Productivity and Schematicity in Metaphors

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The theory of metaphor proposed by Lakoff and Johnson (1980a, 1980b) and Lakoff (1993) involves a mapping of conceptual structure from one semantic domain to another. We investigate properties of these conceptual domain mappings by comparing them to morphological derivational relations. Schematicity and productivity are properties that Bybee (1985) and Langacker (1987) propose for characterizing morphological derivational relations, which we apply to our analysis of metaphor. Metaphors are argued to vary in their degree of semantic schematicity: Domain relations function as generalizations over specific metaphorical expressions. We also demonstrate three points on a continuum of productivity: Conventional metaphors are highly productive, metaphorically motivated transparent idioms are semiproducive, and opaque idioms are unproductive. Each point is compared with an example of morphological productivity having a corresponding conceptual organization. The results demonstrate that semantic productivity can be characterized in the same way as morphological productivity, suggesting that form and meaning are organized by the same principles.

1. BACKGROUND

Lakoff and Johnson (1980a, 1980b) provide one of earliest treatments of metaphor as conventionalized cognitive structure (see also Reddy, 1979). Their theory principally involves a mapping relation from a source semantic domain to a target semantic domain, where the source domain concepts are taken to be ‘literal’ and target domain concepts are ‘figurative’. This work has spawned a variety of research, focusing on what metaphors can reveal about cognitive structure (see also Cacciari & Glucksberg, 1994; Fauconnier & Turner, 1994; Gibbs, 1994; Glucksberg & Keysar, 1993; Johnson, 1987; Indurkhya, 1992; Kittay, 1987; Lakoff, 1987, 1993; Lakoff & Turner, 1989).
This article will examine metaphors as conventionalized conceptual structures. We bring to this research elements from Bybee’s (1985) theory of morphology and Langacker’s (1987, 1991) cognitive grammar; each theory is germane to empirical cognitive science. These both are theories of grammatical organization in which the forms and meanings of linguistic expressions are stored in a network of interrelated units. We adopt technical concepts from these theories and apply them to metaphor. Specifically, we apply the schematicity and productivity of morphological structure to the investigation of semantic structure—with the hypothesis that properties found in linguistic forms are also present in linguistic meaning. We argue that metaphors vary in both their schematicity and productivity, and the Bybee/Langacker cognitive linguistic view of grammatical organization provides a theoretical foundation for describing this variation.

A summary of key concepts from Lakoff and Johnson’s theory of metaphor, Bybee’s theory of morphological representation and Langacker’s theory of grammatical organization is presented in §1. The Bybee/Langacker theory of grammatical organization is used by them chiefly to describe morphologically related forms (root-derived pairs) that share a single meaning (that of the root). Key concepts from this theory are then applied to metaphor. In §2 we argue that this morphological theory can be used to describe semantically related concepts (literal—metaphorical pairs) that share the same formal linguistic expression (the word or phrase used metaphorically). Just as morphological derivations are relations in phonological structure and must be defined at the proper degree of phonological schematicity, metaphorical relations are relations in semantic structure and must be defined at the proper level of semantic schematicity. Likewise, in §3, we argue that just as morphological derivations relate phonological units and account for paradigmatic productivity, metaphors relate conceptual domains and are productive of metaphorical expressions. This extension of the theory is consistent with its treatment of the domain of linguistic form as a conceptual domain just like any other (Langacker, 1987, p. 79), and so is subject to organization and manipulation by the same cognitive principles as other conceptual domains. In §4 we discuss our analyses of schematicity and productivity with respect to metaphor hierarchies, other theories of metaphor, and metaphor constraints. A brief conclusion is provided in §5.

1.1 Metaphor as Cognitive Structure

Lakoff and Johnson (1980a, 1980b) advocate a view of semantics in which human conceptual structure is organized into domains of experiential knowledge (e.g., PHYSICAL OBJECTS, LIVING THINGS, SPACE; cf. Langacker, 1987). A domain is an experiential gestalt; that is, a “multidimensional structured whole arising naturally from experience” (Lakoff & Johnson, 1980b, p. 85). Lakoff & Johnson’s concept of a domain is closely related to Fillmore’s notion of ‘frame’ in frame semantics (Fillmore, 1975, 1982, 1984), and Langacker’s notion of ‘experiential domain’ (Langacker, 1987). A concept is characterized relative to one or more experiential domains, each highlighting and contributing some structure to a particular dimension of the coherent whole (domain). For example, the concept bird is characterized relative to the domains: PHYSICAL OBJECTS, LIVING THINGS, SPACE, etc.? Any one domain is a dimension of experiential knowledge highlighting spec-
specific aspects of the concepts in that domain. The domain LIVING THINGS highlights the knowledge which speakers possess about birds specific to knowledge about the nature of things that are alive—they eat, reproduce, die, etc.

According to the Lakovian theory (Lakoff, 1987, 1993; Lakoff & Johnson, 1980; Lakoff & Turner, 1989) metaphorical concepts are essentially understood by means of a mapping relation between a source domain and a target domain. Structure from complex gestalt S (the source domain) is imposed upon complex gestalt T (the target domain). Concepts from T are metaphorically structured in that they are understood in terms of structure from S. A metaphor is a domain mapping (a semantic relation formulated as T IS S) which can instantiate metaphorical concepts.

In the metaphor TIME IS MONEY the source domain is MONEY and the target domain is TIME. We understand expressions 1a–d as referring to metaphorical concepts of TIME because the source domain MONEY is mapped onto the target domain TIME. Each expression of a metaphorical concept is an instantiation of this metaphor. Any one metaphorical concept about TIME is understood in terms of structure from the source domain MONEY (words in bold).

(1) a. save time  
   b. buy time  
   c. invest time  
   b. spend time

The mapping is between whole domains and not just individual concepts. This is evidenced by many expressions involving a variety of metaphorical concepts each united under the same source and target domains (also e.g., valuable time, living on borrowed time).

Lakoff and Turner (1989) describe metaphor use as "conventional, unconscious, automatic and typically unnoticed" (p. 80). For example, the mapping from MONEY to TIME is a conventional and culturally-specific knowledge structure possessed by English speakers. Conventional metaphor is a mapping in the sense of being a static asymmetric relation in conceptual structure, not a real-time conversion of literal to figurative meaning (Lakoff, 1993, p. 219). The paper focuses on conventional metaphor.

In the following arguments, we will make use of elements from conventional metaphor which may be distinguished from novel metaphor. Conventional metaphors map very general 'image-schematic structure' between domains. Although the definition of 'image-schema' is somewhat controversial among cognitive linguists (see Brugman, 1990; Clausner & Croft, 1993; Lakoff, 1990), the term 'image schema' (Johnson, 1987) means roughly 'topological properties' as described in Talmy, 1977, 1988b), that is, idealized abstract structures such as dimensionality, sequentiality, causality and physical boundedness.

Lakoff & Turner (1987, p. 99) and Lakoff (1993, p. 229) distinguish conventional metaphors which map image-schemas from novel metaphors which map rich specific images. They explain that the example, my wife . . . whose waist is an hourglass is an image metaphor because it maps the specified image of the shape of an hourglass onto the specific image of a woman's waist. This is a novel 'one-shot mapping' in which analogical similarity of a specific shape is established between the specific concepts waist and hourglass. There is no stored schema to instantiate mappings other than this one.
In this article, we focus on image-schematic metaphor because the semantic properties for which we argue are expected to be found in conventionalized conceptual structure. We will refer to these conventional structures (which includes the S and T domains and the image-schematic mapping) as 'metaphor' or 'metaphor schemas.' The linguistic forms manifested by a metaphor schema will be called 'metaphorical expressions' or 'instantiations' of the metaphor.

It is important that the distinction between conventional metaphor and image metaphor is understood to be one of conventionality in semantic structure, not one of expressional form. We recognize that novel metaphors, which primarily involve analogical similarity of semantic structure, appear to be closely related to what is traditionally called 'simile' or 'analogy.' Many studies of 'metaphor' are studies of simile or novel metaphors (Gentner, 1988; Siltanen, 1990; Vosniadou, 1989; Winner, 1979). These typically use expressions of the following form: A is B (e.g., raindrops are the sky's tears) and A is like B (e.g., the moon is like a lightbulb). Some studies which do not exclusively use the simile forms (Keil, 1986; Kelly & Keil, 1987; Pearson, 1990) nonetheless use novel metaphors (e.g., Dawn creeps across the sky). Gentner (1983) calls this 'structure mapping' and has developed an important research enterprise which focuses on the real-time dynamics of domain mapping.

We hypothesize that conventional metaphor schemas exhibit gradient properties of schematicity and productivity. The next section describes these technical concepts.

1.2 The Bybee/Langacker Theory of Morphological (Grammatical) Representation

Bybee (1985) and Langacker (1987) both propose theories of lexical organization in which linguistic forms and the meanings they symbolize are stored as a network of interrelated units. Bybee's 'dynamic model of lexical representation' (based on psycholinguistic, developmental, cross-linguistic, and diachronic evidence) and Langacker's 'cognitive grammar' (based on principles from cognitive psychology) share many elements. We believe that the two are variants of essentially the same theory.

Langacker proposes a general theory of grammatical organization, in which lexicon, morphology, and syntax form a continuum of cognitive structure. We will restrict ourselves here to elements shared by this and Bybee's theory in morphology. The central concepts of this theory which we adopt are: derivational relations, entrenchment, schematicity and productivity. The main argument in this article is that these same concepts are relevant to the organization of semantics.

1.2.1 Derivational Relations

Derivational relations are represented in a network linking basic and derived forms: Figure 1(a) illustrates a basic and derived pair linked by a derivational relation (dashed arrow). The category Verb and its regular past tense derivation Verb-ed are related by a morphological derivational relation. The verb form play, the derivational relation, and the derived
The notion of ‘derivation’ described here is the general notion of morphological derivation of one form from another, not the more specific concept of derivation (word formation) as opposed to inflection. The general concept of derivation involves an asymmetric relationship between any two related forms such that one of the forms can be considered basic (or at least more basic) than the other. Two inflectional forms (e.g., present and past tense) are derivationally related in the more general sense because they are related morphologically and one of them can be considered more basic than the other.

We propose in this paper a parallelism between morphological and semantic productivity, which assumes a parallelism between the derivation of a linguistic form and the extension of a semantic category. Adopting the broad sense of ‘derivation’ allows the parallelism between derivational relations in morphology and the Lakovian theory of metaphor to be obvious: The source and the target domains are in a semantic derivational relation, with the source domain as the basic member of the relation. We will argue that this is not a superficial parallelism; many (if not all) properties of derivational relations in morphology are also found in metaphor.

1.2.2 Schematicity

A schematic unit represents a generalization over specific instantiations. The unit Verb generalizes over all English verbs, for example, play, surmise, etc. Complex units may also be schematic. The complex unit [Verb - → Verb-ed] is a general schema (Figure 1a) for all regular past tense derivations in English (e.g., Figure 1b).

Schematicity is a relation between a schema and its instantiations. In Figure 2 each solid arrow denotes a relation of schematicity holding between the schematic unit and each instantiation of this schema. Solid arrows, which denote schematicity, are distinct from the dashed arrows, which denote a derivational relation. (Other details of Figure 2 will be discussed in the following section.)

The relation between a type and its tokens can be described as one of schematicity. However, schematicity is a relation at all levels of generalization. The instantiation of one schema may function as an intermediate schema for other more specific instantiations. Thus, schematicity may be compared to the vertical relation in a taxonomic hierarchy. For example, the schema Verb-ed is taxonomically higher than the schemas which specify conditions for the past tense allomorphs /-t/, /-d/, or /-ad/. These intermediate schemas are taxonomically higher and instantiate schemas for specific verbs, e.g. played, surmised, fitted.
These are possible levels of schematicity; issues of schema storage are considered in the next section.

Schemas of any complexity may exist in schematic hierarchies. For example, the general schema \([\text{Verb} \rightarrow \text{Verb-ed}]\) may instantiate intermediate schemas which specify allomorphic conditions for past tense derivation, e.g. \([\text{Verb} \text{ with final phoneme } /t/ \text{ or } /d/ \rightarrow \text{Verb suffixed with allomorph } /\text{-ed}/]\). An intermediate schema may in turn instantiate even more specific schemas for particular verbs which are consistent with its allomorphic condition, for example \([\text{fit} \rightarrow \text{fit-ed}]\). For simplicity, these two lowest levels are combined in Figure 2. These are possible degrees of schematicity for regular past tense derivation.

Bybee & Moder (1983) argue that there exist schemas for at least some irregular past tense classes in modern English. These schemas are more specific phonologically that the maximally general regular past tense schema, because they generalize over less systematic past tense forms (see §3.2). Morphological schematicity is a gradient relation, in which a schema and its instantiations may vary in their relative degree of specificity. We will demonstrate in §2 that metaphors vary in their semantic schematicity in comparable ways.

1.2.3 Entrenchment

A linguistic form may become entrenched (stored as a unit in the knowledge network) regardless of its internal complexity (cf. Bybee’s term ‘autonomy’). An entrenched unit may be of any length or level of organization: phoneme, morpheme, word, compound, phrase, etc.

Units are symbolic, in that every phonological unit symbolizes a counterpart semantic unit. For example, a phonological unit such as \([\text{play}]\) symbolizes a semantic unit \([\text{PLAY}]\); however, we will typically only be interested in one of the two poles for any particular diagram. Units will be denoted by boxes in the figures, and in text by square brackets (when italics does not provide sufficient clarity). Phonological units will be denoted by lowercase letters (grammatical categories have an initial capital).

A relation between two units may be entrenched in a complex unit consisting of two subunits and the relation which holds between them. For example, a derivational relation may be entrenched in the following complex unit: \([[[\text{play}] \rightarrow \text{[play-ed]}]]\). Unit status implies that, regardless of its internal complexity and analyzable substructure, a unit will function as a single structure. The activation (i.e., use) of any subunit entails activation of the whole assembly. Figure 2 depicts the unit status of a derivation as the outer box containing the basic and derived units (inner boxes), and derivational relation holding between them.
The specific derivations play–played, surmise–surmised, and all verbs which form the past with the suffix /-ed/, are instantiations which are generalizable as a derivational schema. Mastery of this pattern amounts to entrenchment of the schema [(Verb) → (Verb-ed)]. This schema corresponds to a derivational rule in theories employing symbolic rules (Langacker, 1987, pp. 437–447).

Entrenchment is a gradient, thus a unit may be stored to varying degree. Figure 2 indicates the relative degree of entrenchment of units by degree of boldface. The bold dark boxes denote highly entrenched units and the lighter boxes denote relatively low entrenchment. An analyzable unit may become independently and redundantly entrenched if it occurs frequently enough. For example, played is sufficiently frequent that it is likely to be entrenched as a unit itself, although both component morphemes, the verbal root play and the past tense suffix /-ed/, occur regularly in many other environments and so are also entrenched in their own right. On the other hand, [demythologize] → (demythologiz-ed) is probably not stored. The use of parentheses around the derived past tense form indicates that the derivation occurs by novel computation, rather than by activation of a pre-existing unit (cf. Langacker, 1987, p. 59).

Independent entrenchment of a derived form may lead to the loss of many or all aspects of the derivational relation, thus splitting a derived unit from its root. Bybee observes that derivationally-related pairs of words may be split in both meaning and form: “something can be dirty without involving real dirt...nor do you have to be terrified to think something is terrific” (Bybee, 1985). She argues that the split is due to increasing entrenchment of the derived member of the pair, and observes that even zero-derivations work this way: “someone can soil an item without being near any real soil” (p. 88). She also argues, “The higher the frequency of a derived word, the more likely it is to occur in a variety of contexts, including some in which its related root word, and the semantic notions expressed by it, do not occur” (p. 90). We will demonstrate that some metaphors exhibit exactly this same sort of split.

1.2.4 Productivity

Using the concepts of derivational relation, entrenchment and schematicity, the Bybee/Langacker account of morphological productivity can be advanced. For this we translate some of Bybee's terminology into that used by Langacker. Bybee proposes that a highly productive morphological schema results when there is high type frequency of low token frequency lexical items which instantiate the schema (Bybee, 1985, pp. 124, 133). Low token frequency implies low unit entrenchment of the instantiations (see light boxes of Figure 2). High type frequency implies high unit entrenchment of the schema (see bold boxes). This occurs when there are many different tokens of the same type that instantiate the schema. For example, there are many different English verbs which all form the past in a regular way. Individually, these verbs occur with low frequency compared to the high frequency of forming the past with /-ed/; hence, the regular past formation is highly productive. The solid arrows in Figure 2 denote the schematic relation between the schema and its instantiations; the boldness of the solid arrows denotes high productivity of the schema.
Many lightly entrenched instantiations of a highly entrenched schema results in a highly productive 'rule', such as regular English past tense verb formation.

Conversely, high token frequency items of low type frequency result in low productivity of the type. The Bybee/Langacker theory explains this as follows. High frequency tokens tend to be stored as highly entrenched units. As such they are 'autonomous', and do not reinforce a schema, if such a schema can be generalized (see Bybee, 1985, pp. 117, 124). Moreover, if there are very few of these items, speakers tend not to analyze the derivational pattern, hence no schematic generalization will be stored to connect them. Nonce-probe experiments of Spanish verb paradigms confirm that participants could not extend patterns which occurred in only one or two very frequent verbs (p. 133). There was more success in extending patterns which occur in a large number of medium frequency verbs. As expected, the ability of participants to derivationally extend a nonce verb form depends systematically on the productivity of the derivational pattern being probed relative to actual verbs sharing that pattern.

Productivity is gradient and is determined by the relative type-token frequency of pertinent units, and therefore indicative of the lexical organization of those units. High type frequency enhances productivity, while high token frequency inhibits productivity. These two properties often covary inversely. This is a result of the fact that low token frequency lexical items of a small (low type frequency) inflectional class become 'regularized'—that is, they shift to the high type frequency major class, or less often, to a minor productive class whose members they resemble phonologically. In §3 we will argue that the same gradient effects can be found in metaphor as well.

1.3 Methodology and Data Classification

The methodology used in this investigation to apply morphological schematicity and productivity to metaphor combines standard linguistic methods—analysis based on acceptability judgements of sentences—with a survey of acceptability ratings obtained from a population of speakers. The data which are analyzed in this paper consist of 137 expressions, which we hypothesized to instantiate metaphors of varying degrees of schematicity and productivity, based on our own acceptability judgements. These judgements (and the hypotheses they represent) were assessed as described in detail in this section. The expressions were taken from the existing metaphor literature (the sources are cited in these cases), or were generated by us for the purposes of this analysis. We describe the method of assessment of acceptability judgements first, before the exposition of the arguments in sections §§2–3, since all of the expressions must be presented to make our arguments. This order of exposition, with the acceptability ratings included as the expressions are introduced into the arguments, will facilitate the evaluation of our analysis by the reader.

The analysis of these data partly involve rating each expression's semantic felicity (i.e., its acceptability as a meaningful sentence of English). Felicity judgments were obtained from 40 undergraduate native English speakers. Each rater received one of four differently randomized lists of all 137 expressions. The instructions included the following:
Below is a list of sentences and parts of sentences. For each one, quickly decide whether it "sounds good to you." Some sentences are followed by a context provided in brackets. Mark your response on a scale of 0-4, where 0 = sounds bad, 4 = sounds good. Mark 4, if it sounds good, that is, if it came up in conversation, it would make sense. Mark 1, 2 or 3, to the degree that it sounds marginally good or odd. Mark 0, if it sounds bad, that is, it doesn't make any sense.

The conventional reading of most of the expressions is clearly figurative (e.g., *he remains cool even in a crisis*). Expressions which would otherwise be ambiguous were augmented with a figurative context provided in brackets, e.g., *let the cat out of the bag [talking about revealing a secret]*.

Based on the ratings, each expression was classified according to the following criteria: 'Felicitous' expressions are those for which greater than 50% of raters responded "4" or "3". 'Infelicitous' expressions are those for which greater than 50% of raters responded "1" or "0". All others are classified as 'marginal' expressions.

Of the 137 expressions rated, six appear in §1.1 (including 1a–d, all felicitous) and 120 expressions are each reported in §§2–3 with their felicity classification and mean rating (two expressions are duplicates to track rater consistency). Nine expressions relevant to 'quasi-metaphorical idioms' (see Cacciari & Glucksberg, 1990) are not discussed, as they do not bear directly on our arguments in this article.

There were 75 expressions meeting the criterion for semantic felicity. The mean rating over the 40 respondents for each of these expressions ranged from 3.7 to 2.5. There were 28 expressions classified as infelicitous, with mean ratings ranging from 1.4 to 1.1. The remaining 23 marginal expressions have means ranging from 2.3 to 1.2. the response distribution of each marginal expression is either maximal at 2, minimal at 2, or near chance for each mark 0 to 4.

The classifications 'felicitous', 'marginal', and 'infelicitous' are denoted by expressions being unmarked, marked by a "?", or marked by a "*", respectively. Mean ratings are reported in angle braces following each expression; e.g., *the attic of their theory <0.8>.

These classifications are intended to reflect whether conventional speakers judge an expression to have a conventional figurative meaning.

Using these data we analyze groups of expressions which are semantically consistent with a particular metaphor schema and argue that metaphors exhibit the properties of schematicity and productivity.

2. THE SCHEMATICITY OF METAPHORS

The Bybee/Langacker theory of morphology distinguishes schematicity and productivity in the following way. Schematicity is the degree to which one unit (schema) generalizes over many specific units (instantiations). Productivity is the degree to which a schema is more entrenched than its instantiations. Schematicity and productivity are partly interdependent, thus the description of one requires consideration of the other. The above section described schematicity and productivity of morphological derivational relations. We will now discuss these properties with respect to semantic domain relations in metaphor, and demonstrate relevant theoretical points by comparing morphological cases to metaphorical
ones. We begin by defining more precisely the distinction between schematicity and productivity.

2.1 Schematicity versus Productivity of Metaphors

Lakoff (1987, p. 384) discusses two ways in which metaphors can be productive. We identify one way as schematicity and the other as productivity proper. The first way in which a conceptual metaphor is ‘productive’ in Lakoff’s view is really the essence of metaphor in the Lakoff-Johnson theory: Metaphorical mappings are not random links between concepts, but bring over the whole cognitive model of the source domain (entities, relations, properties, processes, entailments and all) to the target domain. This is in fact the concept of schematicity applied to metaphorical derivation. Comparing a morphological derivation schema to a metaphorical one will demonstrate this theoretical point.

The regular plural of any English noun stem $N$ is formed by affixing the regular plural morpheme /-s/. This suffix has one of three allomorphs /-s/, /-z/, and /-lz/, depending on the final phoneme of the stem. This morphological regularity may be generalized as three schemas:

<table>
<thead>
<tr>
<th>Source</th>
<th>Target Expressions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$N$ with a final voiceless consonant other than /s/</td>
<td>$\rightarrow /N{-}s/ \ (e.g., \ cat{-}cats) /kaet{-}s/$</td>
</tr>
<tr>
<td>$N$ with a final vowel or voiced consonant other than /z/</td>
<td>$\rightarrow /N{-}z/ \ (e.g., \ bag{-}bags) /baeg{-}s/$</td>
</tr>
<tr>
<td>$N$ with a final /s/ or /z/</td>
<td>$\rightarrow /N{-}lz/ \ (e.g., \ bus{-}buses) /kaz{-}lz/$</td>
</tr>
</tbody>
</table>

Each allomorph is associated with a phonological characteristic of the noun stem, and any noun stem fitting that characteristic (Source) will form an instantiation of the plural in the appropriate way (Target). These schemas do not specify relations between individual words, but between whole morphological “domains”. The plural derivation of any specific stem (e.g., *cat*–*cats*, *book*–*books*, etc.) is an instantiation of a schema which maps the “source domain” [$N$ with a final voiceless consonant other than /s/] onto the “target domain” [$N$ suffixed with plural allomorph /-s/]. We propose that the same kind of derivational mapping in the above morphological schemas occurs in metaphor as semantic mapping schemas.

Lakoff and Johnson (1980) argue that a metaphor such as *ARGUMENT IS WAR* involves a metaphorical mapping, not between individual concepts but between whole conceptual domains (§1.1). The metaphor schema maps the semantic source domain *WAR* onto the semantic target domain *ARGUMENT*. They note that everyday argument involves, among other things, a social process in which two people are adversaries. The adversarial ‘force dynamics’ (in the sense of Talmy, 1988a) between two parties engaged in argument is conventionally understood in English in terms of combat. Lakoff and Johnson provide expressions 2a–h. Sanchez (1992) observes that this metaphor may instantiate a large variety of expressions (representative examples 2i–m). Collections of expressions are not intended to be exhaustive of every possible instantiation of the metaphor. In fact, this is one of our hypotheses: That the expressions themselves are a manifestation of a schema’s potentially unbounded productivity.
METAPHOR PRODUCTIVITY

(2)  

a. your claims are indefensible <2.8>  
b. he attacked every weak point in my argument <3.7>  
c. his criticisms were right on target <3.5>  
d. I demolished his argument <2.8>  
e. I've never won an argument with him <3.5>  
f. you disagree? Okay, shoot! [talking about an argument] <3.0>  
g. if you use that strategy, he'll wipe you out [talking about an argument] <3.3>  
h. he shot down all of my arguments <3.7>  
i. he destroyed his opponent in the debate <3.4>  
j. they fought for every single concession <2.5>  
k. she challenged those claims <3.4>  
l. the bill was quickly defeated <2.7>  
m. he fired questions at his opponent <3.6>

The variety of metaphorical expressions which describe argumentation in terms of war is evidence for a metaphor schema that generalizes over these expressions. The schema described by the formula ARGUMENT IS WAR characterizes the range of possible metaphorical concepts.

The schematic generality of a metaphor is represented by the fact that the appropriate level of description of the metaphor is in terms of a relationship between semantic domains (e.g., WAR mapping onto ARGUMENT), rather than individual metaphorical concepts. The appropriate level of schematicity characterizes the full range of expressions of the metaphor. In phonology, this is like a schema which characterizes the range of singular noun stems which are mapped onto a plural noun stem ending in /-s/.

The range of concepts characterized by a domain mapping schema is what we call the metaphor's degree of schematicity. Productivity proper corresponds roughly to the second way in which Lakoff says a metaphor can be productive: “The number of conventional linguistic expressions that code a given conceptual metaphor is one measure of the productivity of the metaphor” (Lakoff, 1987, p. 384). If all the linguistic expressions encoding a concept in the source domain can be used metaphorically, the metaphor is highly productive; if not, then the metaphor is less productive. This sense of metaphor productivity will be explored in §3.

For any schema relating a source and target domain, we define the distinction between schematicity and productivity proper as follows

Schematicity: The range of source (or target) domain concepts consistent with the schema.

Productivity: The proportion of a schema's range which can be instantiated as expressions.

Assessing the productivity of a metaphor presupposes, however, that we have correctly identified the appropriate level of schematicity of the metaphor. Again, we illustrate the problem using our example from morphology, and then show how the exact same problem arises in the analysis of metaphor.

Not all English noun stems fitting the phonological schemas for each of the allomorphs /-s/, /-z/, and /-iz/ actually has a regular plural expression consistent with the schema. Instead, some stems have a variety of irregular plurals. For example, the stem mouse has the plural mice. Even though the stem mouse ends with /s/, and is therefore consistent with
the schema for plural allomorph /-1iz/, the plural does not have the regular form *mouses. (Other irregular plurals include foot-feet but not *foots.) In spite of these irregularities, one might want to argue that there exists one English phonological rule \([N_{\text{SINGULAR}} \rightarrow N_{\text{PLURAL}}]\) covering all noun plurals (the three regular allomorphs and all the irregulars). However, that schema, albeit more general than the regular schema, has relatively little predictive value—it only tells us that many English nouns have plurals of some phonological form. On the other hand, the more specific regular plural schemas can actually derive the plural from the singular form. The only cases in which they do not derive the plural is when they are overridden by still more specific schemas, namely the schemas for the irregular forms. These are very specific schemas that cover small sets of irregulars, such as the set mouse-mice, louse-lice, and maybe die-dice. Still more specific schemas cover only one irregular plural form; for example, even the “rule” deriving people from person is a schema, albeit at the minimum level of schematicity, ranging over only one noun stem.

The system of English plural expressions can be described at many levels of specificity. The irregular schemas do not cover the whole system; they cannot directly produce the regular forms. Conversely, the schema \([N_{\text{SINGULAR}} \rightarrow N_{\text{PLURAL}}]\) is too general, ranging over all plural derivations, and cannot directly produce specific regular forms. The optimal characterization of English plural derivation is the level of the three allomorph schemas, which provides the most specific description of the most productive derivations.

The general principle is that the maximally productive, but most specific (i.e., minimally schematic), representation is the schema that actually determines the form of the derived word. This does not preclude the existence of more general schemas, but implies that an optimally specific schema is necessary to describe the morphological system. Bybee’s theory of morpho-phonological productivity predicts that high productivity is evidence of a highly entrenched schema in the mind of the speaker. Every schema is productive, but the most entrenched schemas are maximally productive. The most specific characterization of these schemas defines their optimal degree of schematicity.

Just as phonological schemas may be characterized at different levels of specificity, one can describe metaphor schemas at greater or lesser degrees of specificity, and like phonological schemas there exists a maximally productive characterization of metaphor schemas that must be a part of the conceptual system of every English speaker.

Empirical evidence that can be used to establish this level is the semantic range of the conventional linguistic expressions used metaphorically to link source and target domains. We predict that if a metaphor has been described at too high a level of generality, there will be systematic semantic gaps in existing conventional metaphorical expressions, and there will be a semantically more specific description of the source and target domains than the one in question. (Semantically nonsystematic gaps are due to a lack of metaphor productivity proper, as defined above and applied in §3.) We also hypothesize that the maximally productive level of schematicity varies depending on the metaphor. To summarize the distinction, schematicity is a measure of a metaphor schema’s generality, whereas productivity is a measure of how successful a schema is in manifesting its generality in actual linguistic expressions.
2.2 Metaphors Vary in Schematicity

In this section we analyze the schematicity of three metaphors, arguing for each that an appropriate-level formulation can characterize the metaphor schema and that these schemas differ in their relative specificity.

The metaphor ARGUMENT IS WAR (see 2 in §2.1) links two quite general domains. We argue that this formulation by Lakoff and Johnson correctly characterizes the conceptual range of this metaphor. This type of 'argument' in the target domain is what Lakoff and Johnson call 'everyday arguments', ranging from philosophical debates of extreme rationality to possibly completely irrational verbal arguments. Likewise, the source domain covers nearly any aspect of war: planning, strategy, the physical and technological interaction, as well as outcomes and consequences.

The appropriate formulation of this metaphor must cover the maximum range of concepts for which metaphorical expressions can be produced. That is, the range of expressions highlighting argument concepts in terms of war is maximal at the schematic level for which the metaphor is most entrenched.

Turner (1991, p. 112) states the metaphor as RATIONAL ARGUMENT IS COMBAT BETWEEN INTENTIONAL AGENTS. In our view, this formulation is probably not schematic enough to adequately characterize this metaphor. As Lakoff and Johnson argue, the target domain includes more than just rational argument, since irrational everyday argument can also be described in terms of war (e.g., they fought every week over who was going to do the dishes <3.6>). Likewise, more aspects of war than combat between intentional agents are found in this metaphor. In particular, many expressions make reference to the argument itself as a war resource to be destroyed (e.g., 2d and 2h). The adversarial meanings highlighted by this metaphor cover a broad range of concepts, which involve very general domains, and the formula ARGUMENT IS WAR appropriately characterizes this high level of schematicity.

On the other hand, some metaphors are formulated too generally, leaving semantic gaps in the metaphorical mapping. The metaphor THEORIES AND ARGUMENTS ARE BUILDINGS (Lakoff & Johnson, 1980, pp. 46, 98) is intended to highlight concepts about the propositional organization of rational argumentation. Below are some expressions (3a–3i) of this metaphor given by Lakoff and Johnson:

(3) a. is that the foundation of your theory? <3.5>; the foundation of their theory <3.1>
   b. the theory needs more support <3.6>
   c. the argument is shaky <3.6>
   d. we need some more facts or the argument will fall apart <3.3>
   e. we need to construct a strong argument for that <3.4>
   f. I haven’t figured out yet what the form of the argument will be <2.7>
   g. we need to buttress the theory with solid arguments <2.5>
   h. the theory will stand or fall on the strength of that argument <3.3>
   i. the argument collapsed <3.1>

Lakoff and Johnson (1980, pp. 87–89) restrict the target domain of this metaphor from the general commonsense model, which includes what they call ‘everyday arguments’ (the target domain of ARGUMENT IS WAR), to just (ONE-PARTY) RATIONAL ARGUMENT. In par-
ticular, they note that several properties of the more specific domain of rational argument may not be present (or at least are not prominent) in the more general domain ARGUMENT. These properties are: obviousness, directness, clarity, content, progress, basicness, strength and structure (pp. 88–89). However, the metaphor is actually less schematic in both source and target domains than this new formulation (RATIONAL ARGUMENTS ARE BUILDINGS). The aspects of rational argument that are highlighted by the building metaphor are only: content, progress, basicness, strength and structure (Clausner, 1993). The source domain is also less schematic than BUILDINGS. Concepts which involve structural integrity, such as foundation in 3a, are part of the source domain, but other aspects of buildings do not form conventional linguistic expressions of this metaphor, as illustrated in 4.

(4)  
   a. *is that the basement of your theory? <0.8>  
   b. *that line of reasoning has no plumbing <1.1>  
   c. *the theory has a broken pipe <0.8>  
   d. o. *the X of their theory  
   d. *attic <0.8>  
   e. *basement <0.9, 1.1>  
   f. *chimney <0.8>  
   g. *corner <1.6>  
   h. *corridors <1.1>  
   i. *hallways <0.9>  
   j. *plumbing <1.1>  
   k. *rafters <0.8>  
   l. *steel frame <1.3>  
   m. *wall <1.1>  
   n. *window <1.5>  
   o. *wiring <1.2>  

We find that the range of concepts which express the metaphor demonstrate a systematic gap when the source domain is characterized as BUILDING. The words expressing building concepts which map include: buttress, collapse, construct, fall, form, foundation shaky, solid, sound, strengthen, strong, stable, stand, support, unsound, and unstable (from 14 felicitous expressions with overall mean rating 3.2). The building concepts which do not express the metaphor include: *attic, *basement, *broken pipe, *chimney, *corner, *corridors, *hallways, *plumbing, *rafters, *steel frame, *wall, *window, and *wiring (from 15 infelicitous expressions with overall mean rating of 1.0). None of the 29 relevant expressions rated were classified as marginal.11 This systematic gap in the range of concepts which express the metaphor demonstrates that BUILDING is too schematic a formulation of the source domain. The distinction between building concepts which map onto argument, and those which do not, differ with respect to a building’s structural integrity. Accordingly, we reformulate the source domain as THE STRUCTURAL INTEGRITY OF A BUILDING. The range of this less schematic source domain does not map onto the whole range of the domain RATIONAL ARGUMENT. We conclude this from the target meanings of the felicitous expressions, which from our inspection are limited to those aspects relevant to an argument’s convincingness. Hence, the formula THE CONVINCINGNESS OF AN ARGUMENT IS THE STRUCTURAL INTEGRITY OF A BUILDING best characterizes the metaphor at its appropriate level of schematicity. In §3 we will argue that this formulation of the metaphor maximally covers its actual conceptual range. That is, this is the level of schematicity for which the metaphor is maximally productive.

The semantic range for a set of conventional metaphorical expressions sometimes requires a different formulation from that found in the linguistic literature on metaphor. The researcher must determine the range of conventional expressions involving that metaphor and determine the maximally productive conceptual relation based on that empirical
survey. The above analysis demonstrates that metaphorical expressions involving argument are not instantiations of a conceptual mapping involving just any aspect of (everyday) argument. Closer examination of the metaphor’s semantic range resulted in reformulation at a more specific level of schematicity. We next analyze a more complex metaphor, requiring reformulation at two levels.

Lakoff and Johnson (1980, p. 49) offer 5a–h as expressions of a metaphor which they formulate as LOVE IS A PATIENT.

(5) a. this is a sick relationship. <2.6>
b. they have a strong, healthy marriage <3.7>
c. the marriage is dead—it can’t be revived <3.3>
d. their marriage is on the mend. <2.9>
e. we’re getting back on our feet [talking about a relationship]<3.5>
f. their relationship is in really good shape <rated twice: 3.4, 3.4>
g. their marriage is on its last legs <2.9>
h. it’s a tired affair [talking about a relationship] <2.5>

Croft (1993, p. 346) analyzes this as two metaphors, dividing the expressions into two classes: 5c and the rest. We will formulate these two metaphors at their appropriate schematic level. The latter class of expressions have a narrower range of source domain concepts than PATIENT. The words sick, strong, healthy, and tired all refer to a bodily state. We reformulate this range of source domain concepts as STATE OF BODILY HEALTH. This may be just a different formulation of what Lakoff and Johnson intended. It is not clear to us whether the metaphor LOVE IS A PATIENT was intended to map concepts extrinsic, but closely related, to being a patient. Expressions 6a–f suggest that concepts which evoke what might be called the ‘health care’ frame, are not involved in this metaphor. Of these 7 expressions, 6 are infelicitous, and one is marginal, with an overall mean rating 1.3.

(6) a. *their relationship went to the hospital <1.0>
b. *he needs an ambulance for that romance <1.3>
c–f. their relationship needs a X
c. *hospital <1.1> d. *ambulance <1.4>
c. *doctor <1.8> f. *nurse <1.3>

The phrases back on our feet, in really good shape, and on its last legs are expressions of a composite metaphor, having the target domain STATE OF BODILY HEALTH, which in turn functions as the source domain of the expressions in (5d–f). We have readjusted the source domain of this metaphor to a lower level of schematicity; whereas, the target domain requires readjustment to a higher level of schematicity. The characterization love is too specific, because the expressions of the metaphor refer to a broader range of relationships, which are not necessarily love relationships, but are social in nature (e.g., 5a, 5f, and 7d). Therefore, the metaphor can be formulated as A SOCIAL RELATIONSHIP IS A STATE OF BODILY HEALTH.

The words dead and revived in 5c are part of a different metaphor, A SOCIAL RELATIONSHIP IS LIFE, which possesses a large range of conventional metaphorical expressions.

(7) a. their letters kept their love alive <3.4>
b. her selfishness killed the relationship <3.1>
c. his effort to understand her breathed new life into their marriage <3.1>
d. Nixon resurrected US-China relations <3.5>
e. their relationship is dead <3.2>
f. their relationship is revived <3.2>

One could argue that alive and dead are states of bodily health also, but they are clearly of a different kind from healthy or sick. Expressions 5c and 7a–f (overall mean rating 3.3) cover a range of source domain concepts which involve aspects of life, not limited to those of PATIENT or A STATE OF BODILY HEALTH, but includes processes of creating and destroying life. Therefore, we reformulate this source domain more schematically as LIFE. The target domain of this metaphor has the same conceptual range as the other; resulting in the formulation A SOCIAL RELATIONSHIP IS LIFE. This is a higher level of schematicity than the original formulation LOVE IS A PATIENT.

Our reformulations have resulted in two metaphors characterized as A SOCIAL RELATIONSHIP IS LIFE and A SOCIAL RELATIONSHIP IS A STATE OF BODILY HEALTH. Since life is presupposed by the notion of bodily states, we conclude that the two schemas are hierarchically related, the former at a higher level of schematicity than the latter. (See Lakoff & Johnson, 1980, pp. 41–45 on coherent metaphors, and Lakoff, 1991 on metaphor hierarchies; see also §4.1.) These two metaphors represent the maximally productive conceptual schemas, based on the evidence from judgments of conventional linguistic expressions.

However, the formulation we propose is not ideal. It is unclear why 6e is marginal and not infelicitous. Other expressions testing the source domain STATE OF BODILY HEALTH also reveal difficulties. Although 8a–d (cf: 5b, 5e, 5g) are felicitous, others are marginal (8e–g; cf: 5a, 5e, 5h).

(8) a–f. Their relationship is X
   a. strong <3.7>        b. healthy <3.7>
   c. back on its feet <3.4>  d. on its last legs <3.3>
   e. ?tired <2.1>         f. ?sick <1.9>
   g. ?Regarding their relationship, they are back on their feet <2.1>
   h. ?They've got a listless marriage <2.1>; ?Their relationship is listless <1.8>

In 5h, tired is a bodily state but not necessarily a health state, which may explain the marginality of 7e, but sick in 5a and 8f is consistent with the schema formulation. We suppose that the marginality of 8g may be a judgment of its syntactic construction, since the same concept is rated as felicitous in 5e. Finally, the concept ?listless (8h) might not be an expression of this metaphor, but if it is inconsistent with the metaphor schema, then it is unclear why it does not classify as infelicitous. As evident from the marginal expressions, our characterization of these metaphors is not definitive, but approaches the appropriate range of mappings for maximal productivity of the actual entrenched schemas.

The criteria of maximal productivity also supports the argument for two metaphor schemas. If the two metaphors were subsumed under a more schematic metaphor like SOCIAL RELATIONSHIPS ARE LIVING THINGS, it would not be maximally productive since there are many other aspects of living things that are not metaphorical for social relationships, specifically those aspects associated with the body (i.e., bodily activities such as spitting and sweating, or the body itself—its parts, shape, etc.). Again, this does not preclude the possi-
bility of English speakers forming the more schematic metaphor. It only implies that there must exist in the speaker's conceptual representation the maximally productive schemas that we have formulated in this section.

Our analysis of schematicity in metaphors has focused on four distinct metaphor formulations: (i) **ARGUMENT IS WAR**, (ii) **THE CONVINCINGNESS OF AN ARGUMENT IS THE STRUCTURAL INTEGRITY OF A BUILDING**; (iii) **A SOCIAL RELATIONSHIP IS LIFE**, and (iv) **A SOCIAL RELATIONSHIP IS A STATE OF BODILY HEALTH**. Our claim that conventional metaphors vary in schematicity has been argued from our analysis that (i) is more schematic than (ii), and (iii) is more schematic than (iv).

### 3. METAPHORS VARY IN PRODUCTIVITY

Once a metaphor schema is characterized at its proper level of schematicity, which is the formulation at which it is maximally productive, only then can we evaluate the degree of that schema's productivity. Productivity is the other major concept from the Bybee/Langacker theory of morphology which we apply to metaphor. Metaphorical productivity can be contrasted with our definition of metaphor schematicity. Recall that the degree of schematicity of a metaphor is the range of concepts consistent with the schema. Metaphor productivity may be defined in terms of the number of roughly synonymous expressions which manifest this range of metaphorical concepts. That is, out of the entire range of mappings defined by the schema, not every metaphorical expression consistent with the schema can be felicitously instantiated. The proportion of this potential range which is actually manifested is the schema's degree of productivity.

We will identify specific degrees of schema productivity with conventional metaphor expressions and some types of idioms. (On idioms, see Makkai, 1972; Nunberg, Sag, & Wasow, 1994; Wood, 1986). Lakoff (1987, p. 449) argues that speakers can 'make sense' of idioms because their meaning is motivated by conventional metaphor. This hypothesis is not uncontroversial and is discussed in §4.

Our analysis of productivity involves varying degrees of schematicity and entrenchment of a derivational relation. Productivity is gradient and three major points on the continuum will be identified: (a) metaphorical expressions instantiated by a highly productive schema, (b) transparent idiom expressions motivated by a semi-productive schema, and (c) nonproductivity in the case of opaque idiom expressions. For each of the three cases we argue for a particular semantic organization and present an example of an analogous morphological organization in terms of derivational relations, entrenchment, schematicity, and productivity.

#### 3.1 High Productivity: Metaphorical Expressions

Conventional metaphors function at the extremely productive end of the productivity continuum. The metaphor **THE CONVINCINGNESS OF AN ARGUMENT IS THE STRUCTURAL INTEGRITY OF A BUILDING**, discussed in §2.2, instantiates expressions which map nearly any concept from the source domain **THE STRUCTURAL INTEGRITY OF A BUILDING** to the target domain **THE CONVINCINGNESS OF AN ARGUMENT**.
Cast at its proper level of schematicity the metaphor is very productive; cf. expressions 3a–i. For example, the metaphorical use of buttress in 3g maps the semantic structure BUTTRESS OF A BUILDING onto EVIDENCE FOR AN ARGUMENT. Figure 3 illustrates that the highly entrenched domain mapping (upper bold box) is highly productive (bold solid arrows) of the many instantiations (lower light boxes). Instantiations of a metaphor schema are semantic units (denoted by small capitals). The potentially unbounded productivity is denoted by the bold arrows and the ellipsis. (Semantic figures do not show the phonological pole of each instantiation, which is a metaphorical expression—these words and corresponding metaphorical concepts are in lower case italics in text.)

High productivity in the Bybee/Langacker theory of morphology is illustrated by the potentially unbounded productivity of the English regular past tense derivation (upper part of Figure 2). The regularity between past and present forms is generalized as the highly entrenched schema (bold box) which is highly productive (bold solid arrows). The many different instantiations of regular forms are each relatively lightly entrenched (light boxes).

Morphological productivity (Figure 2) and the semantic structure of metaphor productivity (Figure 3) display the same organization and relative entrenchment of schematic and instantiated derivational relations. The morphological schema for regular past tense verbs is not completely productive; there are irregular forms of the past tense. Analogously, the metaphor THE CONVINCINGNESS OF AN ARGUMENT IS THE STRUCTURAL INTEGRITY OF A BUILDING is not semantically completely productive, instead it is lexically (partially) idiosyncratic. The concepts expressed in 9a–d are all consistent with the source domain STRUCTURAL INTEGRITY OF A BUILDING. However, strong in 9c (= 3e) instantiates the metaphor, but is marginal in 9d. Moreover, load-bearing in 9e is infelicitous as an instantiation of the metaphor.

(9)  
a. this argument is sound/unsound <3.6/3.1>  
b. this argument is stable/unstable. <2.9/3.0>  
c. (= 3e) we need to construct a strong argument for that <3.4>  
d. *the strong part of the argument is best. <2.3>  
e. *the load-bearing part of the argument is best <1.3>

These small gaps in the metaphor schema’s productivity may be idiosyncratic, or perhaps a more refined analysis can account for these data (see §4.3). Nonetheless, the schema illustrates the extremely high end of the continuum, just short of full productivity.

Some metaphors may possibly be fully productive. The metaphors GOOD IS UP / BAD IS DOWN and MORE IS UP / LESS IS DOWN are only two of many which have UP/DOWN source
domains (Lakoff and Johnson call these ‘orientational metaphors’). These metaphors are extremely productive; nearly any word referring to verticality can be understood in terms of quality or quantity (10a-c). Any one instantiation (e.g., the metaphorical use of “plum-meted”) is low frequency relative to the highly frequent (numerous instantiations) of the schema type, which implies that the metaphor schema is so entrenched relative to its instantiations, that it is nearly fully productive.

(10)  a. the stock market rose/dropped <3.7/3.4>
     b. her hopes plummeted <3.3>
     c. prices descended to a record low today <2.8>

We have argued that the organization of units representing a schema and its instantiations theorized to result in high morphological productivity exhibits corresponding organization in the semantics of metaphor. The same parallels are also found for other points on the productivity continuum. The next section presents intermediate semantic productivity and its morphological counterpart.

3.2 Semi-productivity: Transparent Idioms

The intermediate point in the productivity continuum is exemplified by semantically transparent idioms, those idiomatic expressions for which speakers possess knowledge of a metaphorical connection between the literal and figurative uses. Here we draw on idiom research for evidence of semi-productive metaphor schemas.

Lakoff (1987, pp. 448-453) argues that the link between an idiomatic expression and its meaning includes a conventional image, tacit knowledge about the image, and conventional metaphor. For example, the idiom spill the beans has a conventional image in which the beans are ideas to be kept secret and spill is a process of making those ideas public. The idiom ‘makes sense’ because it is ‘motivated’ by the conventional metaphor THE MIND IS A CONTAINER AND IDEAS ARE ENTITIES, which allows the concept beans in the source domain ENTITIES to map onto the concept secret in the target domain IDEAS. Lakoff uses the term ‘motivated’ to emphasize the underspecificity of the schema relative to the idioms.

Gibbs (1995) and Gibbs and O’Brien (1990), offer experimental support for Lakoff’s hypothesis. A summary of Gibbs and O’Brien’s results will further illustrate the metaphorical motivation of transparent idioms, which we will analyze below as semi-productivity. They tested sets of transparent idioms which share a general figurative meaning. For example, the ‘revelation’ idioms in 11 share the meaning TO REVEAL A SECRET.

(11)  a. spill the beans [talking about revealing a secret] <3.5>
     b. let the cat out of the bag [talking about revealing a secret] <3.7>
     c. blow the whistle [talking about revealing a secret] <3.2>
     d. blow the lid off [talking about revealing a secret] <3.2>
     e. loose lips [talking about revealing a secret] <3.1>

Participants were asked to describe their mental image of each idiom, and to answer probe questions about aspects entailed by these images, including intentionality, causality, consequences, manner, and reversibility. Significant agreement was found across participant’s responses. Given the variety of expressions in 11, and the potential variance in answering
open-ended probe questions, Gibbs and O'Brien conclude that participants possess very specific conventional knowledge of a single image by which they comprehend the group of idioms.

To determine whether this image is based solely on the figurative meaning of the idioms, they tested the phrase to reveal a secret. Literal phrases corresponding to each 'revelation' idiom (e.g. spill the peas, let the cat out of the house) were also tested to determine if the common image reported for the idioms can be explained as a combination of each idiom's literal and figurative meanings. The images subjects describe for these expressions were found to be inconsistent compared with the high consistency of images reported across the idioms.

There is nothing in the relationship between spilling and 'revealing' or beans and 'secrets' to specify that pressure is the cause of the action in people's mental image for spill the beans or that the action is intentional, performed with force, and difficult to reverse. Furthermore, nothing in the link between the literal words and the figurative meanings of these phrases specifically suggest that the container for the beans, the cat, or the pot with a lid to all be generally the size of a human head. (Gibbs & O'Brien, 1990, p. 64)

From this they argue that the conventional image that participants share for the 'revelation' idioms is not predictable, but it is motivated by the metaphor THE MIND IS A CONTAINER AND IDEAS ARE ENTITIES.

We argue that these results provide evidence of a semi-productive relationship between the metaphor THE MIND IS A CONTAINER AND IDEAS ARE ENTITIES and the 'revelation' idioms (11). This semantic organization is illustrated in Figure 4 using the diagrammatic conventions established in this article. The solid arrows denote the relation of schematicity between the metaphor and the idiomatic concepts in 11a and 11b. The arrows are light because the schema is only partly productive. For simplicity, other solid arrows have been omitted which would denote the motivation of idioms 11c–11e. The arrows labeled 1, i and n denote that there are a fixed set of idiomatic instantiations. In this case n = 5, the first instantiation is spill the beans, the ith are not shown, and the nth is let the cat out of the bag.

The idioms are relatively fixed semantic assemblies of specific concepts. Each idiom is a specific mapping of source structure onto target structure and is represented as a separately entrenched unit of semantic knowledge (e.g., the box denoting the schema which maps SPILL THE BEANS onto REVEAL A SECRET. The metaphor is a semantic schema that under-

![Figure 4. Semi-productive semantics.](image-url)
specifies the semantics of the idioms. Due to their semantic fixity, it is reasonable to con-
clude that the idioms are relatively more entrenched (bold boxes) than the metaphor (light
box). This organization results in semi-productivity. The metaphor schema is not produc-
tive of its full range, but motivates a limited set of idioms.

The morphological analog of semi-productive metaphors is found in the analysis which
Bybee and Slobin (1982, p. 288) provide for the following irregular past tense derivational
pairs:

<table>
<thead>
<tr>
<th>action</th>
<th>first form</th>
<th>second form</th>
</tr>
</thead>
<tbody>
<tr>
<td>spin</td>
<td>spin-spun</td>
<td>spun</td>
</tr>
<tr>
<td>win</td>
<td>win-won</td>
<td>won</td>
</tr>
<tr>
<td>cling</td>
<td>cling-clung</td>
<td>clung</td>
</tr>
<tr>
<td>fling</td>
<td>fling-flung</td>
<td>flung</td>
</tr>
<tr>
<td>hang</td>
<td>hang-hung</td>
<td>hung</td>
</tr>
<tr>
<td>sling</td>
<td>sling-slung</td>
<td>slung</td>
</tr>
<tr>
<td>string</td>
<td>string-strung</td>
<td>strung</td>
</tr>
<tr>
<td>swing</td>
<td>swing-swung</td>
<td>swung</td>
</tr>
<tr>
<td>wring</td>
<td>wring-wrung</td>
<td>wrung</td>
</tr>
</tbody>
</table>

Their psycholinguistic experiments reveal that, although the forms are irregular,
English speakers maintain a schematic generalization of the phonological difference
between the basic and derived forms. These form a single class in which the derived forms
have the medial vowel [ʌ] and final velar or nasal consonant [n, ŋ, nk, k, g]. The schema is
shown above its instantiations in Figure 5.

The instantiations are shown in bold denoting that they are more entrenched than the
schema. There are a small number of verbs sharing the same [V-ʌ] vowel alternation;
spin-spun is shown as the first and dig-dug as the nth. The low type frequency of the
schema (n = 17 is small) compared with the relatively high frequency of each token, results
in morphological semi-productivity. This is an organization in which the schema (light
box) motivates the entrenched instantiations (bold boxes), but is not fully productive (light
solid arrows). The schema is semi-productive, instantiating a limited proportion of the
potential range of forms compatible with the schema, and some novel forms.

Bybee and Slobin (1982) found that speakers will produce spontaneous innovations
such as think- *thunk which are overregularized, but nonetheless consistent with the
schema. Bybee (1985) observes that the schema also motivates dialectal brung. The
schema, therefore, motivates forms such as spin-spun, but is generally unproductive, as
evidenced by blink- *blunk and wink- *wunk.

![Figure 5. Semi-productive morphology.](image-url)
We apply the morphological analysis of semi-productivity to the semantic organization of transparent idioms. Semantic semi-productivity is demonstrated by expressions (12) and (13).

(12) a. = (11a) *spill the beans [talking about revealing a secret] <3.5>
    b. (*)spill the peas [talking about revealing a secret] <not rated>\(^{15}\)
    c. *dump the coals [talking about revealing a secret] <0.8>

(13) a. = (11b) *let the cat out of the bag [talking about revealing a secret] <3.7>
    b. ?let the cat out of the box/sack [talking about revealing a secret] <2.1>/<2.0>
    c. *let the hamster out of the bag [talking about revealing a secret] <1.2>
    d. ?permit the cat to come out of the bag [talking about revealing a secret] <1.9>
    e. *let the weasel out of the cage [talking about revealing a secret] <1.1>

Expression 12a is motivated by the metaphor THE MIND IS A CONTAINER AND IDEAS ARE ENTITIES, but the schema is only semi-productive. Expressions 12b and 12c are also consistent with the schema; however, they do not mean TO REVEAL A SECRET. Similarly, expressions 13a–c are all consistent with the metaphor; however, only 13a is an instantiation of the schema, and 13b–c are unacceptable as revelation idioms.

This is not a problem of formulating the metaphor at too high a level of schematicity. Even a less schematic formulation of the metaphor motivating only one of the idioms is not productive. For example, the formulation REVEALING A SECRET IS ALLOWING A PET MAMMAL OUT OF A NONRIGID CONTAINER is consistent with 13a–d, but the actual schema is only productive of 13a. Therefore, it is not the case that there is a family of highly specific but unrelated schemas for each idiom (11a–e) that happen to have identical target domains. The proper analysis is that there is a more schematic metaphor underlying the revelation idioms, and that this metaphor is simply not very productive.

Transparent idioms may represent the best example of metaphor semi-productivity, but some semi-productive schemas instantiate conceptual metaphorical expressions as well. An analysis of two metaphors having the source domain TEMPERATURE reveals nonsystematic gaps in their productivity. The range of concepts specified by the domain TEMPERATURE includes hot, warm, lukewarm, cool, and cold. However, only a limited range of metaphorical concepts can be expressed in 14 and 15 by metaphors DANGER IN A SITUATION IS TEMPERATURE, and EMOTIONAL CONTROL IS TEMPERATURE (Clausner, 1994).

(14) a. the situation is getting a bit too hot to handle <3.4>
    b. ?we got into as hot a corner as a lot of men ever get into
    [talking about danger] <1.2>
    c. *the situation is *warm/ ?warming up now; we might have trouble <1.5>/<2.2>
    d. ?the people in the town tend to make things a bit warm for strangers
    [talking about danger] <1.5>
    e. *trouble was likely, and the situation was getting a bit too warm, so we left <2.3>
    f. *the situation is lukewarm now [talking about danger] <1.7>
    g. the situation is cool now/cooled back down to normal now, we probably
    won't have trouble <2.8/2.6>
    h. *the situation is cold, and provably fail-safe <1.4>

(15) a. he's hot-headed <3.6>
    b. *he's amazingly controlled, but if deeply offended, he'll get warm, and you can see
he's angry. <1.4>

c. Charles occasionally became a bit warm on the subject of architecture [talking about emotional control] <1.6>

d. if he wasn't just lukewarm he'd have been able to control himself. <1.0>

e. he really lost his cool when she told him he was a lousy driver. <3.4>

f. he remains cool even in a crisis. <3.7>

g. he's cool-headed; stay cool [talking about emotional control] <3.0;3.6>

h. she's so cold she never loses control. <2.1>

The limit on which TEMPERATURE concepts may be instantiated metaphorically is partly idiosyncratic. This argues for a limited set of metaphorical concepts which are more entrenched than their domain mapping schema. For example, the source domain concept hot is felicitous when instantiated by the idiomatic expression too hot to handle (14a), but marginal for other expressions (14b) which are nonetheless consistent with the schema DANGER IN A SITUATION IS TEMPERATURE. In 15, the idioms hot-headed, lost his cool, and cool-headed are felicitous instantiations of EMOTIONAL CONTROL IS TEMPERATURE. Conventional metaphorical expressions also express these metaphors (14g, 15f), but few conceptual mappings consistent with these schemas can be expressed metaphorically.

Some but not all variability in felicity may be systematic. Expressions 14b, 14d, and 15c are attested (Oxford English Dictionary, 1989) but classify as marginal according to our ratings. Even if these expressions are excluded from the analysis, the range of felicitous source domain concepts used metaphorically is still partial (i.e., hot, warm, lukewarm, cool, and cold.). The quasi-systematicity of this pattern is evidence for a semi-productive schema.

The metaphors cannot simply be recast at a level of schematicity which excludes the unexpressed concepts, since no coherent subdomain of temperatures accounts for the pattern of concepts not mapped by 14 or 15. Therefore, these two temperature metaphors demonstrate semi-productivity. (See Clausner, 1994, for a similar analysis involving the domain CONTAINER).

The morphological and semantic structures discussed above represent the intermediate point of the productivity continuum, which is characterized by a lightly entrenched schema having a small number of highly entrenched instantiations. We have argued that the morphological analysis of this structure has a semantic counterpart—transparent idioms which are motivated by a low productivity schema. The next section discusses the unproductive end of the continuum.

3.3 Nonproductivity: Opaque Idioms

Semantically opaque idiomatic expressions represent the unproductive extreme of the productivity continuum.

(16) kick the bucket [talking about death] <3.4>

(17) by and large [talking about something in general] <3.7>

Expressions 16 and 17 are unmotivated by a connection between the literal and figurative meanings. The phonological expression kick the bucket is symbolic of the literal
semantic structure KICK THE BUCKET and the figurative structure DIE. These disparate meanings are principally connected via the same phonological form. However, some limited semantic structure may be shared between the literal and figurative meanings. Nunberg (1978, p. 121) argues that the punctual property of the verbal aspect of KICK is carried over to the meaning DIE. Similarly, in 17 Glucksberg (1993, p. 19) suggests that LARGE is somewhat related to the figurative meaning GENERALLY. Nonetheless, these semantic elements are insufficient to make the idioms semantically transparent. Gibbs (1987, 1990) argues that people are unable to form a metaphorically motivated conventional image that makes opaque idioms ‘make sense.’ For example, although diachronic evidence may exist for how kick the bucket came to be associated with the concept of dying, contemporary speakers of English appear to lack knowledge of any semantic relation between the literal and figurative meanings (see also Nunberg, Sag, & Wasow, 1994, pp. 496–498). The absence of a motivating semantic link is significant since our investigation aims to determine the semantic organization actually stored in the mind of contemporary speakers. We take the above as evidence that speakers’ conventional knowledge of an opaque idiom involves entrenched literal and figurative concepts, which lack an entrenched domain relation that would otherwise allow the semantic disparity to make sense.

Presumably, the lack of a relation which could function as a schema also explains the lack of productivity associated with opaque idioms. If there were a metaphor schema, one would expect it to motivate more than one source domain concept and one target domain concept. Since this is the case for 16 and 17 we argue that they lack a metaphorical derivational relation and are therefore unproductive.

We argue that the idioms given in 18a–b are another case of metaphorical nonproductivity.

(18)  
(a) lose face <3.2>  
(b) save face <3.5>

English speakers know that these idioms are about social standing, but the relation between the literal concept of a face and the idiomatic social concepts is opaque. The idioms were borrowed from Mandarin Chinese by the English community in China and thereby into conventional English (Oxford English Dictionary, 1989, Vol. XIV, p. 526). Presumably, the Chinese expressions make sense with respect to the respectful maintenance of pragmatic (illocutionary) force to avoid incurring or inflicting disgrace. Causing someone to ‘save’ or ‘lose’ face involves the maintenance or ill-maintenance of that pragmatic force. We suggest that these and related Chinese expressions about the specific sociocultural concept face are motivated by, and made transparent by, a relevant metaphor, something like RESPECT IS HAVING FACE and DISRESPECT IS NOT HAVING FACE. English seems to have adopted two expressions about FACE, but not the relevant metaphor which would allow the idioms to make sense or be productive of other expressions. For example, English did not borrow other Mandarin Chinese expressions such as gěi miànzì (literally, give face) meaning to show due respect for someone’s feelings. In the absence of a conventional domain mapping, the English idioms are unmotivated and representative of semantic nonproductivity.
The morphological analog of opaque idioms is suppletive morphology, in which there is no derivational relation linking the basic and ‘derived’ forms. For example, the present tense form go and past tense suppletive form went are not derivationally related. Only the nontemporal semantic value GO is shared between them, but there is no morphological schema. The verbs go and went exemplify unmotivated nonproductive morphology. These two highly frequent tokens do not share a derivational pattern with any other verbs. Furthermore, no native speaker of English would propose that the past derivation of some nonce verb jo should be yent. The absence of a morphological derivational relation between go and went precludes any productivity. Similarly, the nonproductivity of opaque idioms is attributable to a lack of any semantic mapping relation between their literal and idiomatic meanings.

In §1.2.3, we described examples of morphological split, in which a derived word form diverged in meaning from its derivationally basic word form. The semantic parallel to this phenomenon would be idiomatic reanalysis, in which the idiomatic form for a derived (metaphorical target domain) meaning would diverge from the form used for the basic (source domain) meaning. These examples are not easy to come by, but an example of it appears to be the idiom cut and dried [talking about something routine] <3.3>.\textsuperscript{18} The original form of this idiom is cut and try. It is believed to refer to the lengths of fuses for explosives, with a more general meaning of something requiring multiple trials to find the one that works best (the length, in this case). It is now interpreted as meaning ‘routine,’ presumably reinterpreted as referring to something that is fully prepared (cut and dried). The split of the new meaning from the original form is evident from the infelicity of *cut and try [talking about something routine] <1.1>.

3.4 Summary

The linguistic principles which result in nonproductivity for a configuration of morphological units also apply to organizations of semantic units. Semantic and morphological nonproductivity have been demonstrated as both resulting from the absence of a relational structure. Morphological nonproductivity results from two phonological units related only through their semantic value, and phonological nonproductivity results from two semantic units related only through their phonological form. The morphological organization lacks a derivational relation and its counterpart semantic organization lacks a metaphorical domain relation. Therefore, the two configurations are isomorphic.

Nonproductivity results from an absent schema (Figure 6c). The absence of a schematic mapping relation $S \rightarrow T$ coincides with the absence of a mapping relation between

![Figure 6. Summary of metaphor productivity.](image-url)
instatiations $S_1$ and $T_1$. Therefore, an association between $S_1$ and $T_1$ is unmotivated. In the case of opaque idioms, there is no schematic metaphor, hence no relation between the literal and figurative semantics. In unproductive morphology, the lack of a morphological generalization coincides with the absence of a derivational relation between a basic and suppletive pair of forms. In both cases the pairing of source and target instantiations is unmotivated by a schema.

The semantic organizations investigated in this section range from extremely productive to semi-productive to unproductive (Figures 6a, 6b, and 6c, respectively). For each of these points on the productivity continuum, a representation of the organization of morphological units has been compared to a semantic organization of metaphorical relations at a comparable degree of productivity. Each figure represents a point on the productivity scale for both a morphological and a semantic case (summarized in Table 1). The results have demonstrated that degrees of semantic productivity can be characterized in the same way as degrees of morphological productivity.

The entries in Table 1 are only representative of our data. A summary of the metaphors we hold as evidence for metaphor productivity are listed below in order from most to least productive with references to expressions used in our analyses.

<table>
<thead>
<tr>
<th></th>
<th>Productive</th>
<th>Semi-productive</th>
<th>Unproductive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphological Schema</td>
<td>Verb</td>
<td>Verb-ed</td>
<td>CVC</td>
</tr>
<tr>
<td>Instantiation</td>
<td>play</td>
<td>play-ed</td>
<td>spin</td>
</tr>
<tr>
<td>Semantic Schema</td>
<td>VERTICAL</td>
<td>QUALITY</td>
<td>ENTITIES OUT OF A CONTAINER</td>
</tr>
<tr>
<td>Instantiation</td>
<td>LOW (HEIGHT)</td>
<td>LOW (QUALITY)</td>
<td>SPILL THE BEANS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>KICK THE BUCKET</td>
</tr>
</tbody>
</table>

The entries in Table 1 are only representative of our data. A summary of the metaphors we hold as evidence for metaphor productivity are listed below in order from most to least productive with references to expressions used in our analyses.

- **Productive**
  - QUALITY (GOOD/BAD) IS VERTICALITY (UP/DOWN) (10)
  - ARGUMENT IS WAR (2)
  - THE CONVINCINGNESS OF AN ARGUMENT IS THE STRUCTURAL INTEGRITY OF A BUILDING (3, 4, 9)

- **Semi-productive**
  - THE MIND IS A CONTAINER AND IDEAS ARE ENTITIES (11, 12, 13)
  - DANGER IN A SITUATION IS TEMPERATURE (14)
  - EMOTIONAL CONTROL IS TEMPERATURE (15)

- **Unproductive**
  - LOSE FACE / SAVE FACE (18)
  - KICK THE BUCKET (16); BY AND LARGE (17)
4. DISCUSSION

4.1 Taxonomic Hierarchies of Metaphor Schemas

Recognizing that metaphors can be described at different levels of schematicity reveals that metaphors can be grouped together and organized in a taxonomic hierarchy. Our identification of a particular level of schematicity—the maximally productive level—as entrenched in the minds of speakers does not exclude the possibility that more schematic representations of the metaphor are entrenched as well. For example, Lakoff (1993), Lakoff and Turner (1989), and Turner (1987, 1991) argue that one must also posit generic-level metaphors. According to Lakoff and Turner (1989, p. 81) generic-level metaphors do not have fixed source and target domains. For example, the generic-level metaphor EVENTS ARE ACTIONS can be instantiated as the specific-level metaphor DEATH IS A DEPARTURE. The specific-level metaphor allows a death event to be understood in terms of a departure action, as in the expression he left us [talking about death] <2.7>. The generic-level metaphor combines with many specific-level metaphors, allowing nearly any action to be understood as an event, even if there is no conventional specific-level metaphor schema: for example, my car decided to give out on me <3.3> (Turner, 1991, p. 165).

Our analysis is compatible with the positing of generic-level metaphors as cognitive structures. One can compare generic-level metaphors to the morphological derivational schema \([N_{\text{SINGULAR}} \rightarrow N_{\text{PLURAL}}]\) which generalizes over all independently entrenched plural derivational schemas (regular and irregular). Speakers almost certainly know the generic correspondence between a singular occurrence of a thing and a plurality of those things; that is, it is part of their mental grammar. However, they must also use more specific schemas to actually produce specific past tense forms. The same is true of generic-level metaphors: they are most likely part of speakers’ knowledge of conceptual relations. Our only claim is that the appropriate specific-level metaphors must also be entrenched in speaker’s minds in order for them to produce the appropriate metaphorical expressions.

The level of schematicity in representing a metaphor that we have described in this section bears an interesting resemblance to Rosch’s (1978) concept of a basic-level category (J. Greeno, personal communication, August 1996). According to Rosch, a basic-level category has a high cue-validity: it has the greatest number of semantic features (cue) specified at that taxonomic level and the least amount of overlap of those features with sibling categories. The maximally productive level of metaphor schematicity also appears to have high cue-validity. More schematic representations (including generic-level metaphors) specify fewer semantic features which can be mapped to the target domain than does the maximally productive metaphor schema. More specific representations—if, for example, we broke down A SOCIAL RELATIONSHIP IS A STATE OF BODILY HEALTH to a set of submetaphors for each kind of social relationship—would possess all the features of the maximally productive schema, but would share all these features with the other submetaphors. This similarity between the maximally productive metaphor schema and basic-level categorization is worth exploring in more detail.

The analogy between basic-level categorization and maximally productive metaphor schemas does relate to another issue raised in connection with our analysis (M. Turner, per-
sonal communication, August 1996). It is well known that the basic level may vary from individual to individual depending on the individual’s specialized knowledge (or lack thereof): for example, TREE may be a basic level category for modern urban dwellers, while PINE is a basic level category for a forester. It is possible, even likely, that such variation is found in the level of the maximally productive metaphor schema as well. For instance, specialized legal knowledge may affect the appropriate schematic representation of ARGUMENT IS WAR for those speakers, and specialized medical knowledge may affect the description of A SOCIAL RELATIONSHIP IS A STATE OF BODILY HEALTH.

We did not test for this type of variation in our ratings study. This variation would be restricted to specialized speech communities (e.g., legal or medical professionals). We have focused our attention on determining the level of schematicity for the general American English speech community, and for this reason we selected a population for our experiment that as a group lacked the relevant specialized knowledge. That is, we assume that the undergraduates we surveyed on the whole lack the specialized technical knowledge that would affect the productivity of the metaphors we tested, and that they are making judgments on the expressions which reflect the speech community in general.

4.2 The Class-Inclusion Theory of Metaphor

A central tenet of the Lakovian view is that conventional metaphor is a semantic relation between two domains (see also Indurkhya 1992; Kittay, 1987). A corollary to this is Lakoff’s (1987) hypothesis that conventional metaphors are the semantic structures which allow idioms to ‘make sense.’ Gibbs has supported this view of metaphor in his psycholinguistic research on idioms (Gibbs, 1990, 1993a, 1993b, 1994, 1995; Gibbs & Nayak, 1991; Gibbs & O’Brien, 1990; Nayak & Gibbs, 1990).

A contrasting view held by Glucksberg and his colleagues treats metaphor as class inclusion involving a superordinate categorization of concepts from two disparate categories (Cacciari & Glucksberg, 1994; Glucksberg & Keysar, 1990; Glucksberg, Keysar, & McGlone, 1992). Like Lakoff and Gibbs, the view that idioms reflect underlying conceptual metaphors is supported by Glucksberg (1993, p. 24) and Cacciari (1993, p. 32). However, the nature of the motivating metaphors is not agreed upon (Glucksberg, Brown, & McGlone, 1993). The Lakovian view focuses on an explanatory account of metaphor based on the principle that linguistic forms (e.g., metaphorical expressions and idioms) are a reflection of stored conceptual structure. Thus, metaphor is held to be a stored relation between semantic domains, and the metaphorical motivation of idioms is rooted at the level of these structures. The Glucksbergian view focuses on the process of discourse use in which conceptual coherence in metaphors is accomplished by ad hoc superordinate categorization, and the motivation of idioms is viewed as a product of discourse use involving “a correlation between word meanings” (Cacciari, 1993, p. 36).

We illustrate the difference between these views by contrasting our analysis of the metaphor THEORIES AND ARGUMENTS ARE BUILDINGS (§2.2, §3.1) as a mapping between distinct domains with that of Glucksberg and Keysar (1993), who view this metaphor as follows:
the concept *theory* belongs to a category of structures. The particular *structure* category is specified by the exemplar—superordinate grouping of *theory* and *structure*, and it permits one to describe theories in terms of the appropriate parts of a structure . . . *Foundations, walls* and *plumbing* may be 'good' parts vis-à-vis the concept *structure* as it applies to *theories*. The parts *chimney, window, and corner* may be poor parts because their functional roles in the structure of a theory may not be important or salient. (Glucksberg & Keysar, 1993, pp. 419-420)

They argue that some building concepts are not apt argument/theory metaphorical expressions. Participation of a building part in the metaphor is determined according to its categorical salience, or its degree of centrality in a superordinate *theory—structure* category.

The class-inclusion theory of metaphor structure differs from the domain-mapping theory in two important respects. First, instead of using a mapping (derivational) relationship between two domains, the class-inclusion theory uses a single general domain that subsumes the source and target. Second, it uses notions of centrality and/or salience to determine which concepts can aptly be expressed metaphorically and which can not. We suggest that the directionality of metaphors requires that a mapping relationship between source and target must be represented; however, some sort of conceptual salience also probably plays a role in constraining metaphorical mappings.

Lakoff (1993, p. 236) argues that the class-inclusion view of metaphor provides no theory of how it is possible to have one kind of thing metaphorically categorized in terms of a basically different kind of thing (Gibbs, 1992, offers similar criticisms). Glucksberg and Keysar argue that class-inclusion preserves the directionality of metaphor (1993, p. 415ff.), accomplished by two constraints: (a) the metaphor predicate must provide relevant and diagnostic aspects of the metaphor topic, and (b) possible metaphor predicates are constrained to be prototypical instantiations of the attributive (source) category.

However, the constraints do not clearly block nonexistent metaphors which would link *theory* and *building* in the reverse relationship. For example, *The steel frame is valid* [talking about buildings] <1.6> is not an apt expression about buildings in terms of theories or arguments. However, it is not clear that the class-inclusion constraints disallow the predicate *is valid* from providing relevant and diagnostic aspects of *theory-structure*, such that steel frame structure is described in terms of theoretical validity. The *theory-structure* category, is not sufficiently specific to make this determination. The generality of class-inclusion categories might by nature preclude such specification. In contrast, the derivational relation between source and target domains allows one to restrict metaphors to the domain relations that conventionally occur, in the proper source-target configuration.

Fauconnier and Turner (1994), Turner (1996) and Turner and Fauconnier (1996) propose a new theory which appears to integrate aspects of Lakoff and Johnson’s mapping theory and Glucksberg et al.’s class-inclusion theory. They have proposed a replacement of the mapping theory with one which includes two ‘input’ spaces (i.e., source and target), as well as a ‘generic’ space (i.e., generic-level structure) and a ‘blending’ space (for novel integration). We simply point out here that the empirical evidence of varying degrees of productivity and schematicity of metaphors are relevant to any theory of conventional metaphor.
4.3 Constraints on Metaphor

We have argued that metaphors should be characterized at the level of schematicity which represents their maximal productivity, and that even given the appropriate metaphor schema by this criterion, the productivity of metaphors varies. Hence, both the level of schematicity and the degree of productivity of a metaphor constrain what concepts from the source domain are found to map onto the target domain.

We believe that specifying a metaphor at its appropriate level of schematicity, and a careful description of the semantic structure of the domain, will largely constrain the concepts that can map in a metaphor. For example, in §2.2 we argued that the source domain for AN ARGUMENT IS A BUILDING should be THE STRUCTURAL INTEGRITY OF A BUILDING. This predicts that concepts which can be profiled in this domain can instantiate the metaphor, and those which cannot be profiled in this domain do not instantiate the metaphor. The prediction agrees with the felicity ratings we obtained for relevant expressions of this metaphor. Glucksberg and Keysar’s (1993) analysis of this metaphor does not fully agree with this prediction. Both our analysis and theirs predict that the concept foundation can form an apt expression of the metaphor, but *chimney, *window, and *corner do not. However, the analyses differ in that we find *plumbing and *wall do not express apt instantiations of the metaphor, whereas they predict these concepts are apt.

In our view, Glucksberg and Keysar’s criteria of categorial centrality and salience are either not sufficient or are not sufficiently specific to account for the metaphorical aptness of building concepts. Instead, we argue that metaphorical aptness depends on what conceptual structure (entailments and all) can be profiled in the source domain. For example, since the structural integrity of a plumbing system does not entail the structural integrity of a building, the entailment is not expected to operate in the target domain. There are other building parts that also are predicted not to be apt expressions of the metaphor, which have structural integrity local to part of a building, but do not necessarily contribute to overall building integrity. For example, *the theory has a broken pipe (4c) and *the rafters of their theory (4k) are not apt metaphorical expressions, because pipes and rafters have structural integrity of their own but do not confer this integrity on the entire building.

Most concepts are specified relative to multiple intersecting domains, called ‘domain matrices’ by Langacker (Langacker, 1987, p. 147; cf. Croft, 1993, p. 340). Conceptualization involves the activation of some portion of a domain matrix, what Langacker calls a concept ‘profile.’ The concept wall has at least two conceptualizations: as a barrier or as a support. The latter may entail a building’s structural integrity, but the former does not. The infelicity of concepts such as *load-bearing in 9e suggest that for this metaphor *wall does not map because it is not conceptualized in a way that entails structural integrity. The particular choice of alternate conceptualizations may be an idiosyncratic fact about this metaphor.

Glucksberg (personal communication, August 1996) has raised the question of how our extensions to the theory proposed here would exclude field kitchen, medical evacuation and amputated leg from the ARGUMENT IS WAR metaphor. There are several possible explanations in the semantic theory assumed here, although we are not certain which is the
correct explanation in these particular instances. First, it could be that \textit{WAR} is too general a formulation of the actual source domain, and that we should use a more specific formulation, such as \textit{BATTLE}. We wish to emphasize that formulations such as \textit{WAR}, \textit{BATTLE}, \textit{BUILDING} and \textit{STRUCTURAL INTEGRITY} are merely abbreviatory and can only approximately characterize entrenched semantic structures, and throughout our analysis we have provided clarifying descriptions of specific domains (e.g., everyday arguments, \S 2.2).

The first two concepts Glucksberg mentions are profiles in a domain matrix that includes \textit{WAR}, but also includes \textit{COOKING} or \textit{HEALTH}, respectively. Domains are defined by Langacker (1987) as containing only that knowledge which is presupposed by the understanding of that concept (p. 184). Perhaps only those concepts which can be profiled only in the domain of \textit{WAR} participate in a metaphor such as \textit{ARGUMENT IS WAR}, but not those concepts which are profiled in domain matrices also containing \textit{WAR}.

A third explanation may be relevant, namely a constraint proposed by Lakoff called the Invariance Hypothesis (Lakoff 1990; see also, Brugman, 1990; Clausner, 1993; Lakoff, 1993; Turner, 1990). The Invariance Hypothesis states that metaphors only map image-schematic structure found in the source domain and compatible with the target domain. For example, we suppose that image-schemas such as \textit{FORCE}, \textit{RESISTANCE} and \textit{OVERCOMING} (or \textit{CHANGE OF STATE}) are found in the \textit{WAR} domain. Field kitchens, medical evacuations, and amputated legs might not profile image-schematic structure which is sufficiently compatible with the target domain to map in the \textit{ARGUMENT IS WAR} metaphor.

We do not rule out the possibility that salience also plays a role in determining which concepts map and which do not. Langacker proposes that one must distinguish primary from secondary domains in the domain matrix of a concept (p. 165). For example, consider the fact that \textit{amputated leg} does not map in \textit{ARGUMENT IS WAR} but \textit{shoot}, \textit{target} and \textit{artillery} do. Artillery are almost exclusively associated with war (that is, presupposes war). Amputated legs occur in contexts other than war, and so are not so closely associated with war and hence do not map. However, shooting at targets occurs in non-war contexts as well; yet their conceptual context is intuitively more directly connected to war than amputated legs are.

Another important point is that although the domain mapping theory and the class-inclusion theory make different predictions about specific metaphors, neither sufficiently constrains all metaphors, and in certain respects we find theoretical compatibility. One could propose that the class which subsumes \textit{ARGUMENT} and \textit{BUILDING} for the purpose of describing the metaphor is something like \textit{STRUCTURAL INTEGRITY} rather than \textit{THEORY-STRUCTURE}. This analysis would properly constrain the metaphorical ‘mapping’ within the class-inclusion theory. However, there would still remain the problem of specifying the directionality of the mapping, discussed in \S 4.2.

Although we are not aware of experimental evidence which clearly distinguishes between metaphor theories, we are interested in future work which would provide supporting experimental evidence for variable metaphor productivity. This might be achieved with variants of experiments which claim to provided evidence for the existence of metaphor schemas. For example, Allbritton, McKoon, and Gerrig (1995) use sentence recognition priming to access the degree to which elements of a text representation are associated with one another, arguing that a metaphor schema is the basis for relating and connecting these
elements. If these results are correct, then variable metaphor productivity might be measurable in terms of more productive metaphor schemas having stronger connections to their instantiations, and less productive schemas having weaker connections to their instantiations.20

5. CONCLUSION

We have argued that a theory of grammatical organization developed by Bybee for morphology, and independently developed by Langacker for the morphology-syntax-lexicon, can also be suitably applied to semantic organization.

Derivational relations exist between semantic domains in the form of conventional metaphors as analyzed by Lakoff and Johnson. These derivational relations are analogous to derivational relations in morphology between related word forms. This provides the basis for extending the Bybee-Langacker theory to semantic organization.

First, we demonstrated that metaphorical semantic mappings are formulated at different levels of schematicity of both source and target domains, just as different morphological schemas ('rules') are formulated at different levels of phonological schematicity.

Second, we compared morphological productivity to idioms and metaphors, and argued that the difference between opaque idioms, transparent idioms and conventional metaphors reflected differences in degree of productivity of the semantic mapping relation. We have argued that semantic and morphological organization have isomorphic organization for varying degrees of productivity. Specifically, the organization of form and meaning relations for metaphors and idioms mirrors the organization of form and meaning relations in the Bybee/Langacker theory of morphology.

In the context of the cognitive linguistic approach, our results are significant but easily accommodated in this approach. The cognitive linguistic approach emphasizes the conceptual nature of our mental representations. The experience which speakers of language communicate through their linguistic expressions is a conceptual structure, related to the external world through various processes of conceptualization or construal in the process of perception. However, the linguistic expressions themselves are also conceptual structures; even the sounds we hear are structured by our minds and perceptual apparatus as phonemes, morphemes, words and sentences. This insight has led to the application of many ideas from cognitive psychology to theories of linguistic form. For example, cognitive linguists have argued for the prototype organization of phonetic and phonological form (Bybee & Moder, 1983; Jaeger & Ohala, 1984), morphological form (Bybee & Moder, 1983) and syntactic form (Lakoff, 1987, Case Study 3 on There-constructions). We hope to have demonstrated here that it can work the other way around as well: principles of mental organization established in the study of linguistic form may also prove insightful for the study of semantics.

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NOTES

1. Domains are different from a feature set, in that they are not parts of a concept, but are fields in which concepts are specified (see Langacker, 1987, pp. 147–154 for a theory of conceptual domains; see also, Croft, 1993, pp. 336–345).
2. We adopt the typographical convention in text that small capitals denote semantic domains.
4. This view is not uncontroversial. Langacker does not identify a distinct grammatical relation of ‘derivation’ on a par with other fundamental relations such as ‘symbolization’ (the symbolic relation between a linguistic form and its meaning). Instead, he argues that derivational relations are a kind of category extension:

   The “derivation” of one structure from another is regarded as a manifestation of our general capacity for extension, i.e., categorization by prototype. Many such categorizations (e.g., metaphorical extensions) do not correspond to anything recognized as “rules” in derivational frameworks, and those that do are not the exclusive province of either the grammar (“competence”) or its use (“performance”) . . . (Langacker, 1987, p. 443).

In Langacker’s view, extension is a special case of instantiation, where an instance is judged as a member of a category but does not have all of the features of a central or prototypical category member.
5. We will use the notation x-y as an abbreviation for [[x] → [y]].
7. We thank Elaine Andersen and Joseph Allen for their inconvenience in helping us collect these ratings.
8. Our description of morphophonology is about the existence of generalizations (i.e., schemas) and is not intended to be specific to either distributed or rule-based theories of representation.
9. Many everyday arguments do not involve rational argumentation. See also Turner (1991, Chapter 5) for a discussion of this distinction.
10. The expression appeared twice in the rating list and received consistent ratings as expected.
11. We also tested the expression ‘the steel frame of their building <2.0>’, expecting the building concept to be felicitous in its own domain, but it was marginal. We are unable to explain an almost even distribution of ratings from 0 to 4.
12. Some strong positions on synonymy claim that different words strictly symbolize different concepts. We are interested in distinctions between conceptual aspects of a semantic domain, not just syntactic variants of an expression, or schematically subordinate or superordinate conceptual variants.
13. Our main concern here is the semantic fixity of the idioms. The concepts beans and spill are fixed, but they may occur in a variety of constructions, for example, “the beans were spilled,” “he’s always spilling the beans”; Glucksberg (1993, p. 21) offers, “not a bean was spilled.” These idioms happen to be morphosyntactically rather flexible while preserving their figurative meaning. This may be accounted for by specific constructional schemas which instantiate these specific expressions (Nunberg, Sag, & Wasow, 1994, pp. 504–507). However, violations of semantic fixity cannot be instantiated (e.g., *spill the peas). This is the sort of error second language learners may make, suggesting that they have acquired a general schema, but not the more specific instantiations.
15. This expression was not included in our data judged by raters, but we do not expect it to be felicitous.
16. These expressions are British English. We did not control for the English dialect spoken by our raters.
Opaque idioms are rare, hence the often cited example *kick the bucket*. The semantically opaque expression *by and large* is often distinguished as a 'grammatical' idiom. Other examples *trip the light fantastic* and *make the scene* are semantically marginal, perhaps due to low conventionality.

We express our thanks to John Lawler for bringing this example to our attention.

These examples were suggested after we conducted our survey, but we believe that most people would consider these unacceptable metaphorical expressions for arguments.

We thank Maryellen MacDonald for relevant discussions on this matter.

REFERENCES


