be stronger when the novel base term had received the conventionalization manipulation than when it had not. On the surface, this prediction is counterintuitive – seeing a given base term in two similes might be expected to result in an increased preference for the simile form. Thus, the predicted shift from simile to metaphor would constitute strong support for the career of metaphor claim that metaphoric categories are created by the initial comparison process.

Such a shift could, however, occur for reasons other than schema abstraction. Having encountered a base term in one grammatical frame, subjects might simply prefer to see it in a different grammatical frame. To control for this possibility, some of the novel figuratives in the test phase contained base terms from triads of literal comparisons previously seen in the study phase. For example, subjects might see *a ballerina is (like) a butterfly* having previously seen the following set of literal comparisons:

- (a) *A bee is like a butterfly.*
- (b) *A moth is like a butterfly.*
- (c) \_\_\_\_\_ *is like a butterfly.*

If subjects simply prefer placing old base terms in new grammatical frames, then their preference for expressing novel figuratives as metaphors should be stronger if they use base terms that have previously been seen in literal comparisons. If not, then seeing the same base term in a triad of literal comparisons should have little or no effect on subjects' subsequent grammatical form preferences.

To ensure the generality of our results, we varied the degree of target concreteness for the figurative statements. Although most metaphors and similes involve relatively concrete base terms (e.g., Katz, 1989; Lakoff & Johnson, 1980), their target terms may be either abstract, as in *Time is (like) a river*, or concrete, as in *A soldier is (like) a pawn*. Subjects received both abstract and concrete targets paired with novel and conventional bases.

## Method

### Subjects

Forty-eight Northwestern University undergraduates participated in partial fulfillment of a course requirement.

### Materials and Design

Twenty-four novel figurative statements and 24 conventional figurative statements were used for the test phase. Each of these sets was further divided into 12 abstract and 12 concrete statements. During the test phase, each subject received all 48 figuratives in

both the comparison (simile) form and the categorization (metaphor) form.

The key manipulation occurred during the study phase, in which the 24 novel figuratives were assigned to one of three study conditions. In the *simile* condition, the original base term was paired with two new target terms to create two new similes (e.g., *Doubt is like a tumor, A grudge is like a tumor*). The two new similes were similar in meaning to one another as well as to the novel statement seen during the subsequent test phase (e.g., *An obsession is (like) a tumor*). Half the pairs of similes contained abstract targets, and half contained concrete targets, to match the concreteness of the corresponding test-phase statements. In the *literal comparison* condition, the original base term was paired with two new target terms to create two literal comparisons (e.g., *A blister is like a tumor, An ulcer is like a tumor*). The two literal comparisons were similar in meaning to one another, but different in meaning from the test-phase statement. Finally, in the *no prior exposure* condition, subjects did not receive any statements using the original base term. The study condition assignment of the novel figuratives was counterbalanced within and between subjects. Thus, each subject saw eight pairs of novel similes, and eight pairs of literal comparisons. In addition, each subject saw eight pairs of conventional metaphors (unrelated to the conventional figuratives used in the test phase) and eight pairs of literal categorizations as filler items. The filler items were like the experimental items in that the statements in each pair used the same base term, and were similar in meaning to one another. All pairs of statements were followed by a third statement with the same base term and grammatical form as the first two, but with a blank line in place of a target term.

### Procedure

For the study phase, each subject was given a booklet containing the 32 statement triads (two complete statements plus one incomplete statement) in a random order. Subjects were instructed that for each triad, they should read the first two statements carefully and then complete the third statement by writing a target term that would make it "similar in meaning to the first two". After subjects had completed the study phase, the booklets were removed and a 20-minute filler task was administered.

For the test phase, each subject was given a new booklet containing the 48 figurative statements in a random order. The statements were presented in both the comparison (simile) form and the categorization (metaphor) form, with the two grammatical forms separated by a 10-point numerical scale. Half the subjects received the comparison forms on the left and the categorization forms on the right, and half received the statements in the reverse order. Subjects indicated which form – comparison or categorization – they felt was more natural or sensible for each pair by circling a number on the 10-point scale. They were told that the stronger their preference for the form on the left, the closer their answer should be to 1, and the stronger their preference for the form on the right, the closer their answer should be to 10.

### Results and Discussion

Table 1 shows the mean grammatical form preference ratings from the test phase, transformed so that higher numbers indicate a preference for the categorization (metaphor) form over the comparison (simile) form. Focusing solely on the novel figuratives, a 3 (study condition: simile, literal comparison, no prior exposure) x 2 (concreteness: abstract, concrete) repeated measures analysis of variance (ANOVA) was conducted on the subject means. There was a main

effect of study condition,  $F(2, 94) = 3.87, p < .05$ . As predicted, the preference for the categorization form was significantly higher when the base terms had previously been seen in novel similes than when there had been no prior exposure to the base terms ( $M = 3.87$  versus  $M = 3.52$ ),  $t(47) = 2.67, p < .025$ . In contrast, when the base terms had been previously seen in literal comparisons, the grammatical form preference rating ( $M = 3.62$ ) did not differ from that of the baseline condition. There was no main effect of concreteness, and no interaction between these two factors.

TABLE 1  
Mean Preferences for the Categorization Form (and Standard Deviations) as a Function of Conventionality, Concreteness, and Study Condition

Conventionality Study Condition	Concreteness	
	Abstract	Concrete
Novel	3.69 (1.14)	3.65 (1.23)
Simile	3.84 (1.44)	3.90 (1.66)
Literal Comparison	3.66 (1.33)	3.58 (1.27)
No Prior Exposure	3.57 (1.41)	3.47 (1.26)
Conventional	6.16 (1.28)	6.10 (1.26)

These results are consistent with the career of metaphor claim that metaphoric categories are derived as a consequence of comparing the target and base of a novel figurative statement, which in turn allows for a shift towards categorization processing as the statement is conventionalized. Encountering a set of novel similes using the same base term encouraged the creation of an abstract schema as a kind of incipient secondary meaning of the base term, and led to a greater preference for the metaphor form of subsequent figurative statements involving that term. Indeed, this finding is particularly striking when one considers that subjects only received three novel similes for any given base term in the study phase. Thus, although novel metaphor bases may typically take years to be conventionalized, the evolutionary path described by the career of metaphor hypothesis can be sped up if the base is consistently aligned with a number of different targets within a short period of time.

Turning now to consider the entire set of data, a 2 (conventionality: novel, conventional) x 2 (concreteness: abstract, concrete) repeated measures ANOVA was conducted on the subject means. The preference for the categorization form was much higher for the conventional figuratives ( $M = 6.13$ ) than for the novel figuratives ( $M = 3.67$ ),  $F(1, 47) = 214.51, p < .001$ . That is, the move from novel to conventional figuratives was accompanied by a shift from similes to metaphors. This is as predicted by the career of

metaphor hypothesis, and replicates the findings of the grammatical form preference experiments reviewed earlier. There was no main effect of concreteness, and no interaction between these two factors.

### Conclusions

By viewing metaphor as a species of analogy, two generative functions of metaphors can be explained – namely, the structural enhancement of target concepts, and the lexical extension of base terms. In this paper, we have focused on the latter of these two functions, and have discussed the relationship between polysemy and conventionality in metaphors. The career of metaphor hypothesis outlined here seeks to offer a more complete theoretical framework for metaphor comprehension by describing the kinds of representational and processing changes that occur as metaphors are conventionalized.

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