Ontological and Grammatical Constraints on Metaphor Productivity

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Abstract

Traditional approaches view metaphor as a semantic/pragmatic phenomenon that occurs at a conceptual level as mappings between independent concepts. These conceptual mappings are then lexicalized into observed metaphoric expressions. In this view, the lexical and grammatical structure of a metaphoric expression is not relevant to the underlying metaphor's level of productivity. This paper argues that lexical constraints, ontological constraints, and grammatical constraints are all required to explain the productivity of metaphors. The productivity of metaphor lexicalizations is used to argue for the usefulness of a systematic script-based and ontology-based approach to meaning.

1 Productivity and Conceptual Metaphors

The now-traditional approach to metaphor views it as a conceptual mapping between two independent concepts (Lakoff & Johnson 1980 and 1999). These independent concepts are discrete entities defined by (i) their place in a hierarchy of other concepts and (ii) their relationships to other concepts (i.e., as modeled by an ontology: Nirenburg & Raskin 2004). For example, we could posit a concept CAT that is a type of ANIMAL and, more generally, a type of ANIMATE_BEING. This concept is defined, further, by its relations to other concepts: DOESN'T_LIKE -> DOGS or DOES_LIKE -> MILK. The traditional approach views a *metaphoric mapping* as an additional, perhaps temporary, relationship between concepts that largely mimics other types of mappings between concepts. For example, the metaphoric utterance in (1a) could be described using the conceptual metaphor in (1b), notated in all capitals by convention. In this case, there is a concept CAT that has a property such as DOES_LIKE -> SCRATCHING. And there is a concept BOSS with a property such as IN_CHARGE_OF -> EMPLOYEES. The simplest conceptual view of metaphor is that the metaphoric mapping overlaps or merges these concepts CAT and BOSS, but only temporarily in order to support the interpretation of this utterance.

(1a) *My boss is a tom cat and I'm his scratching post*.
(1b) BOSS IS A CAT

These metaphoric mappings are seen as temporary additions to an ontology (i.e., to a formal representation of the conceptual system). However, conceptual metaphors are most often cited within the usage-based Cognitive Linguistics paradigm. One of the important tenets of this approach to linguistics is that frequent perception becomes entrenched to such a degree that it influences future production. This, in turn, influences future perception and creates a production-perception loop until particular patterns become grammaticalized. In the case of the BOSS IS A CAT

metaphor, this process has not taken place: this is still a novel metaphor. In the case of (2a), however, this conceptual metaphor has been produced and perceived so many times that it is posited to have *grammaticalized* a conceptual or metaphoric link between these two concepts. Informally, grammaticalized here means that a new linguistic structure has been created by repeated and consistent usage. The linguistic evidence for this grammaticalized conceptual link is the productivity of unmarked utterances such as (2b), (2c), and (2d). Over time, the metaphoric mapping itself becomes like a concept and influences both language use and reasoning.

(2a) ARGUMENT IS WAR
(2b) *The boss beat back our advances for better treatment.*
(2c) *John defended his position.*
(2d) *Mary rebelled against the established paradigm.*

The problem with a usage-based approach to the relationship between production and perception is that it becomes a just-so story. In other words, simply positing that metaphoric mappings become more entrenched the more they are used is not sufficient. What we need is a model of metaphor productivity: Which metaphoric mappings are able to produce new metaphoric utterances (novelty)? Which metaphoric mappings have left behind fossilized metaphoric utterances but cannot produce new tokens? What are the ontological or conceptual constraints on which metaphoric mappings are possible and likely to become productive? What are the grammatical constraints on how conceptual mappings can be lexicalized into actual observed utterances (c.f., Steen 2007)? This sort of model has been neglected by conceptual approaches to metaphor.

This paper synthesizes work on three types of constraints on the productivity of conceptual metaphors: First, lexicalized properties can influence the meaning of conceptual metaphors even when the same concepts are involved in the underlying mapping; Second, ontological relationships between concepts constrain which metaphoric mappings are possible and how metaphoric the resulting utterances are; Third, grammatical constraints on the realization of metaphoric material in various case roles influences how metaphoric a particular utterance becomes and whether that utterance is ambiguous in context.

2 Lexical Constraints on Metaphor Productivity

Although conceptual approaches to metaphor view this phenomenon as an emerging mapping between concepts, there are few attempts to determine what the conceptual system is like outside of metaphor. What are the independent concepts that are available for metaphoric mapping? How do we know that metaphor operates on concepts and not just lexical items? How do we know what the baseline relationships between concepts are? Ontological semantics (Nirenburg & Raskin 2004) provides a systematic approach to these questions by attempting to develop a formal model of the conceptual system. Here we draw on previous work (Dunn 2013a) and test how concepts behave as part of metaphoric mappings using the technique of *forced metaphorization*, which is essentially a semantic substitution test. Starting with a non-metaphoric utterance, we replace one of the concepts with a new lexical item. This changes the meaning of the utterance in one of three ways: first, the two utterances can have equivalent meanings; second, the two utterances can have different meanings; third, the utterances can have no meaning (i.e., interpretation is not possible). The purpose of applying a semantic substitution test like this is (i) to map out independent concepts that are then posited to be involved in metaphor and (ii) to understand the influence of non-conceptual lexical properties on metaphoric meaning.

A syntactic substitution test relies on intuitions of grammaticality; a semantic substitution test relies on intuitions about implications. First, when two utterances have the same essential or propositional meaning, the utterances should also then share the same strong implications. This is not strictly speaking an entailment. The test for this kind of equivalence is whether there is a strong implication that differs between the utterances. A strong implication here is not necessarily an entailment but, more simply, an implication that is not easily canceled (non-defeasible). The point is that, if substitution changes one of these strong implications, then the propositional or essential meaning of the utterance has changed as well. For example, (3a) has the strong implication in (3b); this strong implication, and thus the same essential meaning, is shared by the examples in (3c) and (3d). The implications have metaphoric sources; the point here is that the metaphoric implications are consistent.

(3a) *Market confidence <u>tumbled</u> last Friday.*
(3b) Strong Implication: Market confidence is lower now than two weeks ago.
(3c) *Market confidence <u>dived</u> last Friday.*
(3d) *Market confidence <u>plummeted</u> last Friday.*

Not all semantic substitutions will produce utterances that have the same essential meaning. The example in (4a) has the strong implication in (4b). This example does not indicate substantial change but instead implies that market confidence has remained at the same general level. The substitution in (4c) shares this strong implication but the substitution in (4d) does not.

(4a) *Market confidence <u>ambled</u> last Friday.*
(4b) Strong Implication: Market confidence may or may not be lower now than two weeks ago.
(4c) *Market confidence <u>drifted</u> last Friday.*
(4d) *Market confidence <u>sky-rocketed</u> last Friday.*

Using this method, the utterance in (5a) has the strong implication in (5b.a) and the weak implication in (5b.b). The negation test is being used to distinguish between strong and weak implications: (5b.a') is unacceptable, but (5b.b') is acceptable. This use of *dive in* requires that parliament at least attempted to take care of this problem (on the assumption that the participants intended to dive; the intention is important for the implication). However, it is possible given this scenario that parliament is unable to avoid the problem any longer so that this is a grudging move. For example, (5c) may be more or less grudging given the intentions of parliament. The substitutions in (5c) through (5e) hold the same strong and weak implications: thus, they have the same essential and non-essential meanings.

(5a) *Parliament <u>dived into</u> a difficult problem this week.*
(5b.a) Strong Implication: Parliament debated and tried to fix a difficult problem.
(5b.a') **Parliament did not debate or try to fix the problem, however.*
(5b.b) Weak Implication: Parliament is active or purposeful in doing this.
(5b.b') *Parliament is grudgingly facing a problem it can no longer avoid.*
(5c) *Parliament <u>galloped into</u> a difficult problem this week.*
(5d) *Parliament <u>jumped into</u> a difficult problem this week*.
(5e) *Parliament <u>strutted into</u> a difficult problem this week.*

This methodology of semantic substitution is important for showing that lexicalizations of metaphor do, in fact, operate on independent concepts that can be modeled in an ontology. The claim is that lexical items either (i) point to concepts or (ii) lexicalize semantic properties of

individual concepts or the utterance as a whole (i.e., aspect). Combining a script-based approach to semantics with metaphor as mappings between concepts, the first prediction is that semantic substitution of words that point to the same concept will not change metaphoric meaning. This term, *metaphoric meaning*, refers to the weak and strong implications discussed above. There may be additional emotional or affective meanings as well. The second prediction is that semantic substitution of the same concept with different lexicalized properties will only change the non-essential meaning of the utterance. The third prediction is that lexical items pointing to different concepts will create utterances with different essential meanings. This is important as a baseline for understanding the productivity of metaphor lexicalization: how do metaphoric mappings interact with the mapping from lexical items to concepts?

The original utterance in (6a) shows a non-metaphoric use of *ignore.* This lexical item points to a concept that could be labeled COMMUNICATION or KNOWLEDGE (the label is not important). The utterances in (6b–d) contain semantic substitution with the verbs *flee*, *evade*, and *abandon*. These lexical items point instead to a concept that could be labeled MOTION. In other words, the substitutions in (6b-d) all point to the same concept. As predicted, these three utterances share the same strong implication in (6e) (i.e., they share the same essential meaning). This is evidence that the metaphoric mapping can be modeled at the conceptual level in a way that provides generalizations across many lexical items.

(6a) Non-metaphoric: *Most politicians ignore scientific findings.*
(6b) Metaphorized 1: *Most politicians flee scientific findings.*
(6c) Metaphorized 2: *Most politicians evade scientific findings*.
(6d) Metaphorized 3: *Most politicians abandon scientific findings.*
(6e) Strong Implication: Most politicians do not make conclusions based on scientific findings.

Starting with the original utterance in (7a), the verb *made* points to the concept CREATE. Metaphoric utterances are produced in (7b-d) by substituting *went along with*, *entered*, and *reached.* As before, these substitutions point to a single concept (MOTION) and also lexicalize similar properties: there is intended movement towards a goal. The strong implication in (7e) is shared by each of these new utterances, again matching the prediction that the metaphoric mapping is between concepts and that all lexical items which point to the same concept will experience the same metaphoric interpretation. Some may consider (7a) metaphoric on its own because the arms treaty is reified as an object; that, however, does not change this analysis.

(7a) Non-metaphoric: *Russia has made an arms treaty with the United States.*
(7b) Metaphorized 1: *Russia has went along with an arms treaty with the United States.*
(7c) Metaphorized 2: *Russia has entered an arms treaty with the United States*.
(7d) Metaphorized 3: *Russia has reached an arms treaty with the United States.*
(7e) Strong Implication: Russia and the United States now have an arms treaty.

Even though metaphoric mappings are conceptual, not all lexical items that point to the same concept share all the same semantic properties. If this is the case, then metaphor productivity will be influenced by lexicalized properties in addition to concepts: these utterances will share the same essential meanings but have different non-essential meanings. The utterances in (8b–d) have substituted *meandered*, *sauntered*, and *struggled*. While these all point to the concept MOTION, they also lexicalize different semantic properties. *Meandered* implies that there is no specific destination and that the movement is slow. *Sauntered* implies a slow and self-assured manner of movement and

leaves the destination vague (there is neither a specific destination nor the lack of a specific destination). *Tripped* implies that the motion is difficult, prevented by something. These utterances share the strong implication in (8e), evidence that they also share the same essential meaning. But they do not share the same weak implications. *Meandered* (8b) carries the weak implication that there is no fixed purpose for the communication. *Sauntered* (8c) carries the weak implication that the communication is slow and self-assured. *Tripped* (8d) carries the weak implication that the communication is difficult to understand. The fact that these different substitutions carry different implication is evidence that they differ in their non-essential meaning. This is an important point for the productivity of metaphors because the underlying conceptual mapping is filtered or influenced by lexicalized meaning.

(8a) Non-metaphoric: *The recorded message sounded through the poor cell connection*.
(8b) Metaphorized 1: *The recorded message meandered through the poor cell connection.*
(8c) Metaphorized 2: *The recorded message sauntered through the poor cell connection*.
(8d) Metaphorized 3: *The recorded message tripped through the poor cell connection.*
(8e) Strong Implication: The recorded message could be heard in spite of the poor connection.

A final example in (9b–d) substitutes the motion verbs *stampeded*, *wandered*, and *crawled*; these words point to the same concept but provide different properties on top of that concept. After metaphoric mapping, these utterances share the same essential meaning, as shown by the shared implication in (9e). But again the additional lexicalized meaning alters the metaphoric mapping. The manner of motion is specified by *stampeded*. The weak implication as a metaphor is that these foreign nationals were not particularly welcome but came anyway. Again, the lack of a specific destination is lexicalized in *wandered*. As a metaphor, this produces the weak implication that the foreign nationals do not have a clear plan and did not all invest in the same way. A slow manner of movement is lexicalized in *crawled*. As a metaphor, the implication is the foreign nationals considered entering the New Zealand market very carefully.

(9a) Non-metaphoric: *Foreign nationals bought into New Zealand when its currency was weak.*
(9b) Metaphorized 1: *Foreign nationals stampeded into New Zealand when its currency was weak.*
(9c) Metaphorized 2: *Foreign nationals wandered into New Zealand when its currency was weak.*
(9d) Metaphorized 3: *Foreign nationals crawled into New Zealand when its currency was weak.*
(9e) Strong Implication: Foreign nationals are now invested in New Zealand.

The point here is that these lexical items point to the same concept and so produce metaphors with the same essential meaning. But the additional lexicalized properties of these verbs change the metaphor. The implication is that metaphoric mappings are conceptual but are still influenced and constrained by lexical properties. Thus, the normal processes of lexical semantics apply to metaphoric mappings and the final utterance meaning is not simply a result of conceptual processes. The idea that lexical semantics contributes to metaphor is not in itself a new proposal. This discussion is important, however, because a focus on conceptual mappings has left a gap in the literature that overlooks the influence of linguistic factors.

3. Ontological Constraints on Metaphor Productivity

So far we have assumed that a metaphoric mapping involves two discrete and independent concepts. It is clear, however, that not all concepts can be mapped together. This section discusses constraints at the ontological level (i.e., at the level of relations and properties of concepts) that constrain metaphor productivity. These ontological constraints are used to describe which concepts

cannot be mapped onto one another. The main constraints used in the literature are (1) semantic similarity, (2) abstractness/concreteness, and (3) a sufficient number shared attributes. We can synthesize these constraints using Searle's social ontology (1995, 2010).

The first idea is that most concepts contain some meaning that can be experienced by the senses together with some meaning that cannot be. A concept like NURSE or DOCTOR, for instance, combines physical information about the expected characteristics of these social roles together with non-physical social information about the roles of nurses and doctors within the script of health-care. The concepts that are potentially available for metaphoric mappings can be incapable of being experienced by the senses because (i) they are inherently created by humans or (ii) they are physical objects that have been assigned non-physical functions by humans. This is an important point because it allows us to be more precise about the oft-cited generalization that metaphoric mappings have less abstract source concepts and more abstract target concepts. This generalization is, in many cases, not true. If we make more precise predictions about source and target concepts, we can maintain accuracy.

The second idea is that there is not a clear distinction between concepts about external reality (the physical world) and those about internal reality (the mental or social world). This two-way distinction is impoverished. Searle says, "The world of Supreme Court decisions and of the collapse of communism is the same world as the world of the formation of planets and of the collapse of the wave function in quantum mechanics" (1995, p. 120). Searle's social ontology can be used to collapse abstractness, semantic distance, and shared attributes into a single continuum based on two notions: fact-status and function-status.

The first, fact-status, is a property that transitions from the purely physical to the purely social. Some concepts reference items that are present in the external world. These *brute-physical-facts* are independent of human consciousness and account for prototypical concrete concepts like BIRD, TREE, ROCK, and WATER. These concepts are not problematic for the traditional definition of abstractness, even if they are not universal "reflections" of some external reality. Other concepts, called *mental-facts*, are products of human consciousness: concepts created by humans. The simplest of these mental-facts are non-intentional sensations: PAIN, EXHAUSTION, HUNGER. These concepts are mental states experienced passively.

Searle distinguishes these from active *intentional-mental-facts*: DESIRE, IDEA, BELIEF. Searle defines intentionality as "that capacity of the mind by which it is directed at, or about, objects and states of affairs in the world, typically independent of itself" (2010, p. 25). Such intentional-mental-facts "are always about, or refer to, something" (25) while *non-intentional-mental-facts* are sensations or perceptions that do not refer to something outside the mind. Non-intentional-mental-facts exist in solitary individuals, even individuals who have only lived in isolation. Intentional-mental-facts, however, can exist either in individuals or in groups of individuals. Going a step further, many concepts are cultural. Their existence depends upon being shared among many individuals. These *collective-intentional-mental-facts* exist only if many individuals believe or accept that they exist: GOVERNMENT, UNIVERSITY, FOOTBALL, CONFERENCE.

Searle in this way creates a distinction between *physical-facts* and *mental-facts*, between *non-intentional* and *intentional mental-facts*, and between *singular* and *collective intentional-mental-facts*. This fact-status property arranges concepts on a continuum of how much or how little they

depend on human beings. In terms of metaphoric mappings, the more a concept depends on humans the more available it is for metaphoric reinterpretation by humans.

The second part of Searle's social ontology involves the function information that concepts contain. As Searle argues, function information is inherently ontologically subjective even if that function information is supplied for purely physical objects: "This consequence follows from the observer-relative character of all functional attributions" (1995, p. 123). The function-status of a concept is the purpose of a concept as defined by humans: "[A] function is a cause that serves a purpose. And the purposes have to come from somewhere; in this case, they come from human beings" (2010, p. 59). Function information depends upon humans for its existence: even concepts referring to physical-facts can contain human-dependent function information, and this information is more available for metaphoric reinterpretation by humans.

Many concepts contain no function information: ROCK, TREE, BIRD. Other concepts contain embedded function information that is independent of human interpretation: *non-agentive* functions (also called natural functions) like HEART (purpose: circulating blood), DIGESTION (purpose: creating energy from food), BREATHE (purpose: intaking oxygen). Functions like this are achieved independently of human intentionality. In Searle's ontology these concepts are less concrete than functionless concepts, but only slightly. Non-agentive functions add information about the concept's purpose in addition to causal information. This allows these functions to be evaluated against their ability to achieve their purpose (Searle 2010, p. 59).

Going further, a large number of concepts contain functions that depend entirely upon human consciousness. *Agentive functions* contain human-centered information that situates these concepts according to their use for or by humans. *Causal-agentive-functions* have a use that is performed by the essential properties of the concept itself: HAMMER, CAR, CLOTHING. This category of concepts are used for specific purposes by humans and embed this functional information. *Institutional-agentive-functions* are performed not by the concept itself but rather by the consent of the humans who have created that concept: MARRIAGE, MONEY, TREATY. This category of functions can only be fulfilled if humans believe or accept that they have been fulfilled.

Searle's social ontology now provides a second hierarchy: concepts with no function information (BLUE, SWEET, MOUNTAIN), followed by *non-agentive functions* (NOSE, CAT, MOONLIGHT, TIDE), *causal-agentive-functions* (UNDERWEAR, CIGARETTE, TRUMPET) in which much of the definition of the physical object comes from how humans use that object, and finally *institutional-agentive-functions* (POET, ELECTION, PROTEST) in which much of the definition of these concepts comes from their use by humans and yet that use is a matter of human convention and acceptance (e.g., a treaty cannot be enacted unless a group of humans believes or accepts that it has been enacted).

The important point here is that (i) concepts and (ii) the functions of concepts can depend more or less on human beings under this system. Semantic similarity is measured by how close in this hierarchy two concepts are situated. This is not a complete semantic similarity, in the sense that antonyms and converses actually end up rather close on this hierarchy. Abstractness is also measured by where concepts fall on this hierarchy: concepts that depend more on human beings are more abstract. The essential property of concepts, in this view, is how dependent they are on humans for their existence. This hierarchy is made more tangible by using the decision trees below, reproduced from Dunn (2015b).

Table 1. Annotating for Fact-Status (from Dunn 2015b)	
1	A: Does the concept depend strictly upon definition (e.g., DEDUCTION)? B: Does the concept exist only within a formal system (e.g., INTEGER, INTEGRAL)? C: Does the concept exist in multiple domains (such as PHYSICAL, MENTAL, SOCIAL)? *If yes to any: fact-status is ABSTRACT; Else: continue to 2*
2	A: Can the concept be experienced by the senses (sight, sound, smell, touch)? B: If yes, is the concept distinguished from similar concepts by characteristics that can be experienced by the senses (e.g., TABLE v. CHAIR as opposed to JUDGE v. POLICEMAN)? *If yes to both: fact-status is PHYSICAL; Else: continue to 3*
3	A: Can the characteristics that distinguish the concept from similar concepts exist in the mind of a single individual in isolation (e.g., IDEA v. LAW)? *If yes: fact-status is SINGULAR-MENTAL; Else: continue to 4*
4	A: Do the characteristics that distinguish the concept from similar concepts exist only when common to the minds of a group of individuals (e.g., WIFE and WIDOW)? B: Does the concept exist only if its existence is accepted or acknowledged by a group of individuals (e.g., LAW, TREAT, MONEY)? *If yes to either: fact-status is COLLECTIVE-MENTAL; Else: If no: restart decision tree*

The purpose of Table 1 and Table 2 is to make tangible this hierarchy of concepts. First, the categories in both tables move from least abstract to most abstract. This captures the property of abstractness that is important but undefined in metaphor theory. Second, the closer that concepts come within these hierarchies the more similar they are. This partially captures the property of semantic similarity that is important for restricting which metaphoric mappings are possible. It is important to note that more difficult mappings remain possible but are marked or highly metaphoric.

Table 2. Annotating for Function-Status (from Dunn 2015b)	
1	A: Does the concept contain or carry by default any information about the purpose, function, use, or role of the concept (e.g., not CLAY or MEADOW)? *If no: function-status is NO-FUNCTION; Else: continue to 2*
2	A: Is the concept's purpose, function, use, or role carried out without human intervention (e.g., bees make honey and cows produce milk)? B: Does the concept have a natural cause-and-effect relationship that is interpreted by humans as a purposeful act (e.g., the heart pumps blood)? *If yes to either: function-status is NON-AGENTIVE; Else: continue to 3*
3	A: Is the purpose, function, use, or role of the concept carried out by means of or according to the intrinsic properties of the concept itself (HAMMER v. STOP-SIGN)? *If yes: function-status is CAUSAL-AGENTIVE; Else: continue to 4*
4	A: Is the purpose, function, use, or role of the concept carried out only by the consent of a group of individuals (e.g., MARRIAGE and TREATY)? B: Is the purpose, function, or role of the concept performed only when a group of individuals accepts that it has been performed (e.g., CHRISTENING, BAPTISM)? *If yes to either: function-status is INSTITUTIONAL; Else: restart decision tree*

We now have a way to define the relationship between concepts in order to formulate ontological constraints on metaphor productivity. To accomplish this, we will systematically test the acceptability of metaphors by drawing source and target concepts from adjacent parts of the hierarchy, taking examples from Dunn (2015b). How similar (in semantic distance and

abstractness) can two concepts be while still supporting a metaphoric mapping? Singular-mental-facts are more abstract than physical-facts. Starting in (10) we take a concept from each category, in this case sharing a function-status: WEED and PASSIONS. Mapping from less abstract to more abstract produces the utterance in (10b), an acceptable utterance with a metaphoric meaning. The reverse mapping, however, produces a non-metaphoric utterance. The only reading of (10c) is one involving literal weeds. This suggests that a metaphoric mapping between these concepts is not possible in this direction.

(10a) Source: WEED (physical-fact; no-function)
(10a') Target: PASSIONS (singular-mental-fact; no-function)
(10b) *The passions grow up like weeds wherever the soul is left untended.*
(10c) ∗ *The weeds in our flower garden need to be brought up in confession*.

To what degree does function-status influence the possibility of mapping these concepts? We repeat the same test in (11), this time drawing concepts that have a causal-function categorization. In this case, metaphoric utterances are possible with mappings in both directions. The mapping from more abstract to less abstract in (11c) is, however, more metaphoric (i.e., more marked). This suggests that this type of mapping is less productive.

(11a) Source: CAMERA (physical-fact; causal-function)
(11a') Target: OBSERVING (singular-mental-fact; causal-function)
(11b) *She watched his walk and stored the images in her head for later.*
(11c) *The camera was her eyes and the roll of film her only memory.*

Staying on the fact-status hierarchy, the next two adjacent categories are singular-mental and collective-mental. Searle's distinction here essentially separates individual and social cognition. In the example in (12) an individual mental state is mapped with a collective mental state. As above, both directions of mapping can produce acceptable metaphoric utterances. As above, however, the reverse mapping from less to more abstract produces a more marked utterance in (12c). For further investigation along these lines, including corpus and psycholinguistic evidence, see Dunn (2015b).

(12a) Source: KNOWLEDGE (singular-mental-fact; no-function)
(12a') Target: MARRIAGE (collective-mental-fact; institutional-function)
(12b) *A good marriage takes time, study, and teaching to mature*.
(12c) *His knowledge of tax law stayed with him despite his many adulteries with corporate law and only occasionally nagged him about his misdoings.*

We now switch to differences between concepts as measured using the function-status hierarchy. Again, the question is whether particular mappings are productive and, if so, which direction of mapping produces a more marked metaphoric utterance. The example in (12) maps between two purely physical concepts which differ only in the function that is assigned to them. Is this function information enough to influence the productivity of metaphoric mappings? Mappings in both directions produce acceptable metaphors; but mapping from more to less abstract concepts produces marked metaphors. This case may be unique, however, because physical concepts provide rich source domains for metaphors.

(12a) Source: GROWING (physical-fact; non-agentive-function)
(12a') Target: RECYCLING (physical-fact; causal-function)

(12b) *Recycling allows us to grow new products out of old products*.
(12c) *Every fall the trees turned in their empty leaves to the recycling center and waited to receive their refurbished leaves in the spring.*

The next adjacent pair on Searle's hierarchy is between non-agentive and causal functions, but here we draw the concepts from separate fact-status domains as well. This increases the distance between concepts and allows us to probe whether reversed mappings are acceptable given larger ontological differences between concepts. The example in (13) shows that the expected mapping produces an unmarked metaphoric utterance (13b), but the reverse of that mapping produces a very marked and perhaps unacceptable utterance in (13c). This may be a one-off case and the coupling is tried with different concepts from the same categories in (14), with the same effect. We can now begin to generalize that reverse mappings between concepts close in the ontology produce marked but acceptable metaphors while reverse mappings between more distant concepts produce unacceptable metaphors.

(13a) Source: DIGEST (physical-fact; non-agentive-function)
(13a') Target: IDEA (singular-mental-fact; causal-function)
(13b) *Ideas take time to digest newly discovered facts into new theories.*
(13c) ?*My indigestion is an idea that sometimes comes out of nowhere and then leaves as quickly*.

(14a) Source: SLEEPWALKING (physical-fact; non-agentive-function)
(14a') Target: REHEARSE (collective-mental-fact; causal-function*)*
(14b) *We will rehearse until we can do all this walking in our sleep*.
(14c) ?*My younger brother sleepwalked every night, rehearsing for the next day at school.*

Does this asymmetry extend to institutional-function concepts? The test case in (15) shows that it does. The distance between concepts is greater here and the reverse mapping produces a questionable metaphoric utterance in (15c). Even if it is possible, we can say that this sort of mapping is unproductive given how marked and highly metaphoric it is.

(15a) Source: KIDNAPPING (collective-mental-fact; causal-function)
(15a') Target: ELECTING (collective-mental-fact; institutional-function)
(15b) *They kidnapped the election with campaign contributions and received their ransom later*.
(15c) ?*The kidnappers campaigned hard to pass their rival gang in the primaries.*

We finish this line of investigation with the paired examples in (16) and (17). Again the ontological distance between concepts comes from function-status, with fact-status held constant. The interesting difference here is that the reverse mapping in (16c) is clearly unacceptable while the reverse mapping in (17c) produces an unmarked metaphoric utterance. The reason seems to be that physical concepts provide rich source domains even when the distance between concepts is large. This points to ontological constraints specific to source domains.

(16a) Source: STAGE-HAND (collective-mental-fact; causal-function)
(16a') Target: LAWMAKER (collective-mental-fact; institutional-function)
(16b) *Members of congress are just stage-hands doing what the big corporations require*.
(16c) ∗ *The stage-hands passed a bill to change the scene from a forest to a lake*.

(17a) Source: UNDRESSING (physical-fact; causal-function)
(17a') Target: THEATER (physical-fact; institutional-function)

(17b) *Acting in front of audiences leaves you exposed and naked up there on the stage.*
(17c) *He finished undressing with a dancer's flourish and bowed to the audience in the mirror*.

Ontological constraints on metaphor productivity, in which relationships between two concepts determine whether a metaphoric mapping is possible and how marked or unmarked that mapping is, have been examined here using Searle's social ontology to situate concepts against one another. This is an important undertaking for the overall program of predicting metaphor productivity, but one that has been neglected in the metaphor literature with its lack of interest in concepts and conceptual systems outside of metaphoric mappings. An important take-away from this short discussion is that ontological constraints are less likely to produce unacceptable utterances than to produce marked and highly metaphoric utterances.

4. Grammatical Constraints on Metaphor Productivity

The final and least considered constraint on metaphor productivity is grammar: how is a conceptual mapping lexicalized in the observed linguistic structure of an utterance? This section draws from Dunn (2011, 2015a) and argues that the lexicalization of metaphoric mappings is constrained by the density of metaphoric fillers for case roles. The more metaphoric case roles an utterance contains, the more marked and less likely to occur that utterance becomes. At a certain point, called *metaphoric saturation*, an utterance on its own becomes ambiguous between a very metaphoric reading and a literal reading. Such highly metaphoric and saturated utterances are less likely to be productive, providing evidence that there are also grammatical constraints on metaphor productivity.

Case roles describe the relationships between an event and its participants. In analyzing the lexicalization of metaphor, we draw on the case roles recognized in Nirenburg and Raskin (2004): *agent, beneficiary, destination, experiencer, instrument, location, path, purpose, source, theme*. In addition, because the verb often also lexicalizes metaphor, *event* is also considered a case role. Depending on the particular frame or script of an utterance, some of these case roles are necessary (obligatory) or unnecessary (optional). The point of this section is to systematically probe how filling different case roles influences the final density of a metaphoric utterance. Each example provides instances of a single underlying conceptual mapping, ARGUMENT IS WAR. One problem with a conceptual metaphor analysis here is that, given the linguistic expression, there is no reason this could not be analyzed as an instance of ARGUMENT IS BUILDING.

The examples in (18) through (21) lexicalize the same underlying metaphor into different case roles. Each of these lexicalizations produces a metaphoric utterance because there is a semantic clash: no literal interpretation is possible (this is an important observation that contrasts with lexicalization into multiple case roles, as we will see soon). On the other hand, there is no clear increase in the markedness of the metaphor based on which case role receives the lexicalized metaphor, except that perhaps that optional case role in (21) is more marked.

(18a) Event
(18b) *Mary [demolished] John's argument*.

(19a) Agent
(19b) *[The enemy] produced a strong argument*.

(20a) Theme
(20b) *Mary disproved [John's strongest weapon].*

(21a) Instrument
(21b) *Mary disproved John's best argument [using a double-edged sword]*.

When the metaphor is lexicalized into multiple case roles, the density of the metaphoric expression increases. We have seen above that mappings between certain concepts create marked metaphoric utterances. In this case, increased density also creates marked metaphoric utterances. In each of these examples in (22) through (24) the metaphoricity of the utterance increases with each additional case role. On the other hand, only (23) is a potentially ambiguous utterance: this could be a literal description of a military action. This sort of ambiguity seems to be possible only if there is no case role that is filled by non-metaphoric material.

(22a) Event-Theme
(22b) *Mary [destroyed] [John's strongest weapon]*.

(23a) Agent-Event-Theme
(23b) *[The enemy] [besieged] [John's best stronghold]*.

(24a) Agent-Event-Instrument
(24b) *[The enemy] [besieged] John's dissertation argument [using a horde of empirical warriors].*

A metaphoric utterance becomes *saturated* when it contains enough metaphoric case roles (i.e., with sufficient density) to be ambiguous between a metaphoric reading and a literal reading. The example in (23a) is continued in (25); it is ambiguous between the two readings, which here means that it could be followed by the utterances in either (25b) or (25c). Metaphor saturation provides an upper limit for density: an utterance without metaphoric case roles is not at all metaphoric but an utterance with only metaphoric case roles is ambiguous between literal and metaphoric readings.

(25a) *[The enemy] [besieged] [John's stronghold].*
(25b) He was denied tenure after his theory was disproved.
(25c) He was captured and convicted of treason.

How do metaphoric utterances become saturated in actual usage? Previous corpus studies found that quite a few saturated metaphors are used (Dunn, 2013, 2015a). In this section we look at causes for saturation together with examples from previous corpus studies. The first two examples are caused by simple ambiguity: in (26), we do not know whether "it" refers to a literal or metaphoric computation and in (27) we do not know whether "case" is a physical object or a legal abstraction. In both examples, saturation is simplistic in the sense that this ambiguity most likely does not exist in the complete communicative context.

(26) Referential ambiguity
(26a) *I didn't know what it was. It would not compute. It had a kind of clarity about it.*

(27) Lexical ambiguity
(27a) *So – and they can't throw the case out.*

Unspecified arguments are a more significant reason for saturation. In (27a), we can assume that what is *jumping* is the number of chapters and conferences. But we do not know for sure. In (27b), the missing argument of *butchered* also dictates whether the utterance is metaphoric or literal. This means that pragmatic implicatures used to fill in that missing argument determine whether the utterance is metaphoric or not.

(27) Unspecified arguments
(27a) *India, the number of members increased 18% and chapters and conferences also saw significant*

jumps.
(27b) *Mom butchered ours. There's only two pictures left of Dad in all twelve albums*.

Background knowledge is another significant cause of metaphor saturation insofar as the utterance underspecifies its interpretation. In (28a) the town is not legally owned, because that is not possible. However, without script-based background knowledge to tell us this (forcing a metaphoric reading of the utterance), a literal reading is possible.

(28) Background Knowledge
(28a) *It's about a town bought and paid for and subverted by a gangster element*.

The more case roles are filled with metaphoric material, the denser the lexicalized metaphor becomes. This means that examples like (29a), which have a large number of optional and obligatory case roles, can potentially become very dense metaphors.

(29) Many metaphoric constituents
(29a) *Veterans of many an evening at the routine pursuit of duty in the field, their emotional sacs barnacled with cynicism and their minds programmed for sardonic wit, sprang to their feet*.

The presence of grammatical metaphors (Lakoff 1987; Sullivan 2013) also creates highly metaphoric utterances. The corpus example in (30a) is more marked than its constructed counterpart in (30b). But the only difference between these utterances is their grammatical structure. Unusual constructions or argument structure can increase metaphoricity.

(30) Altered or unexpected argument structure
(30a) *My normal sensations flooded back, although I had to migrate my eyes to get them pointed forward.*
(30b) *My normal sensations flooded back, as my eyes migrated forward again.*

The purpose of these examples is to show that grammatical constraints on the lexicalization of metaphoric mappings also influence the productivity of those mappings, both in the form of (i) which metaphoric utterances are acceptable and (ii) how marked or metaphoric an utterance is in actual usage. An alternate analysis is that some of these examples involve mixed metaphors that increases their markedness (Crisp 2005; Goatly 2011). In some cases, the two analyses overlap, but the observations about metaphoricity here apply to many cases in which only one conceptual metaphor is present.

5. Summarizing Constraints on Metaphor Productivity

The purpose of this paper has been to synthesize findings from recent work in order to make the argument that script-based semantics is necessary to describe the linguistic productivity of metaphoric mappings. Even though linguistic utterances are the primary evidence for metaphor as a phenomenon, most theories of metaphor have little if anything to say about the two main questions that have been asked here:

> First, what metaphoric utterances are possible?
> Second, what metaphoric utterances are marked or highly metaphoric?

Even though metaphor is a mapping between concepts, there are a number of predictable constraints on which concepts can be mapped and on how metaphor is lexicalized into observed linguistic utterances. The first type of constraint is on lexicalized meaning: in a script-based approach to semantics, words can point to concepts in an ontology. However, as shown in section 2 words are not always simple pointers and often encode other non-concept meanings as well. These

lexicalized meanings persist after metaphoric mappings and change the meaning of the produced metaphoric utterances. The point here is that lexical semantics provides a constraint on the productivity of metaphoric meanings in a way that goes beyond simple relationships between concepts.

Ontological constraints on metaphor productivity influence which concepts can be mapped together and in which direction the mapping can occur (source vs. target). We use Searle's social ontology to show that the degree to which a concept depends on humans for its definition is the primary factor required to explain mapping constraints. The difficulty here is that, in most cases, metaphoric mappings do not become unacceptable but rather become more marked. A more marked mapping produces a highly metaphoric linguistic utterance (Dunn 2014a, 2014b, 2015a).

Grammatical constraints on metaphor productivity influence the lexicalization of conceptual mappings into specific utterances. The increased density of metaphoric case roles increases the markedness of metaphoric utterances in the same way that certain ontological constraints increase metaphoricity. At a definable point, an utterance becomes ambiguous between literal and metaphoric readings.

Taken together, these constraints support models that make predictions about metaphor-in-language: what utterances are metaphoric (i.e., Dunn 2013b, 2013c) and how metaphoric are these utterances (i.e., Dunn 2014a, 2014b)? The ability to make predictions in this way is essential for a falsifiable approach to metaphor and it depends heavily on an ontology-based and script-based approach to meaning.

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