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The Career of Metaphor

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A central question in metaphor research is how metaphors establish mappings between concepts from different domains. The authors propose an evolutionary path based on structure-mapping theory. This hypothesis—the career of metaphor—postulates a shift in mode of mapping from comparison to categorization as metaphors are conventionalized. Moreover, as demonstrated by 3 experiments, this processing shift is reflected in the very language that people use to make figurative assertions. The career of metaphor hypothesis offers a unified theoretical framework that can resolve the debate between comparison and categorization models of metaphor. This account further suggests that whether metaphors are processed directly or indirectly, and whether they operate at the level of individual concepts or entire conceptual domains, will depend both on their degree of conventionality and on their linguistic form.

Over the past two decades, the cognitive perspective on metaphor has undergone a radical shift. Traditionally, metaphors have been treated as both rare in comparison to literal language and largely ornamental in nature. Current research suggests precisely the opposite. Rather than being restricted to poetic uses, metaphor is common in everyday communication (e.g., Graesser, Long, & Mio, 1989; Pollio, Barlow, Fine, & Pollio, 1977; Smith, Pollio, & Pitts, 1981). For example, in an analysis of television programs, Graesser et al. (1989) found that speakers used approximately one unique metaphor for every 25 words. A growing body of linguistic evidence further suggests that metaphors are important for communicating about, and perhaps even reasoning with, abstract concepts such as time and emotion (e.g., Kovecses, 1988; Lakoff & Johnson, 1980; Quinn, 1987; Reddy, 1979; Sweetser, 1990). Indeed, studies of scientific writing support the notion that far from being mere rhetorical flourishes, metaphors are often used to invent, organize, and illuminate theoretical constructs (e.g., Boyd, 1979; Gentner & Grudin, 1985; Hoffman, 1980; Kuhn, 1979; Roediger, 1980; Sternberg, 1995). For example, Gentner and Grudin (1985) found that the nature of mental metaphors used by psychologists has shifted over time from *animate-being* metaphors (e.g., *ego defenses*) and *spatial* metaphors (e.g., *connections between ideas*) to *systems* metaphors (e.g., *attentional switchboards*), simultaneously reflecting and motivating the conceptual evolution of psychological models. More recently, Cooke and Bartha (1992) found that the use of such mental metaphors by psychology students actually tends to increase with expertise. These observations underscore Ortony's (1975) claim that "metaphors are necessary and not just nice" (p. 45).

The growing recognition of the importance of metaphor in language and thought has resulted in a proliferation of studies on the cognitive processes involved in metaphor comprehension (e.g., Pollio, Smith, & Pollio, 1990). A basic assumption that grounds the vast majority of this research is that metaphors establish correspondences between concepts from disparate domains of knowledge. For example, consider the well-known metaphor *The mind is a computer*. The *target* (the first term or topic) of this metaphor refers to an abstract entity, and the *base* (the second term or vehicle) refers to a complex electronic device. Such juxtapositions distinguish metaphors from literal comparison statements (e.g., *A mallet is like a hammer*) and literal categorization statements (e.g., *A mallet is a tool*), in which the target and base representations typically belong to the same semantic domain. Like literal comparison and categorization statements, however, metaphors convey that certain aspects of the base also apply to the target. Indeed, in spite of (or perhaps because of) the semantic distance between their terms, metaphors are often more effective instigators of conceptual change than are their literal counterparts. For example, the computer metaphor of mind has had a profound impact on psychology in suggesting that cognition is a form of information processing involving symbol manipulation, serial processing stages, and so on.

Yet despite the widespread acceptance of viewing metaphors as cross-domain mappings, there is little consensus on how these mappings take place. Our goal in this article is to uncover the mechanisms of metaphoric processing. We begin by reviewing two existing approaches to metaphoric mappings, of which the first treats metaphors as figurative comparison statements and the sec-

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ond treats metaphors as figurative categorization statements. We then offer a hybrid account of metaphor comprehension based on Gentner's (1983) structure-mapping theory of analogy. One central claim is that as metaphors are conventionalized, there is a shift in mode of processing from comparison to categorization. In the empirical section of this article, we present four tests of this claim. Finally, after discussing methodological implications of this work, we use the proposed theoretical framework to explore two additional questions about metaphor comprehension. First, are metaphoric mappings established directly or indirectly?—That is, are nonliteral comprehension processes automatic and immediate, or do they only kick in once literal ones have failed? And second, does the act of placing two concepts in metaphoric correspondence involve creating or accessing a more global domain mapping? For example, might hearing the metaphor *Love is a rose* invoke links between other concepts from the target domain of emotions and the base domain of plants (e.g., *jealousy* → *weed*)?

Two Views of Metaphoric Mappings

Metaphors Express Similarities

The standard approach to metaphor comprehension treats metaphors as comparisons that highlight preexisting but potentially obscure similarities between the target and base concepts. The process is assumed to be one of feature matching (e.g., M. G. Johnson & Malgady, 1980; Malgady & Johnson, 1980; Miller, 1979; Ortony, 1979; Tversky, 1977). For example, the interpretation of the metaphor *Dew is a veil* would be given by the overlapping properties of the target and base, as shown in Figure 1. The notion that metaphors express similarities between semantically distant concepts is intuitively appealing—it dates back at least as far as Aristotle's *Poetics* and has some empirical support. The degree of similarity between target and base has been found to be positively related to the aptness and interpretability of metaphors (M. G. Johnson & Malgady, 1979; Malgady & Johnson, 1976; Marschark, Katz, & Paivio, 1983) and to the speed of metaphor comprehension (Gentner & Wolff, 1997).

Nevertheless, this view of metaphoric mappings has been criticized on several grounds (e.g., Glucksberg & Keysar, 1990; Lakoff & Johnson, 1999; Tourangeau & Sternberg, 1981, 1982).

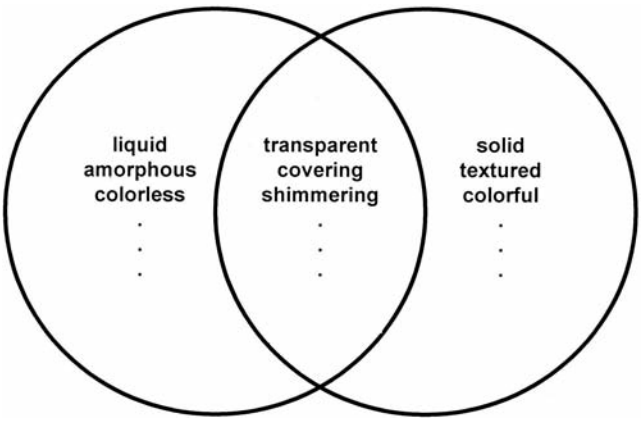

Figure 1. A feature-matching interpretation of the metaphor *Dew is a veil.*

One criticism concerns property selection: Whereas feature-matching models equate figurative meanings with sets of common properties, not every property shared by the target and base of a metaphor will necessarily enter into its interpretation. For example, both dew and veils are inanimate, and both are silent, but neither of these common properties seems relevant to the meaning of *Dew is a veil*. A second criticism concerns the issue of asymmetry: Although the order in which two items are compared should not influence their degree of property overlap, metaphors often cannot be reversed or change their meaning (e.g., Conner & Kogan, 1980). For example, whereas *Dew is a veil* is a meaningful figurative statement, *A veil is dew* seems nonsensical.

Of course, neither of the above criticisms is necessarily fatal to standard comparison theories. Ortony (1979) has argued that metaphoric feature matching is constrained by *salience imbalance*: Only those common properties that are significantly more salient for the base concept than for the target concept will be relevant to the meaning of a metaphor. On this view, *Dew is a veil* elicits the common property *covering* but not the common property *silent* because the former is of high salience for the base and of low salience for the target, whereas the latter is of low salience for both items. Likewise, this metaphor cannot be reversed because there are no common properties that are significantly more salient for dew than for veils. The notion of salience imbalance has the advantage of pointing toward one way in which metaphors can be informative—they can focus the hearer's attention on aspects of the target concept that might otherwise be ignored because of their low salience. Further, some studies have confirmed that the matching properties selected during comprehension are often less salient for the target than for the base, not only for metaphors (Katz, 1982; Ortony, Vondruska, Foss, & Jones, 1985; but see also Gentner & Clement, 1988; Tourangeau & Rips, 1991) but also for literal similarity comparisons (Medin, Goldstone, & Gentner, 1993).

There are, however, two additional aspects of metaphoric mappings that seem incompatible with feature-matching models, even with the addition of constraints such as salience imbalance. First, because the target and base concepts of metaphors are typically from different semantic domains, metaphors may establish correspondences between nonidentical, domain-specific properties. For example, the metaphor *Men are wolves* can be interpreted as meaning that both men and wolves are predatory, but the social predation of men is manifestly different from the carnivorous predation of wolves. Because feature-matching models treat nonidentical properties as distinctive rather than common, they do not predict the inclusion of such matches in the interpretation of a metaphor. Second, and more seriously, metaphoric mappings often involve the projection of new information from the base to the target. The computer metaphor of mind was not informative because it simply highlighted certain well-known aspects of the mind that were also true of computers but rather because it promoted a transfer of knowledge from the domain of computers to that of minds. Feature-matching models provide no mechanism for the projection of such distinctive base properties. Nor do they suggest any means for predicting which distinctive base properties will be inferred of the target. For example, computers are typically obsolete within a few years of being manufactured, but this salient fact is irrelevant to the meaning of *The mind is a computer*. Whereas standard comparison models allow for the identification of preex-

isting similarities between a target and a base, they do not explain how metaphors can lead to the creation of new similarities, either by establishing matches between nonidentical properties or by generating new inferences about their targets.

Metaphors Express Category Memberships

Given the limitations of feature-matching models, a number of researchers have recently proposed that metaphors are not understood as comparison statements but rather as categorization statements (e.g., Glucksberg & Keysar, 1990; Glucksberg, McGlone, & Manfredi, 1997; Honeck, Kibler, & Firment, 1987; A. T. Johnson, 1996; Kennedy, 1990). That is, metaphors establish taxonomic relations between semantically distant concepts. According to Glucksberg and Keysar (1990), the literal target and base concepts of a metaphor are never placed in direct correspondence during metaphor comprehension. 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. On this view, metaphors differ from literal categorization statements in that metaphors involve *dual reference*: The base term refers simultaneously to a specific literal concept and a general metaphoric category.

To illustrate this approach, consider the metaphor *My job is a jail*. The base term *jail* literally refers to a building that is used to detain criminals and therefore does not seem immediately applicable to the target term *my job* (assuming that the speaker does not actually work inside a jail). On the categorization view, then, comprehension of the statement requires that one use the base concept to elicit a metaphoric category that it typifies—namely, *any situation that is unpleasant and confining*. If this category is already associated with the base concept, then it is simply accessed during comprehension. If, however, the category is not well established, then it must be abstracted online, much as people may create literal ad hoc categories to achieve certain goals (Barsalou, 1983, 1987). In either case, once the metaphoric category has been elicited, the target can be understood as a member of the category. This sets up the kind of inheritance hierarchy that is implicit in all taxonomic relations. Consequently, all properties characterizing the metaphoric category named by *jail* are attributed to the subordinate concept *my job*.

Categorization models can account for many aspects of metaphoric mappings that are troublesome for feature-matching models. First, because the target concept is never actually compared with the literal base concept, there is no need to explain why not every property shared by the target and base will be relevant to the meaning of the metaphor. Second, because metaphors express category memberships and because taxonomic relations are intransitive (e.g., compare *A mallet is a tool* with *A tool is a mallet)*, metaphors will naturally be nonreversible. Third, because properties of categories are automatically inherited by subordinate concepts, metaphors can transfer new information to their targets. A further advantage of this view of metaphoric mappings is that it would seem to explain why metaphors such as *My job is a jail* have the same grammatical form as literal categorization statements—a point that we return to shortly.

Nevertheless, categorization models are not without their own difficulties (e.g., Gibbs, 1992). A central claim of such models is that the base concept of a metaphor elicits a metaphoric category without input from the target and that this abstraction provides the gist of the expression. But if comprehension begins with abstraction from the base, how does the hearer arrive at the appropriate metaphoric category? Consider, for instance, the potential metaphor base *snowflake*, which literally refers to a crystal of snow. In the absence of a corresponding target concept, this base does not seem to suggest any particular metaphoric category. Indeed, pairing this base with two semantically related targets can lead to two different meanings: The metaphor *A child is a snowflake* implies that each child is unique, whereas the metaphor *Youth is a snowflake* implies that youth is ephemeral. On the categorization view, this semantic flexibility would indicate that the base concept has elicited a different metaphoric category for each expression, but clearly the relevant category could not have been uniquely generated prior to attending to the target concept.

Recognizing this problem, Glucksberg et al. (1997) have proposed a more sophisticated version of the categorization view, the *interactive property attribution model*. According to this model, metaphor targets and bases play distinct but interacting roles: Whereas the base suggests metaphoric categories, the target simultaneously suggests dimensions of applicability. In other words, metaphor targets provide information about what types of properties they can meaningfully inherit and therefore about what types of categories they can meaningfully belong to. A further claim made by Glucksberg et al. is that base concepts need not typify just one metaphoric category but rather can elicit multiple abstractions in parallel. Thus, because different targets (e.g., *child*, *youth*) will tend to suggest different dimensions of applicability, they can select different metaphoric categories named by the same base term (e.g., *snowflake*).

Glucksberg et al.'s (1997) assertion that the target and base terms of a metaphor play different roles during comprehension is quite reasonable—after all, metaphors often involve a transfer of knowledge from the base to the target. To account for the semantic flexibility of metaphor bases, however, the interactive property attribution model would seem to place unreasonable demands on a hearer's mental capacity. This is because many base concepts can suggest a potentially unlimited number of ad hoc categories. For example, the categories that might reasonably be evoked by the concept *snowflake* would include not only *things that are unique* and *things that are ephemeral* but also *things that are delicate*, *things that are white*, *things that are wintry*, *things that fall gently from the sky*, and *things that accumulate to change the landscape*. During comprehension, the hearer would have to generate and maintain all of these metaphoric categories (as well as the initial base concept) while the target concept is scanned for dimensions of applicability. Once the relevant category has been selected, all competing categories would then have to be suppressed.

We believe that a more parsimonious way to address the flexibility of metaphoric mappings would involve allowing the target concept to interact with the base concept itself, rather than with the entire set of possible metaphoric categories that the base concept typifies. What is needed, then, is an account that enables the target and base concepts to be placed in immediate correspondence without falling prey to the problems that have plagued feature-matching models of metaphor. In the following section, we describe just such an account.

The Analogical Turn

As discussed above, some researchers have used the limitations of feature-matching models to argue that cross-domain mappings between metaphor targets and bases are mediated by abstract metaphoric categories. Other researchers, however, have argued for a less radical alternative to feature-matching models, in which correspondences are established between partially isomorphic conceptual structures of the target and base rather than between sets of independent properties (e.g., Gentner, 1982, 1983; Gentner, Bowdle, Wolff, & Boronat, 2001; Holyoak & Thagard, 1995; Indurkhya, 1987; Kittay & Lehrer, 1981; Murphy, 1996; Verbrugge & McCarrell, 1977). From this viewpoint, metaphor can be seen as a species of analogy.

We use Gentner's (1983) *structure-mapping theory* to articulate this approach to metaphor comprehension. Structure-mapping theory assumes that interpreting a metaphor involves two interrelated mechanisms: alignment and projection. The alignment process operates 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 element of one representation can be placed in correspondence with at most one element of the other representation, and arguments of aligned relations and other operators 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 representations has been found, further elements from the base that are connected to the common system can be projected to the target as *candidate inferences*.

The Structure-Mapping Engine (SME) is a computational model that simulates this comparison process (Falkenhainer et al., 1989; Forbus, Gentner, & Law, 1995). In the first stage, SME begins blind and local by matching all identical predicates in the representations being compared. This initial mapping is typically inconsistent, containing many-to-one matches. In the second stage, these local matches are coalesced into structurally consistent connected clusters, called *kernels*, by enforcing one-to-one mapping and parallel connectivity. In the third stage, SME gathers these kernels into one or a few global interpretations. This is done using a *greedy merge* algorithm. It begins with the maximal kernel and then adds the largest kernel that is structurally consistent with the first one, continuing until no more kernels can be added without compromising consistency. It then carries out this process beginning with the second largest kernel to produce a second interpretation and so on. At this point, SME produces a structural evaluation of the interpretation or interpretations, using a kind of cascadelike algorithm in which evidence is passed down from predicates to their arguments. This method is used because it favors deep systems over shallow systems, even given equal numbers of matches. Up to this point, the mapping process has been nondirectional. Now, however, a directional inferences process takes place. Predicates connected to the common structure in the base, but not initially present in the target, are projected as candidate inferences about the target.

To better illustrate this approach to metaphoric mappings, consider *Socrates was a midwife*—a metaphor that was first used in Plato's *Theaetetus* and that has been examined in depth by Kittay and Lehrer (1981). Given the simple target and base representations shown in Figure 2, structure-mapping theory and SME predict the following sequence of events during the interpretation of the metaphor. First, the identical predicates in the target and base concepts (i.e., the relations *helps* and *produce*) are matched, and the arguments of these predicates are placed in correspondence by parallel connectivity: *midwife* → *Socrates*, *mother* → *student*, and *child* → *idea*. Next, these local matches are coalesced into a global system of matches that is maximally consistent. Finally, predicates that are unique to the base but connected to the aligned structure (i.e., those predicates specifying the gradual development of the child within the mother) are carried over to the target. Thus, the metaphor could be interpreted as meaning something like, "Socrates did not simply teach his students new ideas but rather helped them realize ideas that had been developing within them all along."

According to structure-mapping theory and other analogical accounts, metaphors typically 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 (e.g., Gentner et al., 2001; Gentner & Markman,

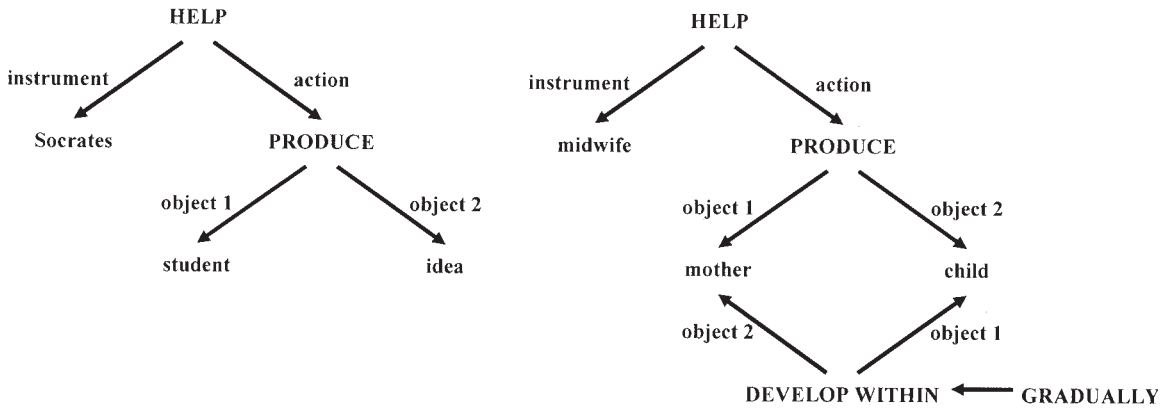

Figure 2. Target and base representations for the metaphor *Socrates was a midwife*.

1997). In fact, the centrality of relational predicates in metaphor comprehension has been confirmed by several recent studies. For example, people's interpretations of metaphors tend to include more relations than simple attributes, even for statements like *Tree trunks are drinking straws* in which both types of commonalities seem potentially salient (e.g., Gentner & Clement, 1988; Shen, 1992; Tourangeau & Rips, 1991). Further, Gentner and Clement (1988) found that the relationality of people's metaphor interpretations was positively related to the judged aptness of these same metaphors.

This relational focus allows structure-mapping theory and kindred models to meet many of the challenges posed to standard comparison theories of metaphor comprehension, but without requiring the additional processing step of deriving a metaphoric category from the base concept. The problem of property selection is solved because only those common elements that are part of the maximal structurally consistent match will be included in a metaphor's interpretation. Thus, although both Socrates and midwives breath air, this shared property does not contribute to the meaning of *Socrates was a midwife* because it is not relevant to the aligned system shown in Figure 2. The problem of establishing correspondences between nonidentical, domain-specific properties is also solved because distinctive elements can be aligned if they play common relational roles in the target and base. Thus, the alignment of *child* and *idea* in the above example was determined by their participation in like relational structures, and not by any physical similarities between the two entities. In some cases, such matching elements may even undergo *rerepresentation* to improve the quality of the alignment—that is, implicit identities within the common system may be rendered explicit (e.g., Forbus et al., 1995; Kotovsky & Gentner, 1996; Yan, Forbus & Gentner, 2003). A principal mode of rerepresentation is what Clement, Mawby, and Giles (1994) called *generalization by abstraction*, in which distinctive semantic features of nonidentical predicates are omitted so that identities at a higher level of representation are obtained. For example, the fact that both the target and base representations in Figure 2 contain the identical relation *produce* could be seen as the outcome of rerepresenting two different, domain-specific relations—*realize* in the target (as in "Socrates helped his students realize ideas") and *give birth to* in the base (as in "A midwife helps a mother give birth to a child"). Such rerepresentations could account for the occurrence of *emergent properties*, or properties not directly associated with isolated target and base terms, in people's interpretations of metaphors (Black, 1962; Tourangeau & Rips, 1991).

A further advantage of treating metaphors as analogies is the provision of a constrained mechanism for projecting candidate inferences. Specifically, distinctive elements of the base can be transferred to the target to the extent that they are connected to the common relational system. This mechanism also offers a plausible explanation of metaphoric asymmetries. Because inferences flow from the base to the target and assuming that people expect metaphors to be informative, reversed metaphors will be unacceptable whenever there are no distinctive properties of the original target concept that can plausibly be inferred of the original base concept (Bowdle & Gentner, 1997). If this is true, then it should follow that metaphoric asymmetries arise late in the course of metaphor comprehension—according to structure-mapping theory, inference projection takes place following the initial stage of structural alignment, which is itself a symmetric matching process (see Wolff & Gentner, 2000). In fact, this prediction has been confirmed by Wolff and Gentner (2004), who found that people responded to reversed metaphors as meaningful when given rapid deadlines (i.e., less than 1,200 ms), but not when allowed to fully process the statements. Critically, these findings are inconsistent with categorization models of metaphor, which require that the target and base play distinct roles—and are therefore not reversible—from the very outset of comprehension.

Indeed, analogical accounts of metaphor comprehension offer a computationally more tractable explanation of the flexibility of metaphoric mappings than do categorization models. Consider again *A child is a snowflake* and *Youth is a snowflake*. On the present view, these metaphors suggest different meanings not because the targets make different selections from among multiple metaphoric categories abstracted from the base but rather because the metaphors invite alignments among different systems of predicates. Specifically, the concept *child* includes the knowledge that all children are special, whereas the concept *youth* includes the knowledge that youth is a temporary state. These two targets will therefore tend to align with distinct aspects of the base concept *snowflake*, resulting in different interpretations.

The analogical approach to metaphoric mappings implies that contrary to the claims of categorization models, metaphors can indeed be understood by directly linking concepts from different domains of knowledge. In this sense, the present view may be seen as an extension of the standard comparison theories reviewed earlier, albeit one using more dynamic and inferentially productive mechanisms than a simple feature-matching process. Of course, one might argue that these mechanisms are far removed from what is commonly meant by "comparison" and that metaphors should not be classified as such (e.g., Holyoak & Thagard, 1995; Lakoff & Johnson, 1999). However, a growing body of evidence suggests that even the comprehension of literal similarity comparisons such as *A zebra is like a horse* involves structural alignment and inference projection rather than mere feature matching (e.g., Bowdle & Gentner, 1997; Jameson & Gentner, 2003; Markman & Gentner, 1993, 2000; Medin et al., 1993). To therefore claim that literal comparisons are also not really comparisons would be absurd. We would argue that literal comparisons, analogies, and metaphors all rely on the same basic mechanisms, with analogies and metaphors more likely to focus on relational commonalities and metaphors more likely to involve cross-domain mappings.

If we accept that metaphors can be understood as figurative comparison statements, does this mean that categorization is irrelevant to metaphoric mappings? We believe that the answer is no. In the following section, we argue that categorization may come to play an increasing role during comprehension as metaphors are conventionalized. Going further, we propose that it is the initial act of comparison that gives rise to conventional metaphoric categories.

Conventionality, Polysemy, and Metaphor Comprehension

Comparison and the Induction of Metaphoric Categories

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 may lead to knowledge change. It is often claimed that metaphors are a

primary source of polysemy—they allow words with certain specific meanings to take on additional, related meanings (e.g., Gibbs, 1994, 1996; 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 the road. With repeated use as the base term of metaphors such as *Fear is a roadblock to success*, however, *roadblock* has also come to refer to any obstacle to meeting a goal. Likewise, the term *gold mine*, which literally refers to a hole in the ground from which gold is excavated, has over time acquired the more figurative sense *anything that is a source of something valuable*.

What is interesting about these and other examples of metaphoric polysemy is that the secondary, figurative senses are typically more abstract than the original word senses. That is, the derived meanings strongly resemble the types of metaphoric categories described by Glucksberg and Keysar (1990) and other proponents of categorization models. But if metaphors are processed as comparisons, as we have argued, how do they give rise to such abstractions? We believe that the answer to this question 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 do more than simply provide a solution to the target problem—such alignments may also lead to the induction of abstract problem schemas that can be applied to future situations (e.g., Bassok & Holyoak, 1989; Brown, Kane, & Echols, 1986; Gentner, Loewenstein, & Thompson, (2003); Gick & Holyoak, 1983; Kotovsky & Gentner, 1996; Novick & Holyoak, 1991; Ross & Kennedy, 1990). For example, Gick and Holyoak (1983) found that people were better able to solve Duncker's (1935/1945) radiation problem when they had previously studied two analogous convergence problems—one involving a general trying to overtake a fortress by dividing his army into several small groups and one involving a firefighter trying to extinguish an oil-well fire by using several small hoses—than when they had studied only one such problem. Gick and Holyoak claimed that prior comparison of the two analogous problems led to the creation of a convergence schema that captured the common relational structure of the problems. Because this schema eliminated domain-specific details of the original convergence problems, it was easier to align with the new radiation problem than the original problems would have been. In other words, the radiation problem could be solved simply by seeing it as an instance of this abstract problem category.

We propose that similar forces are at work during metaphor comprehension. When a metaphor such as *An obsession is a tumor* is first encountered, both the target and base terms refer to specific concepts from different semantic domains, and the metaphor is interpreted by (a) aligning the two representations and (b) importing 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's interpretation will increase in relative salience. That is, the aligned system of predicates will become more strongly activated, and nonalignable predicates will be suppressed (Gernsbacher, Keysar, & Robertson, 1995). As in analogical problem solving, this may lead to the induction of an abstract relational schema that preserves only identical elements of the target and base, including any initially nonidentical predicates that have been successfully rerepresented. The comparison has created a common metaphoric category for the target and base concepts. Now suppose that the base of the metaphor, having been found to convey useful information about the target, is figuratively compared with a range of new targets in future discourse (e.g., *Doubt is a tumor*, *A grudge is a tumor*). If these new alignments yield the same basic interpretation as the original alignment—that is, if the same abstract relational schema is repeatedly derived or activated in the context of the base—then the abstraction may become conventionally associated with the base. At this point, the base term will be polysemous, having both domain-specific meaning and a related domain-general meaning. In other words, the base term will have achieved the type of dual reference described by Glucksberg and Keysar (1990). We refer to this evolution toward metaphoric polysemy as *the career of metaphor* (Bowdle, 1998; Bowdle & Gentner, 1995; Gentner & Bowdle, 2001; Gentner & Wolff, 1997). (For related proposals, see Holyoak & Thagard, 1995, and Murphy, 1996.)

Of course, not just any metaphor can lead to lexical extension of the base term. Rather, there are at least two constraints on the metaphoric creation of polysemous words. First, the alignment of the target and base concepts must be able to suggest a coherent category. Mappings that focus on relational structures are therefore more likely to generate stable abstractions than mappings that focus on less systematic object descriptions (see also Gentner, in press; Gentner & Kurtz, in press; Ramscar & Pain, 1996; Shen, 1992; Zharikov & Gentner, 2002). For example, the metaphor *The sun is a tangerine* elicits two common attributes of the target and base: Both are round in shape, and both are orange in color. Because these two attributes are not systematically related, the metaphor is unlikely to suggest a category of things that are round and orange, and it will not lead to lexical extension of the base term *tangerine*. Second, even if a metaphor is able to suggest a coherent category, the abstraction must not already be lexicalized. This follows from E. V. Clark's (1992) principle of *preemption by synonymy*: If a potential innovative use of a term is synonymous with a well-established term, then the former will be preempted by the latter and will be considered unacceptable. For example, the metaphor *An encyclopedia is a silver mine* elicits the common property of being a source of something valuable. However, this meaning is already lexicalized by the term *gold mine*. The term *silver mine* is therefore unlikely to acquire this meaning as a secondary sense.

Like categorization models, then, the career of metaphor hypothesis predicts that metaphoric categories may be created during the course of metaphor comprehension in the form of abstract relational schemas. However, the present account differs from existing categorization models in two critical ways. First, metaphoric categories are derived from the common relational structure of the target and base concepts and not from the base concept alone. Second, because metaphoric categories are created as a byproduct of figurative comparisons, they do not affect the interpretation of these comparisons. But we believe that this state of affairs is only temporary. If a base term has been used frequently enough to become polysemous and to automatically elicit a metaphoric category, it is only natural to assume that the abstraction can contribute to the meaning of a metaphor.

Conventionality and Categorization

Research on metaphor comprehension often treats metaphor as an undifferentiated type of figurative language. However, a number of theorists have 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; Giora, 1997; Turner & Katz, 1997). Our account of the relationship between metaphor and polysemy is in line with these claims. Specifically, we believe (a) that the process of conventionalization is essentially one of a base term acquiring a domain-general meaning and (b) that this representational shift will be accompanied by a shift in mode of alignment.

The career of metaphor hypothesis suggests that a computational distinction can be drawn between novel and conventional metaphors. *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. In contrast, *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, with the literal and metaphoric meanings semantically linked because of 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.

This raises an interesting question: How, exactly, are metaphoric categories applied to target concepts during comprehension? We suggest that categorization, be it figurative or literal, relies on the same basic mechanisms as comparison—namely, structural alignment and inference projection. Many theories of categorization assume that items are categorized by means of comparison, either to abstracted prototypes (e.g., Posner & Keele, 1968; Reed, 1972; Rosch & Mervis, 1975) or to actual exemplars (e.g., Brooks, 1978; Medin & Schaffer, 1978; Nosofsky, 1986). Thus there is no reason to believe that the processes involved in categorization are different in kind from those involved in comparison. Both processes involve some kind of alignment of representations to establish commonalities and guide the possible inheritance of further properties. The primary distinction between the two may lie in the kind and degree of inference projection. Although comparison processing entails the projection of inferences, the inference process is highly selective; only those properties connected to the aligned system are likely to be considered for projection. In contrast, categorization involves complete inheritance: Every property true of the base should be projected to the target.

Thus, the career of metaphor claim that conventional metaphors may be interpreted as comparisons or as categorizations can be rephrased by saying that such metaphors may be processed as *horizontal alignments* (mappings between representations at roughly the same level of abstraction) or as *vertical alignments* (mappings between representations at different levels of abstraction). There is, however, reason to expect that these two modes of alignment 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 (Gentner & Wolff, 1997). This would be akin to parallel-process models of idiom comprehension (e.g., Estill & Kemper, 1982; Swinney & Cutler, 1979). Which of these mappings wins will depend on a number of factors, including the context of the metaphor and the 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 the corresponding literal base concept. For one thing, metaphoric categories will contain fewer predicates than the literal concepts they were derived from, and a higher proportion of these predicates can be mapped to relevant target concepts. Moreover, assuming that the predicates of metaphoric categories will tend to be more domain general than those of literal base concepts, metaphoric categories should require less rerepresentation when matched with domain-specific predicates in a target concept. In general, then, conventional metaphors will tend to be interpreted as categorizations rather than as comparisons because the former mode of alignment will be completed more rapidly than the latter.

In summary, the career of metaphor hypothesis states that aligning the literal target and base concepts of a metaphor can lead to the induction and eventual lexicalization of domain-general relational schemas, which can act as metaphoric categories. This predicts that as metaphors become increasingly conventional, there will be a shift in mode of alignment from comparison to categorization (Bowdle, 1998; Bowdle & Gentner, 1995; Gentner & Bowdle, 2001; Gentner & Wolff, 1997). The career of metaphor hypothesis is consistent with a number of recent proposals, according to which novel metaphors invite sense creation but conventional metaphors invite sense retrieval (e.g., Blank, 1988; Giora, 1997; Turner & Katz, 1997). On the present view, the senses retrieved during conventional metaphor comprehension are abstract metaphoric categories.

This approach to metaphor has a number of advantages over other approaches. First, it captures many of the intuitions behind both traditional comparison models of metaphor comprehension and more recent categorization models, but without falling prey to the limitations of either. Second, it provides a mechanism for the metaphoric generation of polysemous words. Third, it renders explicit the processing differences between metaphors at different levels of conventionality. Finally, it is parsimonious—rather than treating metaphor as a special class of language or thought, it unifies metaphor with analogy and with other types of conceptual mapping that rely on structural alignment and inference projection, including literal comparison and literal categorization.

Experimental Evidence

The career of metaphor hypothesis is supported by two existing lines of experimental evidence. First, conventional metaphors are comprehended faster than novel metaphors (Blank, 1988; Gentner

& Wolff, 1997). For example, Blank (1988) found that conventional metaphors were read as quickly as literal sentences, whereas novel metaphors took significantly longer to understand. Second, conventional metaphors are processed more asymmetrically than novel metaphors (Gentner & Wolff, 1997). Gentner and Wolff (1997) found that conventional metaphors were comprehended faster when primed by base terms than when primed by target terms, whereas both prime types were equally effective for novel metaphors. Both of these findings can be taken as implying that conventional base terms, unlike novel base terms, have highly accessible metaphoric meanings that can be invoked during processing.

However, neither of these findings directly demonstrates an actual shift in processing as one moves from novel to conventional metaphors, let alone that this shift is one from comparison to categorization. The goal of this research is to directly test for the processing shift predicted by the career of metaphor.

We conducted a series of experiments in which subjects were asked to interpret or evaluate novel and conventional figurative statements. In constructing these studies, we made use of what may seem an unlikely tool: namely, the grammatical distinction between metaphors and similes. In formal terms, a *metaphor* is a figurative statement expressed by means of the copula, taking the form *An X is a Y*. A *simile* is a figurative statement using a comparative term such as *like* or *as*, taking the form *An X is like a 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*). If form follows function in language use, metaphors and similes may tend to promote different comprehension strategies. 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. We refer to this link between form and function in figurative language as *grammatical concordance*.

The notion of grammatical concordance is supported by a number of studies that have found clear differences between metaphors and similes in terms of their interpretation and evaluation (e.g., Aisenman, 1999; Gibb & Wales, 1990; Glicksohn, 1994; Gregory & Mergler, 1990; Kennedy, 1982; Verbrugge, 1980). Gibb and Wales (1990) found that abstract base terms (e.g., *beauty*, *imprisonment*) were more likely than concrete base terms (e.g., *cloud*, *pearl*) to be associated with a preference for metaphors over similes. This makes sense if metaphors, unlike similes, invite categorization, and therefore apply most naturally when the base term is more general than the target term. Gregory and Mergler (1990) found that similes were more likely than metaphors to highlight nonobvious similarities between targets and bases. This supports the claim that similes, unlike metaphors, invite comparison and therefore are likely to involve a larger radius of potential commonalities.

To the extent that grammatical concordance has psychological force, the metaphor–simile distinction offers a valuable tool for examining the use of comparison and categorization during figurative language comprehension. In the experiments reported below, we use this distinction to test the processing predictions made by the career of metaphor hypothesis. In Experiment 1 we test a straightforward prediction of our account, namely, that the metaphor form should become increasingly felicitous relative to the simile form as one moves from novel to conventional figurative statements.

Experiment 1: Grammatical Form Preferences

According to the career of metaphor hypothesis, conventionalization results in a shift in mode of alignment from comparison to categorization—as metaphoric categories are lexicalized as secondary meanings of base terms, these categories will come to play an increasing role during comprehension. Thus, assuming that form reflects function in figurative language, there should be a shift in mode of expression from the comparison (simile) form to the categorization (metaphor) form as figurative statements become increasingly conventional. In Experiment 1, we tested this prediction by giving subjects novel and conventional figurative statements in both grammatical forms and asking them to indicate which grammatical form they preferred for each statement. We also gave subjects statements in which the target was literally similar to the base (e.g., *lemon → orange*)—for which the comparison form should be preferred—and statements in which the target was a member of a literal category named by the base (e.g., *whale → mammal*)—for which the categorization form should be preferred. This was done not only as a manipulation check but also to provide points of comparison for subjects' responses to the figurative statements.

To ensure the generality of our results, we varied the degree of target abstractness for the figurative statements. Although most metaphors and similes involve relatively concrete base terms (e.g., Katz, 1989; Lakoff & Johnson, 1980; Lakoff & Turner, 1989), 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. Sixteen Northwestern University undergraduates participated in partial fulfillment of a course requirement.

Materials and design. The figurative statements were selected on the basis of norming studies in which we collected conventionality and concreteness ratings from independent groups of subjects. The materials used in the norming studies consisted of 100 figurative statements that were either adapted from the existing literature (e.g., Gentner & Wolff, 1997; Glucksberg et al., 1997; Katz, Paivio, Marschark, & Clark, 1988; Ortony et al., 1985) or created by us.

For the conventionality ratings, an initial group of 16 Northwestern University undergraduates were given a randomized list of the 100 figurative statements. Half the subjects received the statements as metaphors, and half received them as similes. The subjects provided a brief interpretation of each statement. Next, the modal interpretation of each statement (as determined by two blind judges) was used to create a canonical metaphoric meaning for the base term, in the form "anything that X." For example, the figurative statement *Time is (like) a river* yielded the canonical metaphoric meaning "anything that flows forward" for the base term *river*. Finally, 16 additional Northwestern University undergraduates were given a randomized list of the 100 base terms followed by the canonical metaphoric meaning. They rated how conventional or familiar each meaning was as an alternative sense of the base term on a scale of 1 (*very novel*) to 10 (*very conventional*).

The concreteness ratings were collected from a separate group of 16 Northwestern University undergraduates. The subjects were presented with a randomized list of the 100 target terms and 100 base terms in isolation. They rated the concreteness of each term on a scale of 1 (*very abstract*) to 10 (*very concrete*).

On the basis of the results of these norming studies, 16 novel figurative statements (mean conventionality rating = 3.31) and 16 conventional figurative statements (mean conventionality rating = 7.82) were selected. Each of these sets was further divided into 8 abstract and 8 concrete statements. Abstract statements contained target terms that were significantly less concrete than the base terms (mean difference in concreteness ratings = 5.75), and concrete statements contained target and base terms of approximately equivalent concreteness (mean difference in concreteness ratings = 0.61). (Both abstract and concrete statements involved bases that were rated as highly concrete, $M = 8.98$.) To ensure that all of the figurative statements were interpretable, we used only those statements that were given the modal interpretation by at least half of the initial group of participants in the first norming study. Thus, although metaphors and similes can often convey a wider range of meanings than their literal counterparts (Ortony, 1980), there was a fairly high level of agreement on the gist of these figurative statements.

In Experiment 1, each subject received all 32 figurative statements in both the comparison (simile) form and the categorization (metaphor) form. In addition, each subject received 16 literal comparison statements and 16 literal categorization statements in both grammatical forms. (Examples of all four statement types are given in Table 1.) Thus the factors were statement type (four levels) and, for the figurative statements, target concreteness (two levels) and grammatical form (two levels), with all factors within subjects.

Procedure. Subjects were run in groups of 1–4. Each subject was seated in a separate booth and given a booklet containing the 64 statement pairs in a random order. For each pair of statements, the two grammatical forms were 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 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 statement on the left, the closer their answer should be to 1, and the stronger their preference for the statement on the right, the closer their answer should be to 10.

Results and Discussion

Table 2 shows the mean grammatical form preference ratings, transformed so that higher numbers indicate a preference for the categorization (metaphor) form over the comparison (simile) form. Not surprisingly, these ratings were high for literal categorization statements but low for literal comparison statements. More critically, the grammatical form preference ratings were higher for conventional figurative statements ($M = 4.35$) than for novel figurative statements ($M = 2.81$). In other words, subjects found the metaphor form more acceptable for the conventional figuratives. This is as predicted by the career of metaphor hypothesis—if conventionalization results in a shift from comparison to categorization, then there should be a corresponding shift from similes to metaphors. Comparisons between the figurative and literal statement ratings yielded further support for the career of metaphor hypothesis. First, subjects' preference for the comparison form was nearly as great for novel figuratives as it was for literal comparisons. This is consistent with our claim that because novel base terms refer only to a domain-specific concept, novel figuratives can be processed only as comparisons (i.e., by horizontal alignment). The simile form is preferred because it is concordant with this mode of alignment. Second, as predicted, there was a shift toward the categorization form for conventional figuratives, consistent with the claim that vertical alignment (concordant with the metaphor form) is possible for conventional figuratives. However, consistent with our position, this shift was not absolute. As noted above, because conventional base terms refer both to a literal concept and to a related metaphoric category, conventional figuratives may be processed either horizontally (as comparisons) or vertically (as categorizations). This predicts that people should be rather pluralistic in their approach to conventional figuratives. Supporting this claim, the preference for categorization form fell well short of that found for literal categorizations. For conventional figurative, both the simile form and the metaphor form are felicitous, as both are concordant with a possible mode of alignment.

Table 1
Sample Materials

Statement type	Examples
Novel figurative	
Abstract	A mind is (like) a kitchen.
	Friendship is (like) wine.
Concrete	A beach is (like) a grill.
	A newspaper is (like) a telescope.
Conventional figurative	
Abstract	Faith is (like) an anchor.
	An opportunity is (like) a doorway.
Concrete	Alcohol is (like) a crutch.
	A soldier is (like) a pawn.
Literal comparison	An encyclopedia is like a dictionary.
	Tape is like glue.
Literal categorization	A bracelet is an ornament.
	Pepper is a spice.

Table 2
Mean Preferences for the Categorization Form for Experiment 1

			Abstract		Concrete	
Statement type	*M*	*SD*	*M*	*SD*	*M*	*SD*
Novel figurative	2.81	0.83	2.54	0.90	3.08	0.88
Conventional figurative	4.35	0.87	4.74	1.11	3.95	0.87
Literal comparison	2.72	0.96				
Literal categorization	8.99	0.75				

Note. Maximum score = 10.

One-way (statement type: novel figurative, conventional figurative, literal comparison, literal categorization) analyses of variance (ANOVAs) were conducted on the subject and item means. (In the subject analysis, statement type was within subject; in the item analysis, statement type was between items.) The predicted effect of statement type was confirmed, $F_s(3, 45) = 185.10$, $p < .001$, and $F_i(3, 60) = 122.41$, $p < .001$. Subsequent analyses showed that the preference for the categorization form was greater for literal categorizations than for conventional figuratives, and greater for conventional figuratives than for either novel figuratives or literal comparisons ($p < .001$ by Tukey's honestly significant difference [HSD] test).

Focusing solely on the figurative statements, 2 (conventionality: novel, conventional) × 2 (concreteness: abstract, concrete)

ANOVAs were conducted on the subject and item means. (Both factors were within subject and between items.) As in the earlier analyses, subjects' preference for using the categorization form was higher for conventional figuratives than for novel figuratives, $F_s(1, 15) = 31.99$, $p < .001$, and $F_i(1, 28) = 10.96$, $p < .005$. There was no main effect of concreteness. However, there was an unpredicted interaction between conventionality and concreteness, significant by subjects, $F_s(1, 15) = 28.17$, $p < .001$, but not by items, $F_i(1, 28) = 2.04$, $p < .20$. For novel figuratives, the preference for the categorization form was higher for concrete statements than for abstract statements, $t_s(15) = 3.39$, $p < .005$, and $t_i(14) = 2.32$, $p < .05$. For conventional figuratives, the reverse was true, significant by subjects, $t_s(15) = 3.25$, $p < .01$, but not by items, $t_i(14) < 1$.

Experiment 2: Online Comprehension

In Experiment 1, we showed that as figurative statements become increasingly conventional, there is a shift in preference from the simile form to the metaphor form. But does this shift at the linguistic level truly reflect an underlying processing shift? To address this question, we collected online measures of subjects' comprehension of novel and conventional metaphors and similes (as well as literal comparisons and literal categorizations) in Experiment 2. According to the career of metaphor hypothesis, conventionalization results in a representational change whereby abstract metaphoric categories come to be associated with literal base concepts. At the processing level, this implies that novel figurative statements, which lack prestored metaphoric categories, can be comprehended only by comparing the literal target and base concepts, whereas conventional figurative statements can be comprehended either as comparisons (by aligning the target with the literal base concept) or as categorizations (by aligning the target with the metaphoric category named by the base), although the latter process will generally be favored over the former because of its relative speed. The career of metaphor hypothesis therefore makes two basic predictions concerning comprehension time.

First, if conventionalization increases the likelihood of categorization processing, then (averaging across grammatical forms) conventional figuratives should be easier to interpret than novel figuratives. Because metaphoric categories will contain fewer predicates than the literal concepts they were derived from and because a higher proportion of these predicates should be applicable to relevant target concepts, mappings between a target and a metaphoric category will be computationally less costly than mappings between a target and a literal base concept. That is, the maximal structurally consistent match between the target and base representations will be easier to locate for conventional figuratives.

A second and more critical prediction concerns the effects of conventionality on the relative comprehension times of metaphors and similes. If novel figurative statements are processed strictly as comparisons, then novel similes should be easier to interpret than novel metaphors. This is because only the simile form directly invites comparison. The metaphor form initially invites an inappropriate comprehension strategy—it invites searching for a category that does not exist. Novel metaphors must therefore be reinterpreted, which should add to the processing time. In contrast, if conventional figurative statements can be processed either as comparisons or as categorizations, then conventional metaphors should be easier to interpret 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.

Of course, a potential problem with comparing the comprehension times of metaphors and similes is that metaphors are one word shorter than similes: They omit the word *like*. This could lead to a reading time advantage for metaphors. However, given that *like* is a short, high-frequency adverb, the size of such a reading time advantage should be minimal, and in any case, we predict the reverse advantage for novel figurative statements.

Method

Subjects. Thirty-two Northwestern University undergraduates participated in partial fulfillment of a course requirement. None had previously participated in any similar experiments.

Materials and design. Each subject received the 16 novel and 16 conventional figurative statements from Experiment 1. The figurative statements (both abstract and concrete) were presented either as metaphors or as similes, and the grammatical form assignment of the statements was counterbalanced within and between subjects. In addition to the figurative statements, each subject received the 16 literal comparison statements and 16 literal categorization from the previous experiment, presented only in their natural grammatical forms.

Procedure. Subjects were run in groups of 1–4. Each subject was seated in a separate booth in front of a computer screen. Subjects saw the statements presented one at a time. They were instructed to strike the enter key on the keyboard as soon as they understood each statement, type in their interpretation of the statement, and then strike the enter key again to move on to the next statement. Subjects were told to read each statement carefully and to make sure that they had an interpretation in mind before responding.

After subjects read the instructions, they were presented with 16 practice trials followed by the 64 experimental trials presented in a random order. Each trial consisted of a row of asterisks (e.g., **** ** * *****) presented for 500 ms, followed by a statement (e.g., *time is a river*). The statement remained visible until the enter key was pressed, and then a window appeared in which the interpretation was typed. When the enter key was pressed again, the next trial began after a 1-s interval. Response timing was initiated when the statement appeared on the screen and was terminated by the first key press.

Results and Discussion

Comprehension times. Extreme outliers (reaction times greater than 12 s) and responses associated with missing interpretations were excluded from the comprehension time data (less than 2% of the trials). Table 3 shows the mean comprehension times. As predicted, novel figurative statements took longer to comprehend than conventional figurative statements. Indeed, conventional figuratives were comprehended as rapidly as literal comparisons and literal categorizations. This result replicates Blank's (1988) finding that novel but not conventional metaphors took longer to comprehend than literal statements. More critically, the predicted interaction between conventionality and grammatical form was also obtained (see Figure 3). Novel figuratives were comprehended faster as similes ($M = 2{,}871$ ms) than as metaphors ($M = 3{,}245$ ms). This supports our claim that because novel figuratives are processed strictly as comparisons, they will be easier to compre-

Table 3
Mean Comprehension Times in Milliseconds for Experiment 2

			Metaphor				Simile			
			Abstract		Concrete		Abstract		Concrete	
Statement type	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Novel figurative	3,058	1,327	3,206	1,927	3,284	1,418	2,890	1,483	2,853	1,273
Conventional figurative	2,160	834	2,027	837	2,099	910	2,302	949	2,213	1,032
Literal comparison	1,943	809								
Literal categorization	1,957	906								

hend when phrased as comparisons than when phrased as categorizations. In contrast, conventional figuratives were comprehended faster as metaphors (M = 2,063 ms) than as similes (M = 2,257 ms). This supports our claim that although conventional figuratives can be processed either as comparisons or as categorizations, they will be easier to comprehend when phrased as categorizations. This is because the metaphor form promotes a computationally less costly alignment between the target and the abstract metaphoric category named by the base term, but the simile form promotes a more complex alignment between the target and the literal base concept.

We conducted 2 (conventionality: novel, conventional) × 2 (grammatical form: metaphor, simile) × 2 (concreteness: abstract, concrete) ANOVAs on the subject and item means. (All three factors were within subject, conventionality and concreteness were between items, and grammatical form was within item.) The predicted effect of conventionality was confirmed: Novel statements took longer to interpret than did conventional statements, $F_s(1, 31) = 31.89$, $p < .001$, and $F_i(1, 28) = 34.04$, $p < .001$. There were no other main effects. The predicted interaction between conventionality and grammatical form was also confirmed, $F_s(1, 31) = 9.50$, $p < .005$, and $F_i(1, 28) = 7.65$, $p < .01$. Novel similes were faster than novel metaphors, $t_s(31) = 2.16$, $p < .05$, and $t_i(15) = 2.24$, $p < .05$. In contrast, conventional metaphors were faster than conventional similes, significant by subjects, $t_s(31) = 2.27$, $p < .05$, but not by items, $t_i(15) = 1.71$, $p < .15$. There were no other interactions.

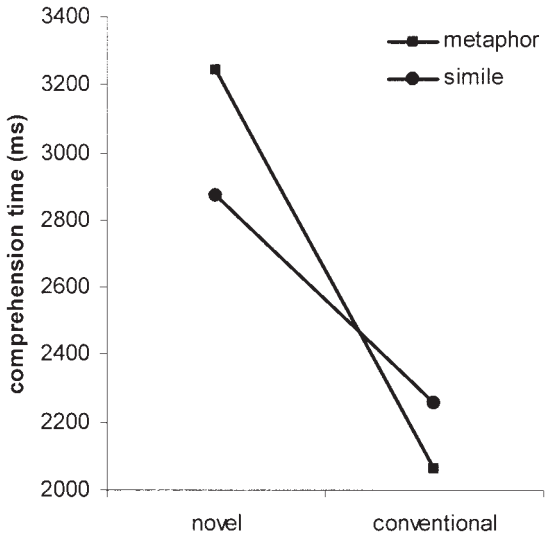

Figure 3. Comprehension times for Experiment 2.

To consider the entire set of materials, we conducted one-way (statement type: novel figurative, conventional figurative, literal comparison, literal class inclusion) ANOVAs on the subject and item means. (In the subject analysis, statement type was within subject; in the item analysis, statement type was between items.) There was a main effect of statement type, $F_s(3, 93) = 32.03$, $p < .001$, and $F_i(3, 60) = 30.12$, $p < .001$. Subsequent analyses showed that the novel figurative statements took longer to interpret than did the other three statement types ($p < .001$ by a Tukey HSD test).

Before moving on, we wish to briefly consider how these findings relate to previous research on the online comprehension of metaphors and similes. To date, only two other studies have collected comprehension times for both metaphors and similes, and the results of these studies seem contradictory. On the one hand, Gregory and Mergler (1990) found that similes were read more quickly than metaphors. (This result emerged in a pretest meant to establish baseline reading times for subsequent verification tasks in which subjects judged whether various types of statements were literally true, made sense, or were metaphoric.) On the other hand, A T. Johnson (1996) found precisely the opposite—across two experiments, metaphors took less time to understand than did similes. One possible explanation for these conflicting results is that the two studies placed different demands on the subjects: Whereas Gregory and Mergler asked subjects to read the statements, Johnson asked subjects to interpret the statements. However, if subjects in the former study were simply reading without comprehension, then metaphors—which omit the word *like*—should have been read faster than similes. Our findings suggest an alternative explanation for the contradictory results of these studies. In the present experiment, the relative comprehension times of metaphors and similes depended critically on the conventionality of the figurative statements, with novel similes faster than novel metaphors but conventional metaphors faster than conventional similes. Because neither of the above studies controlled for the conventionality of the materials, it is possible that Gregory and Mergler's figurative statements were predominantly novel but Johnson's figurative statements were predominantly conventional. Given that neither study provided more than one or two examples of the materials, we can only speculate here. However, the fact that such a difference in the conventionality of the materials could have led to the discrepancy between these two

studies illustrates the need for controlling for this factor in figurative language research—an issue that we return to later.

The issue of aptness. One potential challenge to our interpretation of the reaction time data involves the relative aptness of the novel and conventional figurative statements that were used. In a widely cited study on figurative language comprehension, Blasko and Connine (1993) found that when subjects were asked to interpret metaphors, figurative meanings were accessed just as quickly as literal meanings for familiar metaphors but not for unfamiliar metaphors. In and of itself, this result seems quite consistent with our own findings. However, Blasko and Connine also found that the effect of familiarity was modulated by aptness. For moderately apt unfamiliar metaphors, figurative meanings took significantly longer to derive than literal meanings. For highly apt unfamiliar metaphors, though, figurative and literal meanings were derived equally rapidly. In other words, unfamiliar metaphors behaved very much like familiar metaphors to the extent that they were perceived as being particularly apt.

Of course, familiarity as defined by Blasko and Connine (1993) is not quite the same thing as the notion of conventionality that we have been discussing. *Familiarity* is a property of an entire expression, and a familiar metaphor or simile involves a particular target–base pairing that has been encountered before. *Conventionality*, in contrast, is determined primarily by the base term of an expression: Conventional metaphors and similes contain base terms that have become polysemous because of repeated and consistent figurative use. Because of this, conventional figurative expressions can be either familiar or unfamiliar, depending on the target term that has been paired with the base. And, in fact, a fair number of Blasko and Connine's unfamiliar metaphors (e.g., *Ritual is a prison*, *Indecision is a whirlpool*) would also seem to be rather conventional.

Nevertheless, Blasko and Connine's (1993) findings suggest an alternative account of the interaction we found between conventionality and grammatical form. Proponents of categorization models of metaphor comprehension sometimes describe similes as being implicit metaphors, with the word *like* being used to suggest a somewhat weaker relationship between the target and base concepts (e.g., Glucksberg & Keysar, 1990; Kennedy, 1990). If this is true, then perhaps the reason that novel similes took less time to comprehend than did novel metaphors in the present experiment is that our novel figuratives were in fact not very apt, which led subjects to gravitate toward the "weak" simile form over the "strong" metaphor form when interpreting these statements. On this view, had we used highly apt novel figuratives instead, then they would have behaved much like our conventional figuratives, with metaphors favored over similes.

To determine what effects aptness might have had on our results, we recruited an additional 32 subjects and asked them to rate the aptness of the statements from Experiments 1 and 2 on a 10-point scale, where the low end of the scale was labeled *not at all apt* and the high end was labeled *very apt*. The design of this posttest was identical to that of Experiment 2. There were two main questions of interest here. First, to what extent would our novel figuratives differ in aptness from our conventional figuratives? And second, would the degree of aptness of the novel figuratives correlate in any way with the relative performance of similes versus metaphors? On the categorization account, we would expect that the more apt a novel figurative is, the more it should behave like conventional figuratives, with the metaphor form becoming increasingly felicitous.

Table 4 shows the mean aptness ratings. One-way ANOVAs revealed a main effect of statement type, $F_s(3, 93) = 34.03$, $p < .001$, and $F_i(3, 60) = 49.56$, $p < .001$. Subsequent analyses showed that the aptness ratings were higher for literal categorizations than for either literal comparisons or conventional figuratives and that both literal comparisons and conventional figuratives had higher aptness ratings than novel figuratives ($p < .005$ by a Tukey HSD test). Thus, our novel figuratives were indeed perceived as being less apt than were the other statement types.

Focusing solely on the figurative statements, three-way ANOVAs confirmed the effect of conventionality, $F_s(1, 31) = 142.59$, $p < .001$, and $F_i(1, 28) = 64.82$, $p < .001$, and also revealed main effects of both grammatical form and concreteness. First, similes were more apt than metaphors ($M = 5.52$ vs. $M = 5.21$), significant by subjects, $F_s(1, 31) = 5.21$, $p < .05$, although not by items, $F_i(1, 28) = 3.08$, $p = .09$. Second, abstract statements were more apt than concrete statements ($M = 5.84$ vs. $M = 4.88$), $F_s(1, 31) = 46.54$, $p < .001$, and $F_i(1, 28) = 11.08$, $p < .005$. This latter finding is consistent with the claim that metaphoric mappings are especially useful when it comes to reasoning about abstract subject matter (e.g., Kovecses, 1988; Lakoff & Johnson, 1980; Quinn, 1987; Reddy, 1979; Sweetser, 1990).

There were no significant interactions between any of the factors. However, closer inspection of the aptness ratings revealed a pattern that was quite consistent with our other findings. Specifically, novel similes were significantly more apt than novel metaphors ($M = 4.45$ vs. $M = 3.92$), $t_s(1, 31) = 3.11$, $p < .005$, and

Table 4
Mean Aptness Ratings for Materials From Experiments 1 and 2

			Metaphor				Simile			
			Abstract		Concrete		Abstract		Concrete	
Statement type	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Novel figurative	4.18	1.68	4.28	2.09	3.56	1.86	5.02	2.00	3.88	1.80
Conventional figurative	6.54	1.27	7.07	1.58	5.92	1.65	7.02	1.88	6.16	1.42
Literal comparison	6.26	1.54								
Literal categorization	7.81	1.84								

Note. Maximum score = 10.

$t_i(1, 15) = 2.35$, $p < .05$. In contrast, conventional similes and metaphors were equally apt ($M = 6.59$ and $M = 6.50$). Again, according to the career of metaphor hypothesis, novel figuratives are processed strictly as comparisons, but conventional figuratives can be processed either as comparisons or as categorizations. Thus, it makes sense that the comparison form was rated as being more apt than the categorization form for novel figuratives whereas both forms were rated as being equally apt for conventional figuratives—a pattern of results that has also been obtained by Gokcesu and Bowdle (2003) using a very different set of novel and conventional similes and metaphors.

Turning now to the critical question of whether aptness could account for the relative performance of novel similes versus novel metaphors, we looked to see if there was a relationship between the aptness ratings of the novel figurative statements (averaging across the two grammatical forms) and the difference in latencies between the metaphor and simile forms (i.e., the reaction time for metaphors minus the reaction time for similes). We found no significant correlation between these two measures ($r = -.13$, $p = .64$). This would argue against the position that aptness is a good predictor of the relative felicity of the metaphor form. Indeed, when we compared the reaction time data of the five most apt novel figuratives (mean aptness rating = 5.13) with that of the five least-apt conventional figuratives (mean aptness rating = 5.53), we found the same basic pattern that was obtained in Experiment 2. Specifically—and despite the roughly comparable aptness levels of these two sets of statements—the most apt novel figuratives were still comprehended faster as similes ($M = 2{,}832$ ms) than as metaphors ($M = 3{,}055$ ms), and the least apt conventional figuratives were still comprehended faster as metaphors ($M = 1{,}880$ ms) than as similes ($M = 2{,}553$ ms).

We also decided to see if there might be a relationship between the aptness of the novel figurative statements and the grammatical form preference ratings obtained in Experiment 1, and the results of this analysis were even more telling: There was a significant *negative* correlation between aptness and subjects' preference for the categorization form ($r = -.65$, $p < .01$). In other words, the more apt a novel figurative statement was, the more strongly subjects preferred to phrase it as a simile instead of as a metaphor. This is exactly the opposite of the prediction made by the categorization account—namely, that the more apt a novel figurative is, the more it should behave like conventional figuratives. In summary, then, it would appear that our findings thus far cannot be explained in terms of aptness.

Interpretations. Although the comprehension time data was of primary interest in this experiment, we also examined subjects' interpretations for processing clues. One structural characteristic that clearly distinguished some interpretations from others was whether the description was applied to the target term alone (*target-only predications*) or to both the target term and the base term (*double predications*). For example, given the figurative statement *An obsession is (like) a tumor*, the properties *grow inside you* and *cause harm* could be applied only to the target—as in "An obsession grows inside you and causes harm"—or to both the target and the base—as in "Both obsessions and tumors grow inside you and cause harm." This linguistic distinction may reflect an underlying distinction in comprehension strategies. Specifically, we suggest that double predications are an indication that a statement has been interpreted as a comparison rather than as a categorization. For example, given the literal comparison statement *A mop is like a broom*, the double predication "Both mops and brooms are used to clean floors" is a natural interpretation. However, given the literal categorization statement *A whale is a mammal*, the double predication "Both whales and mammals bear live young" seems odd relative to the target-only predication "Whales bear live young." Double predications may result from aligning two representations at roughly the same level of abstraction and highlighting common elements.

If these intuitions are correct, then double predications should be more typical of literal comparisons than of literal categorizations. More critically, double predications should follow the career of metaphor in two respects. First, double predications should be more typical of novel figuratives than of conventional figuratives. This follows from the claim that conventionalization results in a shift from comparison to categorization. Second, the relative proportion of double predications for metaphors and similes should depend on the conventionality of the statements. Specifically, if both novel metaphors and novel similes are interpreted as comparisons, then double predications should be equally common for both statement types. In contrast, if conventional metaphors are interpreted as categorizations but conventional similes may often be interpreted as comparisons, then double predications should be more common for conventional similes than for conventional metaphors.

Table 5 shows the mean proportions of double predications. One-way ANOVAs revealed a main effect of statement type, $F_s(3, 93) = 48.61$, $p < .001$, and $F_i(3, 60) = 146.44$, $p < .001$. Subsequent analyses showed that proportion of double predications was significantly different across all four statement types, with literal comparisons having the highest proportion, followed in turn by novel figurative statements, conventional figurative statements, and literal class inclusions ($p < .005$ by a Tukey HSD test).

Table 5
Mean Proportions of Double Predications for Experiment 2

			Metaphor				Simile			
			Abstract		Concrete		Abstract		Concrete	
Statement type	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Novel figurative	.33	.29	.27	.32	.35	.35	.31	.34	.41	.35
Conventional figurative	.24	.26	.23	.32	.21	.27	.19	.30	.32	.31
Literal comparison	.63	.40								
Literal categorization	.05	.08								

Double predications were far more typical of literal comparisons than of literal class inclusions, suggesting that they may indeed serve as indicators of comparison processing. Further, as predicted by the career of metaphor hypothesis, double predications were more typical of novel figuratives than of conventional figuratives.

Focusing solely on the figurative statements, three-way ANOVAs confirmed the effect of conventionality, $F_s(1, 31) = 16.53$, $p < .001$, and $F_i(1, 28) = 10.04$, $p < .005$, and also revealed a main effect of concreteness, $F_s(1, 31) = 6.91$, $p < .025$, and $F_i(1, 28) = 5.41$, $p < .05$. The proportion of double predications was higher for concrete statements ($M = .32$) than for abstract statements ($M = .25$). There was no main effect of grammatical form and no interactions.

As expected, double predications were equally frequent for novel metaphors ($M = .31$) and novel similes ($M = .36$). Contrary to our predictions, however, double predications were also equally frequent for conventional metaphors ($M = .22$) and conventional similes ($M = .26$). To the extent that double predications serve as an indicator of comparison processing, this latter result is problematic for our claim that conventional metaphors are interpreted as categorizations but conventional similes may often be interpreted as comparisons. According to the career of metaphor hypothesis, both the domain-specific and domain-general meanings of a conventional base term are activated simultaneously during comprehension, and attempts to map each representation to the target concept are made in parallel. Alignments involving the domain-general meaning (vertical, category-like alignments) should typically be faster than those involving the domain-specific meaning (horizontal, comparison-like alignments). The simile form should promote the slower mode of mapping—that is, it should invite a comparison between the target and the literal base concept. This argument follows from the notion of grammatical concordance.

One possible explanation for the observation that double predications were equally common for conventional metaphors and similes is that vertical alignments are sufficiently fast relative to horizontal alignments that the simile form only forestalls the inevitable—namely, the completion of categorization processing before the completion of comparison processing. In other words, although the simile form may indeed divert processing resources from alignments between the target and the metaphoric category named by the base term, such mappings are still sufficiently fast to win during comprehension. This would also explain why conventional similes take longer to comprehend than do conventional metaphors. However, the present null result in the interpretation data by no means argues conclusively against our earlier claim that metaphors and similes may produce different mappings for conventional figuratives. Indeed, given that double predications were relatively infrequent in all figurative interpretations, this measure may not have been sensitive enough to illuminate such processing.

Experiment 3: In Vitro Conventionalization

The results of Experiments 1 and 2 support the claim that there is a shift in mode of alignment from comparison to categorization as metaphors are conventionalized. However, because these experiments simply contrasted novel and conventional figurative statements, they have not addressed 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. Although our evidence thus far strongly suggests that metaphoric categories are activated and applied during the comprehension of conventional figuratives, we cannot know for certain how the subjects in these experiments had acquired these metaphoric categories. Indeed, for many of the conventional figuratives, subjects may have learned the secondary, domain-general meanings of the base terms directly, either through exposure to the linguistic practices of their community or through explicit instruction, instead of having derived them over time through the successive metaphoric application of the original base concepts. Even so, we would still be left with the question of how such meanings arose in the first place.

In Experiment 3, we sought to directly test our claims about the creation of metaphoric categories by speeding up the process of conventionalization from years to minutes. According to the career of metaphor hypothesis, a metaphoric category is induced as a result of highlighting the common relational structure of the target and base concepts of a metaphor. If the same abstraction is repeatedly derived or activated in the context of the base as it is applied to other target concepts, then the abstraction will become lexicalized as a secondary sense of the base term. In this study, we gave subjects multiple examples of novel similes using the same base term. The question was whether such repeated experiences would induce a domain-general representation of the base term. If so, then further figurative statements using the base should behave less like comparisons and more like categorizations. Specifically, we predicted a shift in preference from the simile form to the metaphor form.

Experiment 3 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 figurative statements 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 (as in Experiment 1). The key manipulation was that some of the novel figuratives in the test phase were truly new, while others used base terms previously seen in the triads of novel similes, combined with a new target term (e.g., *A ballerina is (like) a butterfly*). Our prediction was that subjects' preference for the metaphor form would 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 for terms previously seen in the figurative triads would constitute strong support for the career of metaphor claim that metaphoric categories are created through comparison processing.

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, we also included triads of literal comparisons. For example, subjects might see 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.*

Some of the novel figurative statements in the test phase contained base terms from such triads of literal comparisons from the study phase. If subjects simply prefer placing old base terms in new grammatical frames, then when they receive *A ballerina is (like) a butterfly* in the test phase, they will shift toward the metaphor version if the base term was previously used in either metaphorical or literal triads. However, if the shift toward metaphor form results specifically from abstraction due to alignment, then having seen the base term in a triad of literal comparisons should have little or no influence on subjects' subsequent grammatical form preferences.

Method

Subjects. Forty-eight Northwestern University undergraduates participated in partial fulfillment of a course requirement. None had previously participated in any similar experiments.

Materials and design. On the basis of the results of the norming studies reported in Experiment 1, 24 novel figurative statements (mean conventionality rating = 3.52) and 24 conventional figurative statements (mean conventionality rating = 7.61) were selected. Each of these sets was further divided into 12 abstract and 12 concrete statements. As before, abstract statements were defined as containing target terms that were significantly less concrete than the base terms (mean difference in concreteness ratings = 5.77), and concrete statements were defined as containing target and base terms of approximately equivalent concreteness (mean difference in concreteness ratings = 0.51). (Both abstract and concrete statements involved bases that were rated as highly concrete, $M = 9.04$.) To ensure that all of the figurative statements were interpretable, we used only those statements that were given the modal interpretation by at least half of the initial group of participants in the first norming study described in Experiment 1.

During the test phase of Experiment 3, each subject received all 48 figurative statements in both the comparison (simile) form and the categorization (metaphor) form. The key manipulation in this experiment occurred during the study phase, in which the 24 novel figurative statements described above 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 novel statement seen during the subsequent test phase. 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 figurative statements 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 space in place of a target term.

Procedure. Subjects were run in groups of 1–4. For the study phase, each subject was seated in a separate booth and given a booklet containing the 32 statement triads (two similar 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-min 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 statement on the left, the closer their answer should be to 1, and the stronger their preference for the statement on the right, the closer their answer should be to 10.

Results and Discussion

Table 6 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. When subjects had previously seen a novel base term in three similes, their preference for expressing a new figurative statement using that term as a categorization was higher than when they had not previously seen the novel base term in any statements ($M = 3.87$ vs. $M = 3.52$). That is, the conventionalization manipulation led to greater acceptability of the metaphor form. In contrast, when subjects had previously seen a novel base term in three literal comparisons, their preference for expressing a

Table 6
Mean Preferences for the Categorization Form for Experiment 3

	Abstract		Concrete	
Conventionality and initial exposure	*M*	*SD*	*M*	*SD*
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
None	3.57	1.41	3.47	1.26
Conventional	6.16	1.28	6.10	1.26

Note. Maximum score = 10.

new figurative statement using that term as a categorization (M = 3.62) was unaffected relative to the baseline condition. 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 toward categorization processing as the base term 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 that term and led to a shift from the simile form to the metaphor form. 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 decades or centuries to become conventionalized (Zharikov & Gentner, 2002), the evolutionary path described by the career of metaphor hypothesis can be glimpsed even within a short time period when a base term is consistently aligned with a number of different targets.

We conducted 3 (study condition: simile, literal comparison, no prior exposure) × 2 (concreteness: abstract, concrete) ANOVAs on the subject and item means. (Both factors were within subject, initial exposure was within item, and concreteness was between items.) The predicted effect of initial exposure was confirmed, significant by subjects, $F_s(2, 94) = 3.87$, $p < .05$, although not by items, $F_i(2, 44) = 2.48$, $p = .09$. The preference for the categorization (metaphor) form was significantly higher when the base terms had previously been seen in sets of novel similes than when the base terms had not previously been seen, $t_s(47) = 2.67$, $p < .025$, and $t_i(23) = 2.53$, $p < .025$. In contrast, when the base terms had previously been seen in sets of literal comparisons, the grammatical form preference ratings did not differ from those of the baseline condition. There was no main effect of concreteness, and no interaction between these two factors.

A 2 (conventionality: novel, conventional) × 2 (concreteness: abstract, concrete) ANOVA was also conducted on the subject and item means. (Both factors were within subject and between items.) The preference for the categorization (metaphor) form was higher for novel statements than for conventional statements, $F_s(1, 47) = 214.51$, $p < .001$, and $F_i(1, 44) = 66.09$, $p < .001$. This result is as predicted by the career of metaphor hypothesis and replicates the findings of Experiment 1. There was no main effect of concreteness and no interaction between these two factors.

General Discussion

We have made two basic claims about how metaphors are comprehended. First, we have argued that metaphor can be viewed as a species of analogy. And second, we have proposed that there is a shift in mode of alignment as metaphors are conventionalized—the career of metaphor hypothesis. Novel metaphors are processed as comparisons, in which the target concept is structurally aligned with the literal base concept. Over time, though, multiple figurative comparisons can lead to the creation of abstract metaphoric categories as secondary senses of the base terms. Once a base term reaches this level of conventionality, target concepts can be vertically aligned with the abstract relational schema named by the base term during comprehension.

Our results provide converging evidence for the claim that there is a shift in mode of alignment from comparison to categorization as metaphors are conventionalized. In Experiments 1 and 2, we found four kinds of evidence for this shift. First, subjects' preference for the categorization (metaphor) form over the comparison (simile) form increased as they moved from novel to conventional figurative statements. Second, there was a corresponding decrease in comprehension time, consistent with the idea that vertical alignment, which becomes possible for conventional metaphors because of their abstract categorical senses, is typically faster than horizontal alignment, which involves a more complex negotiation between the representations. Third, we found that for novel figuratives, similes (which invite comparison processing) were comprehended more rapidly than metaphors (which invite categorization processing), whereas the reverse was true for conventional figuratives. (It is worth noting that these findings, unlike the overall speedup with conventionality, cannot be attributed simply to some general increase in frequency and accessibility.) And fourth, the proportion of double predications in subjects' interpretations—a likely indicator of comparison processing—decreased from novel to conventional figuratives.

In Experiment 3 we took the further step of attempting to induce conventionalization in the lab. We found that repeated exposure to novel similes using the same base term resulted in a shift toward using the metaphor form in subsequent statements. In other words, there was a shift from the comparison form to the categorization form. There is no reason to suppose that subjects were aware of this choice; they simply found it more natural—evidence for the induction of an abstraction due to multiple consistent alignments over the same base.

Our findings also support the more complex corollary claim that whereas novel figuratives are processed strictly as comparisons, conventional figuratives, being polysemous, can be processed either as comparisons or as categorizations. Experiment 1 showed that subjects strongly preferred the comparison form for expressing novel figuratives but showed no strong preference for metaphors versus similes when expressing conventional figuratives. And in Experiment 2, we found that although the comparison form was significantly more apt than the categorization form for novel figuratives, both forms were equally apt for conventional figuratives.

In summary, our findings suggest that whether figurative statements are processed as comparisons or as categorizations will depend critically on two factors: the conventionality of the base term and—in the case of conventional expressions—the grammatical form of the statement. It is important to note that all the above effects held regardless of whether the target was abstract or concrete, which offers further evidence for the generality of our claims.

From Birth to Death: Extending the Career of Metaphor

Thus far, we have described the career of metaphor hypothesis in terms of two levels of conventionality—novel and conventional. However, the dimension of conventionality should be regarded as continuous rather than discreet. Some conventional metaphors are more conventional than others—the more salient the domain-general meaning of the base term, the more conventional the metaphor. Conventional metaphors can be distinguished not only in terms of whether the base term evokes an abstract metaphoric category but also in terms of how this abstraction is related to the

literal base concept. Figure 4 shows four possible classes of metaphors that follow from this theoretical framework. As discussed earlier, novel metaphors involve base terms that refer to a domain-specific concept; they will therefore be interpreted as comparisons, or horizontal alignments between the target and base representations. Conventional metaphors, whose base terms refer both to a literal concept and to an associated metaphoric category, can be interpreted either as comparisons, by horizontally aligning the target concept with the literal base concept, or as categorizations, by vertically aligning the target concept with the metaphoric category. However, the career of metaphor does not end here. The evolution may continue until the metaphoric category has lost any sense of connection with the original base concept—that is, until it has become a dead metaphor. Such expressions have lost all sense of metaphoricity.

Figure 4 shows two possible types of dead metaphors. *Dead$_1$ metaphors* are similar to conventional metaphors, except that the two representations evoked by the base term are no longer semantically linked. That is, dead$_1$ base terms are homonymous rather than polysemous. For example, consider the statement *A university is a culture of knowledge*. Here, the word *culture* refers to a particular heritage or society, and its use seems quite literal. In fact, this sense of *culture* is a metaphoric extension of another commonly known sense of the word: "a preparation for growth" (as in *the culture of the vine* or *bacteria culture*). However, these two meanings no longer seem related. This is perhaps because a once-domain-general metaphoric category has, through repeated application to the realm of human affairs, acquired new domain-specific features related to social groups. Indeed, such semantic reinstantiations of metaphoric categories may constitute the primary way in which conventional metaphors evolve into dead$_1$ metaphors.

In contrast to dead$_1$ metaphors, *dead$_2$ metaphors* involve base terms that refer only to a derived metaphoric category—the original base concept no longer exists. An example of this is the dead$_2$ base term *blockbuster* (as in *The movie* Star Wars *was a blockbuster*), which means "anything that is highly effective or successful." Although this meaning of *blockbuster* is highly familiar, most people are unaware that this word originally referred to a very large bomb that could demolish an entire city block.

Both kinds of dead metaphors should be processed strictly as categorizations, by aligning the target concept with the metaphoric category named by the base term. The original base concept will either seem irrelevant (dead$_1$ metaphors) or else will no longer be available (dead$_2$ metaphors). The linguistic behavior of dead metaphors backs up this processing claim. Such statements often can be phrased *only* as metaphors—the simile form seems infelicitous. For example, most hearers would probably reject the statements *A university is like a culture of knowledge* and *The movie* Star Wars *was like a blockbuster* as misleading. After all, a university *is* a culture of knowledge, and the movie *Star Wars was* a blockbuster. Thus, dead metaphors represent the logical conclusion to the shift from comparison to categorization described by the career of metaphor hypothesis.

A few caveats are worth mentioning. First, the degree of conventionality of any given metaphor will vary across speakers and contexts at any given point in time. Second, we suspect that additional processes enter into the final stages of the career of

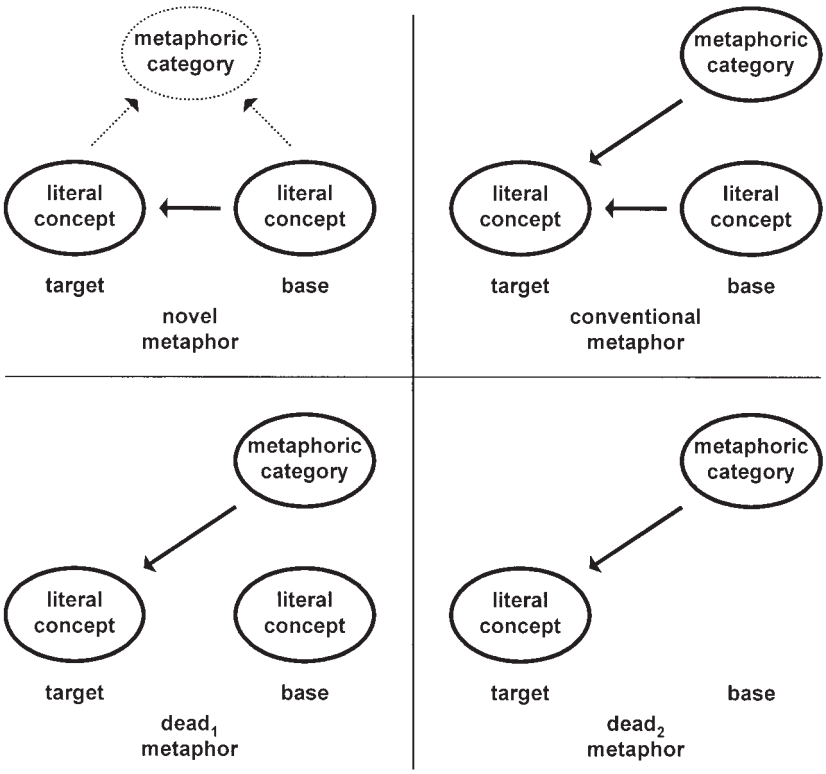

Figure 4. The career of metaphor.

metaphor. Thus, the move from novel to conventional metaphors will be accomplished via the abstraction and lexicalization of metaphoric categories, as described by the career of metaphor hypothesis and will occur for individual speakers. However, the move from conventional to dead metaphors (or from $dead_1$ metaphors to $dead_2$ metaphors) will be accomplished via the loss of semantic associations between the original and derived base representations (or the loss of the literal base concepts themselves); this type of "forgetting" will tend to occur across generations of speakers.

Methodological Implications

Our findings point to significant limitations of the current research. With few exceptions, metaphor researchers have generalized their findings without regard for the conventionality of the materials and often without regard to whether the metaphor or the simile form was used. Our finding that novel and conventional metaphors and similes invoke different comprehension strategies implies that conventionality and grammatical form are factors that must be controlled.

To illustrate these methodological concerns, Table 7 summarizes five recent studies in terms of (a) the proportion of conventional figurative statements used and (b) the predominant grammatical form (metaphor or simile) of the figurative statements. The proportion of conventional figuratives was determined by checking the definitions of the base terms in *Merriam-Webster's Collegiate Dictionary* (1996). Statements containing base terms that were associated with two relevant definitions—a specific literal concept and a related metaphoric category—were counted as conventional. For example, the conventional base term *pawn* (as in *A soldier is a pawn*) is defined as both "one of the chessmen of least value having the power to move forward ordinarily one square at a time, to capture only diagonally forward, and to be promoted to any piece except a king upon reaching the eighth rank" and "one that can be used to further the purposes of another" (*Merriam-Webster's Collegiate Dictionary*, 1996, p. 853). The validity of this check was confirmed by applying it to the figurative statements used in the present experiments. Only 25% of the novel base terms referred both to a specific literal concept and to a related metaphoric category, whereas 88% of the conventional base terms were associated with two such definitions. This is consistent with subjects' ratings of these materials in the stimulus pretest (see Experiment 1).

As Table 7 makes clear, there is little consistency across these studies in the materials used, although conventional figuratives seem to be favored over novel figuratives and metaphors over similes. Nevertheless, these studies have been used to argue for different models of metaphor comprehension and in some cases have even generated contradictory results (e.g., compare Ortony, Vondruska, Foss, & Jones, 1985, with Tourangeau & Rips, 1991). Although other factors are no doubt involved, differences in both the conventionality and the grammatical form of the materials used in these studies may have contributed to these disagreements and discrepancies.

Table 7
Summary of Materials Used in Six Recent Studies of Metaphor

Study	% conventional statements	Predominant form
Glucksberg et al. (1997)	83	Metaphor
Allbritton et al. (1995)	85	Metaphor
Onishi & Murphy (1993)	75	Metaphor
Tourangeau & Rips (1991)	17	Metaphor
Gentner & Clement (1988)	29	Simile
Ortony et al. (1985)	72	Simile

The above discussion is not meant to proscribe studies that focus exclusively on one type of figurative statement. Such studies have their place. For example, if one wishes to examine the comprehension processes involved during the reading of poetry, then novel figuratives will be a more appropriate subject matter than conventional figuratives. Likewise, if one wishes to examine figurative language in everyday speech, then conventional metaphors will tend to predominate. Our point is simply that the conclusions of such studies should be appropriately delimited. The representations and processes involved in figurative language comprehension will depend on both conventionality and grammatical form.

Metaphoric Mappings

We have argued that metaphor is best treated as a species of analogy and processed by structural alignment and projection. Nevertheless, there is a shift in mode of alignment as one moves from novel to conventional figurative statements. We now consider two additional questions about metaphor comprehension from the perspective of the present theoretical framework.

Are metaphoric mappings established directly or indirectly? Most traditional theories of language processing hold that language is fundamentally literal. Because metaphors such as *Love is a rose* are literally false—love is not *really* a rose—they have often been treated as deviations from linguistic norms. More specifically, it has been claimed that metaphors violate conversational maxims of communication and therefore require special comprehension strategies (e.g., H. H. Clark & Lucy, 1975; Grice, 1975, 1978; Searle, 1979). On this view—commonly referred to as *the standard pragmatic view*—metaphors are not interpreted directly. Rather, the hearer invokes a sequence of processing stages that gives priority to literal meaning: (a) Derive a literal interpretation of the statement, (b) assess the soundness of the literal interpretation given the context of the statement, and (c) derive a metaphoric interpretation if the literal one is found to be defective. Metaphoric mappings are only attempted if literal ones cannot be established.

This approach to metaphor comprehension has largely fallen out of favor, primarily because a number of studies have failed to support two key predictions of the standard pragmatic view. First, if literal interpretations always precede metaphoric interpretations, then metaphors should require additional processing time over literal statements. Given sufficient context, however, metaphors often take no longer to read than literal statements (e.g., Inhoff, Lima, & Carroll, 1984; Ortony, Schallert, Reynolds, & Antos, 1978; Shinjo & Myers, 1987). Second, if literal interpretations are obligatory, then metaphoric interpretations should be sought only when literal ones are defective. However, metaphoric meanings often seem to be generated even when contextually appropriate literal meanings can be found (e.g., Gildea & Glucksberg, 1983; Glucksberg, Gildea, & Bookin, 1982; Keysar, 1989).

On the basis of such results, it is now commonly claimed that metaphors are interpreted directly and moreover that the processes involved in comprehending literal and metaphoric language are essentially the same (e.g., Rumelhart, 1979). In most of the above studies, however, the metaphors under consideration were fairly conventional (e.g., Dascal, 1987; Lakoff, 1986). Given this, several researchers have recently suggested that these processing claims may apply only to conventional figurative statements, which can be interpreted by accessing prestored metaphoric meanings. In contrast, the comprehension of novel figurative statements may indeed involve a sequential process, in which the intended metaphoric meaning is derived only once it has been determined that the literal meaning of the base term cannot be sensibly applied to the target (e.g., Blank, 1988; Giora, 1997; Turner & Katz, 1997). On this view, conventional figuratives are interpreted as directly as literal language, but novel figuratives are interpreted indirectly.

Nevertheless, we believe that equating conventionality with directness of processing may be an oversimplification and at any rate is not necessary to explain differences in comprehension times for novel and conventional figuratives. Regardless of whether the mappings are established directly or indirectly, there is already reason to expect that conventional figuratives will be comprehended more rapidly than novel figuratives. As discussed earlier, conventional metaphoric categories will contain fewer predicates than the literal concepts they were derived from, and a higher proportion of these predicates can be mapped to relevant target concepts. Therefore, aligning a target with a metaphoric category will be computationally less costly than aligning a target with a literal base concept. Without invoking the distinction between direct and indirect processing, this explains why conventional figuratives are generally easier to interpret than novel figuratives. This also explains our finding that conventional metaphors, which invite aligning a metaphoric category with the target, are easier to interpret than conventional similes, which invite aligning a literal base concept with the target.

However, the relative complexity of mappings involving different base representations cannot explain our finding that novel similes were comprehended more rapidly than novel metaphors, because both involve novel base terms, which refer only to domain-specific concepts. Rather, we explained this effect in terms of grammatical concordance. When novel figuratives are phrased as metaphors, comprehension will initially be thwarted—the metaphor form invites categorization, but there is no metaphoric category associated with the base. The hearer must reinterpret the metaphor as a comparison between the literal target and base concepts. In contrast, when such statements are phrased as similes, comprehension will be unimpeded—the simile form invites comparison, which is concordant with the mode of alignment required by novel figuratives.

Another way that the direct–indirect dichotomy is an oversimplification is that it ignores the possibility that figurative interpretations can be derived in parallel with literal interpretations. SME, for example, readily derives two or three interpretations for a given comparison—which may be literal, figurative, or a mix. To borrow Gentner and Bowdle's (2001) example, if a friend from Kenya tells you "My neighbor is a lion," you might compute two possible interpretations: "He lives near a formidable person" and "He lives near a large tawny carnivore." Which interpretation you choose will depend not on the relative literality of the two meanings but rather on their fit to your prior knowledge and to the current context, as well as on their relative salience.

The picture that emerges, then, is slightly more complex than the direct–indirect discussion suggests. Figurative language comprehension can involve either direct or indirect processing. However, sequential processing is not predicted by conventionality alone but rather by both conventionality and grammatical form. For conventional figurative statements, comprehension will generally be direct: Conventional metaphors are processed as direct categorizations, and conventional similes are often processed as direct comparisons. For novel figurative statements, comprehension may be either direct or indirect depending on grammatical form: Whereas novel similes are processed as direct comparisons, novel metaphors are processed as indirect comparisons. Note, however, that this indirect processing is not due to an inability to find a meaningful mapping between the literal base concept and the target, as suggested by other accounts. Rather, it stems from the fact that the metaphor form leads to a search for a nonexistent metaphoric category.

Of course, this raises an intriguing question: If novel similes, but not novel metaphors, are processed directly, why would anyone select the metaphor form over the simile form for novel figuratives, as is often the case in poetry? The answer, we believe, is that the metaphor form may lend additional pragmatic force to the statement. Because novel metaphors will initially give the hearer pause, they should call more attention to themselves than novel similes and may therefore be taken more seriously. Indeed, the very presumption inherent in the use of a novel metaphor—that a metaphoric category already exists—may increase the salience of the abstraction once it is arrived at. This possibility is supported by a recent study by Roberts and Kreuz (1994), who had people evaluate the discourse goals accomplished by using different figures of speech, including metaphor, simile, hyperbole, irony, and so on. Not surprisingly, Roberts and Kreuz found that metaphor and simile were highly similar in terms of the discourse goals they satisfied. However, one of the primary differences between these two figures concerned the goal "to add interest": Metaphors were more than three times as likely to elicit this goal as were similes. That is, metaphors were seen as having greater pragmatic force.

One implication of this view is that paraphrasing novel similes as metaphors—that is, expressing figurative comparisons as if they were categorizations—is an acquired communicative strategy requiring a certain level of metalinguistic awareness. If so, then it should be expected that young children will have far more difficulty understanding novel metaphors than novel similes. In fact, this does appear to be the case. For example, Reynolds and Ortony (1980) found that children were more likely to select appropriate figurative conclusions to stories when the correct alternative was phrased as a simile than when it was phrased as a metaphor. Likewise, Vosniadou, Ortony, Reynolds, and Wilson (1984) found that children were better able to enact the meanings of figurative statements when the comparison term *like* was present (e.g., *Sally was like a bird flying to her nest*) than when it was absent (e.g., *Sally was a bird flying to her nest*), and Gentner (1988) found that preschool children who failed to understand the metaphor form (e.g., *Plant stems are drinking straws*) could readily interpret the simile (e.g., *Plant stems are like drinking straws*). These develop-

mental findings add support to our claim that novel metaphoric mappings are processed as comparisons.

Are metaphoric mappings established at a local or global level? Thus far, we have discussed metaphoric mappings as if they operate between individual target and base representations. However, a growing body of evidence suggests that metaphors may often set up mappings between entire conceptual domains or semantic fields. In a historical analysis of English metaphors, Lehrer (1978) found that multiple metaphors relating separate semantic fields tend to enter the language at approximately the same time. For example, most English metaphors describing personality in terms of texture (e.g., *He has a rough personality*, *She's a smooth person*) appeared contemporaneously. Similarly, Keil (1986) found that children tend to shift suddenly from a period in which no metaphors relating two conceptual domains are understood to a period in which most are understood. Extending this finding to adult cognition, Kelly and Keil (1987) demonstrated that metaphor comprehension can affect the similarity of concepts never explicitly presented together but which belong to the same domains as previously juxtaposed concepts. Exposure to metaphors such as *The New Yorker is the quiche of newspapers and magazines* produced an increase in the rated similarity of analogous pairs of concepts that formed appropriate metaphors (e.g., *National Enquirer–rotten egg*) and a decrease in the similarity of pairs that formed inappropriate metaphors (e.g., *National Enquirer–steak and potatoes*).

Thus, the comprehension of individual metaphors may set up extended mappings between the target and base domains. Note that the existence of such global mappings is difficult to reconcile with localist theories of metaphor, including traditional comparison models and more recent categorization models, which ignore the possibility of large-scale domain interactions. If comprehension involves finding matches between sets of independent features for the target and base concepts or begins by abstracting a domain-general category from the base concept, then there is no reason to expect that further specific concepts from the base domain will be mapped to the target domain. However, extended metaphoric mappings can be accommodated by structure-mapping theory and other models of analogical reasoning. This is because such models specify alignments between relational structures. To the extent that concepts are often understood at least partly in terms of relations to other concepts within a particular domain of knowledge (e.g., Barr & Caplan, 1987; Gentner, 1982; Gentner & Kurtz, in press; Murphy & Medin, 1985), metaphoric mappings can be expected to extend beyond the named target and base concepts to more global conceptual systems. This can be seen in our earlier illustration of how the metaphor *Socrates was a midwife* would be interpreted according to structure-mapping theory—correspondences were established not only between the concepts *Socrates* and *midwife* but also between *student* and *mother* and between *idea* and *child*, additional concepts related to the metaphoric structure.

What happens to such extended metaphoric mappings once they have been established? Certainly, these mappings could be used to motivate further figurative expressions using other pairs of concepts from the target and base domains, as suggested by the studies by Lehrer (1978), Keil (1986), and Kelly and Keil (1987). Lakoff and his colleagues (Lakoff, 1987; Lakoff & Johnson, 1980, 1999; Lakoff & Turner, 1989) have taken a stronger position on this issue. They claimed that once established, extended metaphoric mappings become a permanent part of long-term memory and are automatically invoked when reasoning with concepts from the target domain. Indeed, these authors have argued that such mappings are necessary in that abstract domains of knowledge can be conceptualized only in terms of more concrete or experiential ones (see also Kovecses, 1988; Quinn, 1987; Reddy, 1979; Sweetser, 1990). For example, consider the following set of familiar expressions, all of which may be used to talk about love and relationships: "Look *how far we've come*," "It's been *a long, bumpy road*," "We're *at a crossroads*," "We may have to *go our separate ways*," "Our marriage is *on the rocks*," and "We're *spinning our wheels*." According to Lakoff and Johnson (1980), each of these expressions reflects an underlying and widely shared mapping between the abstract domain of love and the concrete domain of journeys, in which entities from the target domain (e.g., the lovers, their common goals, their relationship) are systematically associated with entities from the base domain (e.g., travelers, destinations, vehicles). Not only does this extended metaphoric mapping allow for the production and comprehension of expressions such as the above, but it also actively grounds our understanding of love to a significant degree.

Whether abstract concepts can be understood only metaphorically is an important but highly controversial issue (for recent discussions, see Gibbs, 1996; Murphy, 1996, 1997). Of more immediate interest is the claim that many common figurative expressions are comprehended by accessing more global cross-domain mappings. Again, the analogical approach to metaphor comprehension allows for individual novel metaphors to set up extended mappings between the target and base domains, and for these extended mappings to inspire additional novel expressions. Further, such clusters of expressions may persist in the language, at least to the extent that they remain informative.

It seems likely that the ability of any of these metaphors to invoke large-scale domain interactions may reduce as they become conventionalized. This is because, unlike novel metaphors, conventional metaphors can be processed as categorizations, by aligning the target concept with a metaphoric category named by the base. Often, such metaphoric categories are relatively domain general and make little if any contact with other concepts from the literal base domain. Thus, conventional metaphors will often be processed more locally than novel metaphors. In other words, many of the familiar expressions studied by Lakoff and his colleagues (Lakoff, 1986; Lakoff & Johnson, 1980; e.g., "It's been a long, bumpy road," "We're at a crossroads") may not always be understood in terms of preexisting mappings between specific concepts from the target and base domains.

This prediction has already been confirmed in a study by Gentner and Boronat (1992). Subjects were given passages containing extended metaphors based on themes such as *A debate is a race*. The last sentence of each passage was either a novel or a conventional metaphor and was either a consistent extension of the metaphor of the passage or an extension of an alternative metaphor. When the final metaphor was novel, subjects were faster to read the sentence when it was consistent with the metaphoric context than when it was not. When the final metaphor was conventional, however, there was no difference in reading times between the two conditions.

Of course, this is not to say that conventional metaphors will never invoke extended metaphoric mappings. Some conventional

systems, such as space–time mappings, appear to operate with considerable global coherence (Boroditsky, 2000; Gentner, Imai, & Boroditsky, 2002; McGlone & Harding, 1998). Further, conventional base terms like *crossroads* retain a degree of polysemy, referring both to a literal concept and to an associated metaphoric category. This means that although local categorization processing may generally be favored during the comprehension of conventional metaphors, comparison processing involving a global alignment is still possible. Under what circumstances might this occur? One likely set of circumstances would involve increasing the salience of the domain relations that participate in the mapping. This could be accomplished if a conventional metaphor is embedded in a discourse context that includes other figurative expressions that consistently link the target and base domains. The present research suggests an even simpler way to invoke an extended metaphoric mapping of a conventional metaphor, even when encountered in isolation. Specifically, if the metaphor is paraphrased as a simile—that is, as a comparison—then a much richer analogy may be drawn. In essence, the simile form lays bare the original alignment from which the familiar expression was born.

Conclusion

The career of metaphor hypothesis offers a unified theoretical framework for the study of metaphor. It reconciles the seemingly opposing intuitions behind traditional comparison models of metaphor comprehension and more recent categorization models. Moreover, it provides a mechanism for the metaphoric generation of polysemous words and renders explicit the processing differences between metaphors at different levels of conventionality. Finally, it suggests that whether metaphors are processed directly or indirectly and whether they operate at the level of individual concepts or entire conceptual domains will depend both on their degree of conventionality and on their grammatical form.

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