Extended Metaphors are Very Persuasive

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Abstract

Metaphors pervade discussions of critical issues and influence how people reason about these domains. For instance, when crime is a *beast*, people suggest enforcement-oriented approaches to crime-reduction (e.g., by augmenting the police force); when crime is a *virus*, on the other hand, people suggest systemic reforms for the affected community. In the current study, we find that extending metaphoric language into the descriptions of policy interventions bolsters the persuasive influence of metaphoric frames for an array of important issues. When crime is a *beast*, people are even more likely to endorse "attacking" the problem with harsh enforcement tactics; when crime is a *virus* people are even more likely to to endorse "treating" the problem through social reform.

Keywords: Metaphor, framing, analogy, persuasion, political psychology, reasoning

Introduction

An economic system entails the production, distribution, and consumption of scarce resources. In natural language, though, economic systems are often described metaphorically, as *gardens* (e.g., "The *seeds* of economic *growth* were planted years ago. Today, they are just starting to *bear fruit*, and soon we will *reap the rewards*"), *vehicles* (e.g., "The economy is *off track* or *broken down*"), *bodies* (e.g., "The economy used to be *healthy* but is now *suffering*"), and *machines* (e.g., "The economy is *broken* and needs to be *fixed*").

Conventional metaphors make up as much as 10-20% of natural discourse (Steen et al., 2010) and can be especially persuasive (e.g., Sopory & Dillard, 2002). Metaphors highlight particular relationships in the domains they describe and, as a result, can encourage systematic patterns of inference (Lakoff & Johnson, 2008). For instance, if the economy is a *vehicle* and it is *broken down*, then getting it moving again might require a financial *jumpstart*. On the other hand, if the economy is a *stunted plant*, giving a momentary *jolt of nutrients, sunlight, and water* is unlikely to be an effective long-term solution for the health of the *plant*. Instead, the economy might be better served by consistent *sunlight, water, nutrients* and a *supportive environment* (e.g., investments in education and job training to provide a strong workforce).

Recent work has found that these implicit structural entailments of metaphors affect how people reason about important issues (e.g., Hauser & Schwarz, 2014; Landau, Sullivan, & Greenberg, 2009; Thibodeau & Boroditsky, 2011, 2013, 2015). For instance, a *war* metaphor for cancer makes for an excellent slogan and may facilitate fund-raising efforts at a societal level, but it also seems to downplay the role of relatively mundane behavior change in cancer prevention at an individual level (e.g., smoking less; Hauser & Schwarz, 2014); priming people to think of immigration as a type of *bodily contamination* leads people to adopt anti-immigration attitudes (Landauer & Dumais, 1997); and framing crime as a *virus* (rather than a *beast*) leads people to favor social reforms as a tool for crime-reduction over harsh enforcement and punishment (Thibodeau & Boroditsky, 2011, 2013, 2015).

Here we ask whether extending metaphoric language into the description of candidate responses can facilitate (or inhibit) the persuasive influence of a previously instantiated metaphoric frame. Will people be even more likely to support a proposal to reduce crime by focusing on the educational system when such a program is described as a "treatment" for a crime *virus*? Can metaphor framing effects be negated (or even reversed) when an extended metaphor is used to describe a proposal that would otherwise be incongruent with the metaphor frame, as in "The city should treat a crime [*virus*] by increasing the police force"?

Consistent extended metaphors may facilitate metaphor framing effects by (a) re-instantiating the initial frame and, in turn, further highlight the ways in which the congruent response maps on to the entailments of the initial frame (Nayak & Gibbs, 1990) or (b) by providing a lexical cue that links the frame to a response (Graesser & Bower, 1990). For instance, describing education reform as a "treatment" for a crime *virus* may emphasize the ways in which such a policy is similar to a treatment program for a disease (e.g., by focusing on the root cause of the problem). This would suggest that metaphors play an active role in shaping representations of complex problems and that this role can be facilitated by actively situating a response in relation to the conceptual entailments of the frame.

Alternatively, people may be drawn to "treating" a problem that is framed as a *virus* because the *virus* frame serves as a lexical prime for other *virus*-related language. Although such an account may be less compelling on theoretical grounds, if one could use an extended metaphor to persuade people to choose particular policy interventions, even through lexical priming, this would be an important and interesting result. It would suggest, for instance, that describing crime as a *virus* could promote a variety of policy interventions: both those that are conceptually congruent with the entailments of the metaphor and those that are not, simply by extending language that is consistent with the metaphor frame into the description of the response (e.g., "*Treat* the crime [*virus*] by increasing street patrols!").

Study 1: Conceptual Congruence

Methods

Participants Data from 99 valid participants were collected through Mechanical Turk.

Materials and Procedure Stimuli consisted of 10 stories, including scenarios about cheating, crime, education, ecology, housing, income inequality, a medical mistake, partisan politics, science, and sports. Each story was paired with two metaphor frames and two candidate responses that were designed to reflect realistic judgments relating to policy interventions, risk management, or blame attribution (see, e.g., Thibodeau & Boroditsky, 2011).

In Study 1, after reading about a non-metaphorically framed description of a target issue, participants were asked to match metaphor frames to candidate responses. For instance, after reading a description of a crime problem, participants were told: "Two of the city's officials are debating how to solve this problem; they tend to talk about the problem in different ways. One argues that crime is a *virus*; the other argues that crime is a *beast*. If you had to guess, which of the crime-reducing approaches listed below do you think is supported by each of the officials?:"

1. Increase street patrols that look for criminals.

2. Reform educational practices and create after school programs.

For each issue we identified candidate responses that seemed to map onto the conceptual entailments of different metaphor frames. For instance, a proposal to reform a city's educational system seemed more consistent with a crime *virus* – in which a city is a body that can be brought back to health by treating the root cause of the problem – whereas a proposal to increase a city's police force seemed more consistent with a crime *beast*.

Study 1 served as a manipulation check of these intuitions. The extent to which the sample displays similar patterns of matching behavior is taken to reflect the degree to which the mappings between the metaphor frames and response options are conceptually congruent. Highly consistent matching at a group level would indicate clear conceptual relationships between the metaphor frames and response options. Less consistent matching would indicate weaker conceptual relationships between the metaphor frames and response options.

Each participant was asked to match responses to frames for each of the 10 issues. The order of the issues, frames, and candidate responses was randomized across participants.

Results

The results of this task revealed that there were clear mappings between the responses and issue frames, consistent with the design of the materials – 81.1% consistent overall (95%CI: [.786, .834]). Analyzed separately (i.e., with 10 separate chi-square tests of independence), we found a significant difference in how the responses were matched to the frames for each issue, $\chi^2[1, N = 99]s > 13, ps < .001$, confirming that participants matched the response options to the frames at a rate much higher than chance (50%).

This suggests that our intuitions as researchers about the conceptual relationship between the metaphoric frames and responses options were consistent with the population from which the sample in the experiment will be drawn.

Study 2: Lexical Congruence

In the experiment described in the following section (Study 3), we implemented a 3 frame (*metaphor A, metaphor B, no metaphor*) by 3 extended metaphor (*consistent, inconsistent, no extended metaphor*) design, thereby creating nine versions of each stimulus item. In the *consistent* condition, extended metaphors were paired with their conceptually congruent response (e.g., "treat" with "education reform" and "attack" with "increasing police"). In the *inconsistent* condition, we paired extended metaphors with their conceptually incongruent response (e.g., "treat" with "increasing police" and "attack" with "education reform"; see Table 1).

Table 1: Examples of consistent and inconsistent uses of extended metaphor in the description of response options to an issue that described a crime problem. Italics added to highlight the extended metaphoric language.

Consistent
a. *Treat* the problem by reforming educational practices and creating after school programs.
b. *Attack* the problem by increasing street patrols that look for criminals.
Inconsistent
a. *Attack* the problem by reforming educational practices and creating after school programs.
b. *Treat* the problem by increasing street patrols that look for criminals.

In this section we confirm that the extended metaphors did, in fact, extend the initial frames *consistently* and *inconsistently* by using latent semantic analysis (LSA; Landauer & Dumais, 1997). LSA is a tool that measures the similarity of words, phrases, and texts as a function of their contextual co-occurrence and has been shown to, among other things, reliably predict response times in for lexically primed target words in a lexical decision task (Hutchison, Balota, Cortese, & Watson, 2008).

To conduct this analysis, we identified the words that were used to instantiate the initial metaphor frames for each issue (e.g., "virus plaguing" and "beast preying") and the words used to insatiate the extended metaphors in the description of the responses (e.g., "treat" and "attack"). Then we entered these word pairings into the LSA database, which yielded four similarity scores per issue (see Table 2). In every case two were designed (expected) to be consistent (more similar) and two were designed (expected) to be inconsistent (less

similar).

Table 2: Similarity scores between metaphor frames and extended metaphors as measured by LSA. For this issue (about crime), "virus"-"treat" and "beast"-"attack" were designed to be consistent whereas "virus"-"attack" and "beast"-"treat" were designed to be inconsistent.

	Treat	Attack
Virus	.28	.24
Beast	.18	.26

For each issue, we averaged ratings of similarity between the two *consistent* and the two *inconsistent* pairings. For instance, in this case the average cosine (LSA's metric of similarity) between the *consistent* pairings was .27 and the average cosine between the *inconsistent* pairings was .21. A paired t-test revealed that the consistent matches ($M = .261, SD = .139$) were more similar than the inconsistent matches ($M = .167, SD = .134$), $t[9] = 5.018, p < .001$, confirming the design of the materials.

The average similarity between the consistent matches was greater than the average similarity between the inconsistent matches for all of the ten issues except one. The one issue that yielded anomalous results described a medical clinic that had made a mistake in filling prescription medication. One metaphor framed the clinic as an *ecosystem* and was extended with the word "interactive"; the other framed the clinic as an *assembly line* and was extended with the word "station." LSA revealed that the relationship between the *consistent* pairings was the same as the relationship between the *inconsistent* pairings in this case.

The lack of a difference between the *consistent* and *inconsistent* extended metaphors for this issue raises a larger issue about metaphor frames that has so far been overlooked: sometimes a metaphor frame can be extended in multiple ways. For instance, in the crime context, the word "treat" was found to be more similar to the *virus* than *beast* frame; the word "attack" was found to be more similar to *beast* than *virus* frame. However, *viruses* can be "attacked" and *beasts* can be "treated." For this reason we divided the issues into two groups: those that were more ambiguous (less distinct or specific) with respect to the similarity between the initial frames and extended metaphors (i.e., cases where the initial frames were similar to both extended metaphors) and those that were less ambiguous (more distinct or specific) with respect to the similarity between the initial frames and extended metaphors. We will consider this dichotomy in analyzing the results of the experiment presented below. It may be the case that the extended metaphors are especially likely to facilitate (or inhibit) the effect of the initial frame when the similarity between the frame and extended metaphoric language is less ambiguous (more specific).

The difference in similarity between the initial frames and metaphor extensions was significantly higher for the five items that were identified as less ambiguous (more distinct and specific; $M = .143, SD = .037$) than for the five items that were identified as more ambiguous ($M = .046, SD = .027$), $t[8] = 4.733, p = .001$.

Together, the two norming studies validate the experimental design. For each issue, there were systematic conceptual and lexical relationships between the metaphor frames and candidate responses. A group of nave participants in Study 1 confirmed that the two response options for each issue mapped on to the conceptual entailments of different metaphor frames. Study 2 used LSA to confirm that the *consistent* extended metaphors were more similar to the initial frames than the *inconsistent* extended metaphors. In the following experiment, we will test whether people are sensitive to these relationships when metaphor frames are embedded in the description of a target issue and when extended metaphors are used to describe the response options.

Study 3: Framing Experiment

Methods

Participants Data from 988 valid participants were collected through Mechanical Turk.

Materials and Design Nine versions of each of 10 stimulus items were created by crossing the three framing conditions (*metaphor A, metaphor B, none*) with the three extended metaphor conditions (*consistent, inconsistent, no extended metaphor*). Participants were presented with one version of each of the 10 issues. Their task was to answer a follow-up question for each issue, for which there were two candidate responses. The follow-up question was designed to reveal whether people were sensitive to implicit conceptual entailments of the metaphor frames. In some cases, the follow-up question asked the participant to choose between policy responses (e.g., as in the case of crime); in other cases the follow-up question asked participants to attribute blame for an outcome or to speculate on some other aspect of the target domain (e.g., for the issue that described a mistake at a medical clinic, participants were asked whether the "nurse who administered the medicine" or the "computer system that relayed messages between the nurse and pharmacist" was more responsible for the mistake).

In the *consistent* and *inconsistent* conditions, metaphoric language was used to describe both of the response options, thereby affording careful control over the experimental manipulation (see Table 1). Each participant was exposed to one of the nine versions of each stimulus item. The order and version of the stimuli was randomized across participants.

Congruence To analyze data from the conditions that included a metaphoric frame, we coded responses as "congruent" or "incongruent" with the associated frame. For instance, in the context of the crime example, "Increase street patrols" was coded as congruent with the *beast* frame and incongruent with the *virus* frame, regardless of the presence/absence of extended metaphoric language.

This approach captures the joint effects of the pairs of metaphor frames and is consistent with prior work on metaphor framing (e.g., Robins & Mayer, 2000; Thibodeau & Boroditsky, 2011, 2013, 2015). One advantage of such a coding scheme is that it provides a clear metric for interpreting the degree to which metaphors influence judgments. Metaphor frames that do not systematically influence the way people think about an issue will yield a congruence score close to .5; metaphor frames that influence people to choose the response option that is consistent with the frame's entailments will yield a congruence score above .5; and metaphors that influence people to choose the response option that is inconsistent with the frame's entailments will yield a congruence score less than .5.

For instance, the results of the current experiment found that people were more likely to think that a city should focus on education reform in response to a crime *virus* (59.0%; no extended metaphor condition) than *beast* (51.9%; no extended metaphor condition). Since the shift is consistent with the predicted effects of the metaphor, the congruence score for this item is greater than .5 ($.590 + (1 - .519) = 1.071; 1.071/2 = .536$). In other words, 53.6% of responses to this item were congruent with the metaphor frame (i.e., 7.2% more participants chose the response option that was congruent with the virus metaphor when crime was framed as a *virus* compared to when crime was framed as a *beast*).

Note that if everyone, in both framing conditions, thought that the city should "increase the police force" in response to the crime problem, the congruence score for the item would be .5: all of the responses in the *beast* condition would be coded as congruent with the frame but none of the responses in the *virus* condition would be coded as congruent with the frame ($1 + 0 = 1; 1/2 = .5$). In this way, transforming participants' judgments into a congruence score allows for clear comparison across issues with different metaphor frames and response options.

Coding responses as congruent or incongruent with the metaphor frame requires that we collapse over the two metaphor frames for a given issue. As a result, congruence cannot be computed when the issue is presented without an initial metaphor (i.e. for the *no metaphor* frame trials).

Results

We found that participants chose the congruent response option 54.9%, 51.3% and 50.1% of the time in the *consistent*, *no extended metaphor*, and *inconsistent* extended metaphor conditions, respectively. A mixed ANOVA on the mean congruence ratings for the 10 issues with extended metaphor condition treated as a factor and issue as a repeated measure revealed a statistically significant difference in the degree to which participants chose the congruent response by extended metaphor condition, $F[2, 18] = 4.011, p = .036$.

Due to the relatively small number of items, no pair-wise differences between extended metaphor conditions were significant in post-hoc testing. However, the pattern of results suggested that extending consistent language into the de-

scription of the response options made people more likely to choose the congruent response whereas extending inconsistent language into the description of the response options made people less likely to choose the congruent response. We present additional analyses that help to distinguish between the conditions below.

Did the specificity of the extended metaphor matter? In order to test whether the quality of the relationship between the initial frame and the extended metaphor affected this pattern of behavior, we added an additional factor into this analysis: whether LSA scored the relationships between the initial frames and extended metaphors as more ambiguous (i.e., both frames were similar to both extended metaphors) or less ambiguous (i.e., the frames were much more similar to the matching *consistent* extended metaphor and less similar to the *inconsistent* extended metaphor).

The result was a statistically significant interaction between this factor and the extended metaphor condition, $F[2, 16] = 3.872, p = .043$. As shown in Figure 1, differences in congruence between the *no extended metaphor*, *consistent* extended metaphor, and *inconsistent* extended metaphor conditions were greater for items that were less ambiguous, $F[2, 8] = 7.137, p = .017$, than for items that were more ambiguous, $F[2, 8] = .134, p = .877$.
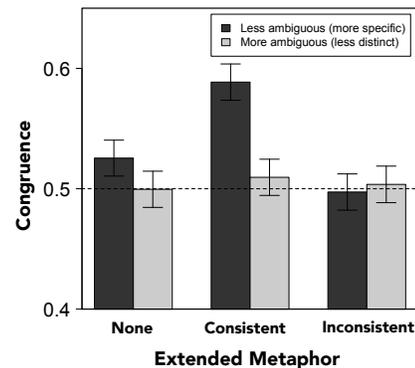

Figure 1: Proportion of congruent responses by extended metaphor condition for items with a less ambiguous relationship between the initial frame and extended metaphor (more specific to the consistent extended metaphor) and for items with a more ambiguous relationship between the initial frame and extended metaphor (indicating that the extended metaphor may be somewhat appropriate in the context of both frames).

This analysis suggests that the degree to which extended metaphors facilitate the persuasive influence of a frame depends, in part, on the specificity of the extended metaphor. For instance, although the word "treat" fits a *virus* frame better than it fits a *beast* frame (and the word "attack" fits a *beast* frame better than a *virus* frame), "treat" can also be used in reference to a *beast* (similarly, the word "attack" can be used in reference to a *virus*). For this issue, people chose

the congruent option more in the *consistent* than *inconsistent* extended metaphor conditions (55% compared to 51%); however, this difference is relatively small when compared to items in which the initial frames were specifically more related to the *consistent*, and not the *inconsistent*, extended metaphor. For instance, another issue described a research scientist as either *climbing a mountain* (extended with "gains ground") or *solving a puzzle* (extended with "looks for connections"). For this issue, 72% of responses were congruent in the *consistent* condition compared to 50% in the *inconsistent* condition). Not only was the relationship between a given frame and the matched extended metaphor relevant to participants' judgments, but the relationship between the frame and the alternative extended metaphor mattered as well.

How strongly did the metaphors affect judgments? So far, we have shown that people were more likely to choose the conceptually congruent response when it was described using *consistent* extended metaphoric language and that the specificity of the relationships between the initial frames and extended metaphors moderated this effect. However, we have not tested whether people chose the conceptually congruent response more often than one would expect by chance in any of the three conditions.

Here, we use mixed-effect logistic regression to test this important question and to make further comparisons between the conditions. On this approach, analyses are conducted at the level of the individual trial, rather than by averaging data over items or participants (i.e., by fitting a single model to participants' binary judgment for each issue; Bates, Maechler, Bolker, & Walker, 2013; Jaeger, 2008). This allows us to take advantage of the statistical power afforded by the relatively large sample and increases the reliability of the results (by reducing the probability of a Type 1 or Type 2 error; Jaeger, 2008). In the model, we included random effects for participant and issue to simultaneously account for error variance associated with these factors (i.e., participant and issue were treated as repeated measures; cf. Clark, 1973). An additional advantage of this approach is that it allows us to compare across all three levels of the framing manipulation (*metaphor frame A, metaphor frame B, and no frame*) as well as all three levels of the extended metaphor manipulation (*consistent, inconsistent, and no extended metaphor*).

We first confirmed the results presented above by testing for an interaction between the framing and extended metaphor manipulations. We compared two models[1]: one that included predictors for interactions between these factors and one that did not. We found that including predictors for the interactions significantly improved the fit of the model, $\chi^2[4] = 11.378, p = .023$. Post-hoc testing (Bonferroni-corrected $\alpha = .017$) revealed that participants were more likely to choose the congruent response in the *con-*

[1]The deviance between the models (i.e., difference in likelihood ratios) is reported as an index of model fit: model deviance approximates a chi-square distribution with the number of added parameters as its degrees of freedom (Menard, 2002).

sistent extended metaphor condition than in the *inconsistent* metaphor condition, $\chi^2[1] = 10.410, p = .001$, or the *no extended* metaphor condition, $\chi^2[1] = 7.608, p = .006$. There was no difference between the *inconsistent* and *no extended* metaphor conditions, $\chi^2[1] = .646, p = .422$.

We then tested whether people were significantly more likely than one would expect by chance to choose the congruent response option for each of the three extended metaphor conditions. We found that the metaphor frames affected participants' judgments when the candidate responses were described with *consistent* extended metaphors, $\chi^2[2] = 25.812, p < .001$, and when the candidate responses were described with *no extended* metaphors, $\chi^2[2] = 13.203, p = .001$. However, the metaphor frames did not affect participants' judgments when the candidate responses were described with *inconsistent* extended metaphors, $\chi^2[2] = 3.963, p = .138$.

In sum, these analyses confirmed the omnibus difference in participants' likelihood of choosing a congruent response by extended metaphor condition, and additionally revealed that people were significantly more likely to choose the congruent response when extended metaphors were used *consistently* to describe the candidate responses, relative to the *inconsistent* or *no extended* metaphor conditions. It also revealed that people were more likely to choose the congruent response than one would expect by chance in the *consistent* and *no extended* metaphor conditions but not in the *inconsistent* extended metaphor condition.

In other words, these analyses revealed evidence of a simple metaphor framing effect when the candidate responses were described without extended metaphors, which was amplified (facilitated) when the candidate responses were described with *consistent* extended metaphors. This effect was not negated when the candidate responses were described with *inconsistent* extended metaphors, as responses in this condition were no different from what one might expect by chance (i.e., this condition did not show a metaphor framing effect).

General Discussion

The results of this study indicate that metaphor framing is especially persuasive when *consistent* metaphoric language is extended to descriptions of candidate responses. Although people are more likely to endorse approaches to crime-reduction that emphasize social reform when crime is framed as a *virus*, they are even more likely to do so when the reform is described as a "treatment" (i.e., in the context of a re-instantiation of the initial metaphor frame).

We found differences of about 10 (54.9% congruent) and 3 (51.3% congruent) percentage points in the *consistent* and *no extended* metaphor conditions that were attributable to the metaphor frame. Of note, we also found that the specificity of the extended metaphor mattered. Extended metaphors that were specifically related to the matching frame, and distinct from the non-matching frame, were most likely to facilitate

persuasion (58.9%; a shift of about 18 percentage points). For instance, the facilitative effect of the extended metaphor was less pronounced in the context of crime because *viruses* and *beasts* can both be "treated" and "attacked."

For comparison, in prior work, we have found shifts on the order of 15 percentage points in a free response task and 8 percentage points in a forced choice task, when response options were described without extended metaphors (Thibodeau & Boroditsky, 2011, 2013). One notable difference between the present work and prior studies is the use of multiple target domains and pairs of metaphor frames. Thus, we are in a position to make a more general claim about how metaphor frames influence reasoning, as well as to explore some of the boundary conditions of metaphor framing effects in future work (Steen, Reijnierse, & Burgers, 2014).

As noted in the introduction, there are at least two reasons that extended metaphors may facilitate persuasion: either because they re-instantiate the conceptual structure of the initial frame or because they provide a more associative (lexical) link to the initial frame. The present work suggests that the conceptual entailments and lexical associations of metaphors are mutually beneficial sources of information (see, e.g., Patterson, 2014), as people were most likely to be influenced by the metaphor frame when the conceptually related response option was described with a matching extended metaphor.

Although it is valuable to think about how these distinct sources of information contribute, separately and in combination, to long-term and on-line representations, it may not be possible to dissociate them completely. Further, at a process level, both of these sources of information can be can be modeled as a spreading activation in an associative network (Flusberg, Thibodeau, Sternberg, & Glick, 2010; Rogers & McClelland, 2008; John, 1992).

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