Metaphor Congruent Image Schemas Shape Evaluative Judgment: A Cross-Linguistic Study of Metaphors for Economic Change

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Abstract

Metaphor pervades discussions of important socio-political topics. Recent research indicates that metaphorical language can influence how people reason about such topics, potentially affecting real-world decision-making. In this study, we report on research into the effects of metaphor on evaluative judgment, another aspect of decision-making that has been less well studied than reasoning. We use a cross-linguistic difference in the metaphors used by English and Spanish speakers to discuss economic change to investigate how metaphorical language affects evaluative judgment. We show that the image schematic information inherent in the semantics of the different metaphors performs a central role in shaping this process.

Keywords: metaphor; evaluative judgment; cross-linguistic variation; image schemas; socio-political discourse

Introduction

I say, block those metaphors. America's economy isn't a stalled car, nor is it an invalid who will soon return to health if he gets a bit more rest. Our problems are longer-term than either metaphor implies. And bad metaphors make for bad policy. – Paul Krugman

We often use metaphorical language to express a stance toward an object or event. The metaphors invoked by Mr. Krugman operate by applying a basic image schema from the domain of spatial motion to the complex socio-political domain of the economy. The image schema is that of BLOCK-AGE. Image schemas are dynamic representations of spatial relationships, force relationships, and motion in space (Langacker, 2001; Talmy, 1990). They develop through experience as encoded in our daily sensory-motor activities, and are thought to be the basis of the human conceptual system (Lakoff & Johnson, 1999). The BLOCKAGE image schema entails an entity whose tendency towards motion is being impeded. It can be used in metaphorical expressions to signal evaluative judgment.

Evaluative judgment is the process of assessing a stimulus through the filter of an internal network of beliefs, values, and aesthetics. This process interacts with sensory-motor nervous system circuitry to influence how we interpret other people's behavior and whether we participate in select activities or events (Norman et al., 2011). It contributes to basic human impulses, such as avoidance and approach. It further serves to guide complex behavior. For example, evaluative judgment informs activities such as participating in a social movement, contributing to a charity, and voting for a presidential candidate where the choice of candidate can be based more heavily on evaluative processes than on reasoning.

Evaluative processes pervade human language on many levels. People use linguistic information as an input into evaluative judgments at the social and interpersonal level: we assess our partners in communication positively or negatively based on accent, intonation, prosody, word choice, and grammatical complexity (Berger & Calabrese, 1975; Fuertes et al., 2012). Evaluative information is, in turn, directly encoded in the lexical semantics of language. For instance, cross-linguistic research shows evaluative information to be the semantic component that factors most frequently and consistently into lexical expressions from a wide variety of language families (Triandis & Osgood, 1958). The words in an utterance, then, potentially lead to entailments and evaluative inferences that are congruent with the stance of the speaker. Similarly, framing a topic to highlight and promote one's own evaluative judgment can influence how that topic is evaluated by others.

Framing can be achieved through metaphorical language, the semantics of which convey an evaluative component that can be as basic as avoidance versus approach: while the *specter of urban violence* must be strictly avoided, an *epidemic of urban violence* can be cautiously approached (Thibodeau & Boroditsky, 2011). Metaphor theorists from ancient times to the present have considered evaluative judgment to be one of the primary functions of metaphorical language (Lakoff & Johnson, 1980). This evaluative information is conveyed largely through the image schemas that are encoded in language and accessible to human cognition through our experiences of perceiving, interacting with, and emotionally responding to our environment (see for example Barsalou, 2010; Zwaan, 2008).

Interestingly, recent experimental research on metaphorical language provides evidence for the influence of image schematic information on evaluative judgment. In one study, participants were more likely to judge immigrants negatively after being primed to view their own country as a human body (e.g., a nation undergoing a growth spurt) rather than as an abstract entity (e.g., a nation undergoing a period of innovation), an effect that is congruent with a conventional metaphor that describes immigrants and immigration in terms of dis-

ease (Landau et al., 2009). Keefer et al., (2014) have characterized this effect as metaphoric fit. Metaphoric fit refers to maintaining consistent image schematic information across metaphors during discourse. In a test of the metaphoric fit hypothesis, they asked participants to read an article on depression and its symptoms, and then evaluate the effectiveness of a proposed antidepressant medication. Three versions of the article framed depression in terms of a spatial metaphor (DEPRESSION IS DOWN), or in terms of a visual metaphor (DEPRESSION IS DARK), or using non-metaphorical language. Participants in the spatial metaphor condition judged a drug called Liftix as more likely to be effective, whereas participants in the visual metaphor condition judged a drug called Illuminix more likely to be so. Recent results from another study (Thibodeau, 2016) support the metaphoric fit hypothesis, finding that people evaluated solutions to social problems more favorably when the solution and the problem were framed with congruent metaphoric schemas. For example, given a description of economic hardship in terms of a BALANCE schema, participants preferred a solution that involved "returning to equilibrium". When the description was given in terms of a SPLITTING schema, they preferred one that "narrowed the gap". Taken together, these findings present compelling evidence that the image schematic information specified by metaphorical language can impact how people evaluate situations. A question that naturally follows from such findings is whether cross-linguistic differences in metaphor usage produce similar effects. For example, if spatial metaphors for depression were predominant in one language, while visual metaphors for depression were in another, would speakers of the first language favor Liftix and speakers of the second Illuminix?

Although several studies have demonstrated that spatial metaphors for time vary across languages (e.g., Chan & Bergen, 2005; Fuhrman & Boroditsky, 2010; Nuñez & Sweetser, 2006), and that these distinctions are reflected in differences in how speakers conceptualize and reason about time (e.g., Casasanto & Boroditsky, 2008), less attention has been directed towards cross-linguistic contrasts in other conceptual domains. Nor has evaluative judgment, as opposed to reasoning, been the focus of previous cross-linguistic research on metaphor. Here, we discuss an investigation into cross-linguistic differences in metaphors for economic change and whether these differences are reflected in speakers' evaluative judgments about economic change. In this study, we focus on the domain of the economy for a few reasons. Behavior related to the economy and financial decision-making is largely motivated by evaluative judgment, and evaluative judgment is consequently a topic of great interest in behavioral economics. In addition, patterns of cross-linguistic differences in the metaphors used to discuss economic change and issues related to the economy have been identified in previous research (e.g., Boers & Demecheleer, 1997). Charteris-Black & Ennis (2001), for instance, compared metaphor use in news coverage of business and financial matters across English and Spanish publications. They found many cross-linguistic similarities in metaphor use, including the tendency to characterize the state of the economy in terms of the physical or psychological health of an organism, to characterize change in the economy in terms of physical motion, and to characterize unusual economic events in terms of natural disasters. At a higher resolution of analysis, however, divergent patterns emerged. The salience of certain metaphors varied across the two languages, as did the types of subordinate concepts favored in metaphor use. Nautical metaphors, for example, were found to be common in English reports on the economy but rare in Spanish reports.

Recent developments in natural language processing approaches to metaphor research have allowed the analyses of much larger corpora to corroborate such hand-annotated corpus studies. Gutiérrez et al., (2017) present a method for detecting fine-grained, cross-linguistic textual differences through the automated analyses of large multilingual corpora. Employing data-driven techniques from natural language processing and machine learning, this method can identify cross-linguistic variation in the use of metaphor among multiple topics. Regarding the topic of the economy, the study found that English discussions of economic change most frequently employ metaphors based on locative motion verbs (e.g., "the economy was going backwards" to describe negative growth). In comparison, Spanish discussions typically rely on metaphors based on expanding/contracting motion verbs (e.g., "la economia se contrajo" to describe negative growth). The image schematic structure of locative motion verb metaphors as in the English example can be categorized as SOURCE-PATH-GOAL with a focus on PATH. Figure 1a illustrates how the English phrase instantiates this schema. The image schematic structure of volumetric motion verbs as in the Spanish example can be categorized as EQUILIBRIUM. Figure 1b illustrates how the Spanish phrase instantiates it. Notably, locative motion verbs feature movement out-of-place whereas expanding/contracting motion verbs feature movement in-place. The experiment in the present study was designed in accordance with these results. In the experi-
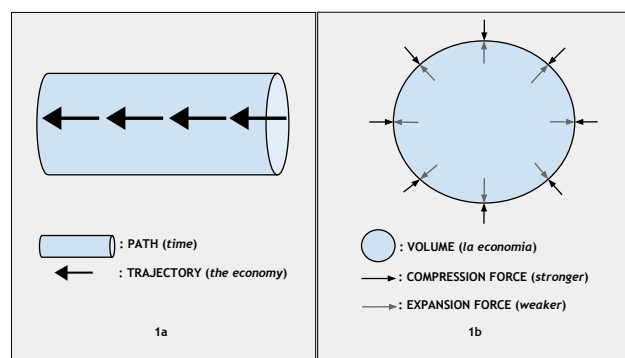

Figure 1: The SOURCE-PATH-GOAL and EQUILIBRIUM image schemas prominent in English and Spanish metaphors for economic change.

ment, conducted across a sample of native English and native Spanish speakers, we tested whether people were more sensitive to information presented in a form congruent with the more salient metaphors for economic change in their language. For the experimental task, participants made an evaluative judgment ("Improved" or "Worsened") regarding economic change in a fictional country based on a representative graphic. Change was depicted in the graphic along the two dimensions characteristic of the SOURCE-PATH-GOAL image schema (henceforth referred to as MOTION) and the EQUILIBRIUM image schema (henceforth referred to as VOLUME). That is, the figure in the graphic progressed from a starting point along a linear path to an end point at the same time that it expanded or contracted. If metaphor-congruent image schemas are active during the process of forming evaluative judgments, we expect English speakers' evaluations of the economy to align more closely with the direction of change in the linear dimension of the graph, and Spanish speakers' evaluations to align more closely with change in the volumetric dimension.

Experiment

Methods

Participants We recruited 60 participants from one English-speaking country (the US) and 60 participants from three Spanish-speaking countries (Chile, Mexico, and Spain) using the CrowdFlower crowdsourcing platform.[1] All participants answered a demographic questionnaire, reporting gender, age, location, native language, level of education, color vision deficiencies, and use of touchscreen device during task. Results from nine US and three non-US participants were discarded for failure to meet the language requirement.

Materials & Design Participants first read a brief description of the experimental task, which introduced them to a fictional country in which economists are devising a simple but effective graphic for representing change in the economy (see Figure 2 for the English version). Spanish speakers read a translation of the English text provided by a native speaker of Spanish who is also fluent in English. They then navigated to a new page to begin the task. Stimuli were presented in a 1200-pixel by 700-pixel frame. The center of the frame contained a sphere with a 64-pixel diameter. For each trial, participants clicked on a button to activate an animation of the sphere which involved (1) a positive displacement (in rightward pixels) of 10% or 20%, or a negative displacement (in leftward pixels) of 10% or 20%; and, (2) an expansion (in increased pixel diameter) of 10% or 20%, or a contraction (in decreased pixel diameter) of 10% or 20%. Participants saw each of the resulting conditions three times. The displacement and size conditions were drawn from a random permutation of conditions using a Fisher-Yates shuffle (Fisher & Yates, 1963). Crucially, stimuli in half of the trials contained conflicting image schematic information with respect

Oxar is a country on the planet Xor. Oxarian economists are experimenting with new ways of modelling economic trends in their country. A group of economists are attempting to design a simple yet intuitive way of representing changes in the economy of the country. You are here to help them in their mission! During the experiment, you'll see a series of graphics representing change in Oxar's economy. Your task will be to decide, according to the dynamic graphic you have just seen, whether the economy has improved or worsened. Then, you will be asked to estimate how much the economy changed according to the graphic. Please try and give your judgments about the economy as accurately as possible.

Figure 2: Description of the experimental task in English.

to the displacement and volumetric metaphors for economic change (e.g., the sphere could both expand and move backwards).

Once the sphere had completed its movement across the screen, participants recorded a judgment of whether the economy improved or worsened by clicking on the appropriate radio button. They then indicated on a seven point scale how confident they were in their judgment and by how much they judged the economy to have changed.

Results & Discussion

Congruence & Direction To analyze participant judgment of the direction of economic change, we first coded the responses as being MOTION–congruent or VOLUME–congruent. For instance, if on a given trial the sphere was expanding while moving backwards and the response was "Economy Improved", the result was coded as VOLUME–congruent. If the response had been "Economy Worsened", the result would have been coded as MOTION–congruent. Figure 3 presents the mean proportion of responses that fall into these categories for both languages,[2] showing that Spanish speakers' judgments were more likely to align with the VOLUME dimension of the stimuli (i.e., the dimension encoded in the image schemas used most frequently in Spanish to discuss economic change metaphorically), and English speakers' judgments were more likely to align with the MOTION dimension (i.e., the dimension encoded in image schemas used most frequently in English to discuss economic change metaphorically). To test whether people's judgments followed a language–specific, metaphor–congruent response more often than predicted by chance, we used a mixed effects logistic regression model to analyze the data using the lme4 package in the R statistical language.[3] We compared two models: one that modeled the influence of language on
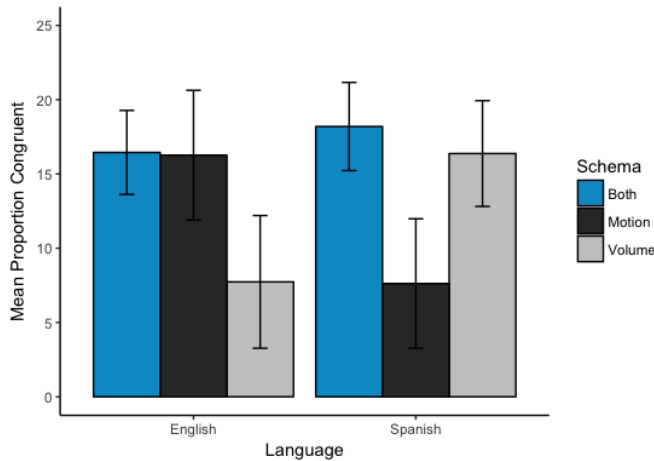
Figure 3: Mean proportion of dimension-congruent responses by language for BOTH-congruent, MOTION–congruent and VOLUME–congruent judgments.

Figure 4: The ROC curve showing the ability of our model to correctly classify the judgments of participants.

judgment for the conflicting trials ($n = 2520$), and one that modeled the influence of language on judgment for the non-conflicting trials ($n = 2520$). We reasoned that, if the image schematic information in the experimental stimuli is influencing judgment in a manner that is both language–specific and metaphor–congruent, language would be a significant predictor of judgment in the conflicting trials but not in the non-conflicting trials.

Both models included random effects for participant and item to control for their associated intraclass correlation, and both used the Laplace approximation for parameter estimation. The results of the analyses show an effect of language in the conflicting trials ($\beta = 3.96$, $p < 0.001$), but not in the non-conflicting trials ($\beta = 0.23$, $p = 0.57$). To evaluate model fit, we randomized the subset of our data containing the results of the conflicting trials and split it into testing and training sets. We then modeled the data in the training set using the same mixed effects logistic regression equation from our original analysis, and used this model to predict participant judgment in the testing set. The prediction accuracy of our model was 0.84. The AUROC (area under ROC curve) for predicting judgment with the model was 0.93 (see Figure 4), indicative of the expected proportion of true positives ranked before a uniformly drawn random negative. The above analyses indicate that participants' judgments of whether the economy improved or worsened varied in a predictable manner based on their native language. The estimated odds that the judgment of a Spanish speaker aligned with changes in VOLUME image schematic information in the stimuli rather than MOTION image schematic information were 52.46 greater than the corresponding odds for an English speaker.

Congruence & Magnitude We also examined whether image schematic information influenced participants' judgments of the magnitude of economic change. Here, we focused on the nonconflicting trials. Recall that for these trials when-
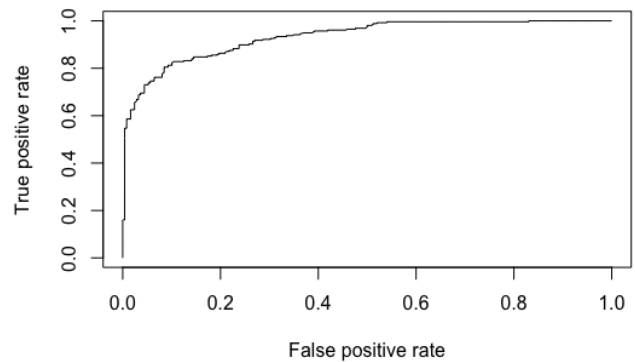
ever the sphere was moving forward, it was expanding; and, whenever it was moving backwards, it was contracting. However, in half of the trials ($n = 1260$), the sphere was either expanding or contracting to a greater degree than it was moving forward or backwards, or *vice versa*. If metaphor–congruent image schemas are affecting speakers' judgments, then we would expect Spanish speakers to increase their estimates of the magnitude of change when expanding or contracting of the sphere is the dominant schema. Similarly, we would expect English speakers' judgments to be greater when forward or backward motion is the dominant schema.

On average, English and Spanish speakers estimated the amount of economic change to be greater when the sphere was expanding/contracting than when it was moving forward/backwards, as shown in Figure 5. To assess whether the differences across language and dominant schema were significant, we analyzed the data using cumulative link (probit) models via the ordinal package in R.[4] We first modeled amount of change with additive predictors of language and dominant schema, with participant and item as random effects. To test for an interaction between these factors, we fit a second model with the interaction as a predictor and used the likelihood ratio test to compare the two models. Our analysis indicated no main effects for language or for the interaction between language and dominant schema. There were marginal effects for VOLUME as the dominant schema both when contracting ($\beta = 0.3122$, $p = 0.009$) and when expanding ($\beta = 0.3150$, $p = 0.009$). These results tell us that a 10% change in contraction of the sphere increases the probability of higher estimates of the amount of change by 31.22% for Spanish and English speakers. A 10% change in expansion of the sphere increases the probability of higher estimates of the amount of change by 31.50%, again for both groups of speakers.
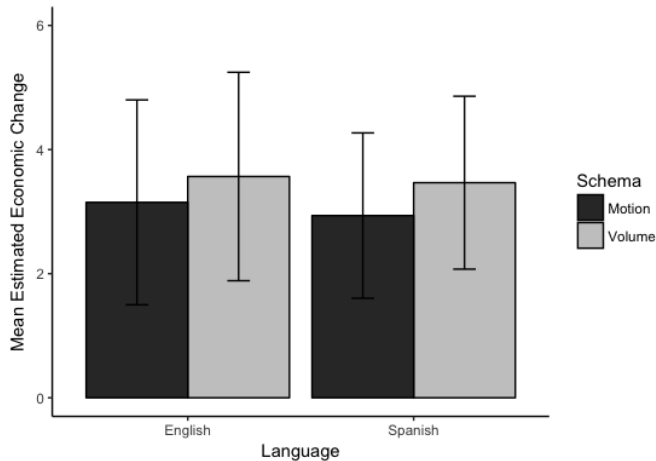
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[4]http://www.cran.r-project.org/package=ordinal/

Figure 5: Mean estimated amount of change per language and stimuli dimension.

Congruence & Confidence With the last metric we collected from participants, that of confidence, we investigated whether one group of speakers found a particular set of stimuli (or the experimental task itself) to be more difficult or confusing than was the case for the other group of speakers. English speakers, for example, may have had more difficulty in assessing the stimuli with contradictory information since English employs MOTION and VOLUME based metaphors in discussions of economic change.

We again analyzed the data using cumulative link (probit) models, here with additive predictors of language and stimuli class, with participant and item as random effects. To test for an interaction between the factors, we fit a second model with the interaction as a predictor and used the likelihood ratio test to compare the two models. We found no significant differences across languages and no significant interaction between language and stimulus condition. English speaking participants and Spanish speaking participants both showed a highly significant increase in confidence for judgments in three of the stimulus conditions: when the sphere was contracting by 20% and moving backward by 20% ($\beta = 0.4907, p < 0.001$), when the sphere was expanding by 20% and moving forward by 20% ($\beta = 0.6553, p < 0.001$), and when the sphere was expanding by 20% and moving forward by 10% ($\beta = 0.4815, p < 0.001$).

Both groups of participants, then, showed greater confidence in their judgments, with a 49.07% increased probability, given a stimulus congruent with a large decline in the economy across both image schemas. Given a stimulus suggesting a large improvement in the economy across image schemas, participant confidence increased with a probability of 65.53%. Given a stimulus congruent with a large improvement in the economy per the VOLUME dimension of the stimuli and a moderate improvement per the MOTION dimension, confidence improved with an increased probability of 48.15%. These results suggest that, for all participants,

confidence in judgment relied on magnitude. In the first two conditions where confidence increased, the sphere was increasing or decreasing to a maximum degree along both dimensions. Hence, it is unclear whether participants were more sensitive to language-specific, metaphor-congruent image schematic information. That participant confidence increased in the third condition noted above suggests that participants overall were more confident when the sphere was moving forward rather than backwards. Since the results were consistent across languages, we found no evidence that any particular combination of schemas were more difficult to parse for one, but not the other, group of speakers.

General Discussion

Metaphors based on movement are regularly used in English and Spanish (amongst other languages) to discuss the economy and economic change. Past research suggests that in discussions of important socio-political topics, such as the economy, metaphorical language can influence people's reasoning. Here, we presented evidence that metaphorical language also affects people's evaluative judgment. Evaluative judgment, which differs from reasoning in that it is not logic-based, is a crucial component of decision-making. The results of our study thus serve to tease apart how these two mechanistically different processes influence decision-making, with our results indicating that metaphorical language affects the evaluative judgment component of decision-making through the image schematic information present in the semantics of the metaphor. These findings corroborate accounts of language and cognition that emphasize the role of language in the development of associative and representational routines. In line with such accounts, the current findings reflect Spanish speakers learning to associate economic change with shifts in VOLUME and habituating focus to volumetric image schematic information. English speakers, who learn to associate economic change with shifts in MOTION, habituate focus to image schematic information involving displacement.

Our findings with respect to congruence and amount of change, and with respect to congruence and confidence, provide further nuance to this view. While judgments of economic improvement or decline aligned more consistently with language-specific, metaphor-congruent dimensions in the stimuli, judgments regarding the amount of change were more consistent with changes in VOLUME for both groups of speakers. A possible explanation for this effect is that visual experience of a change in amount is more strongly correlated with a change in density than with a change in location. Another possible explanation is that English speakers associate direction of change with motion through space but associate amount of change with manner of motion, and changes in the size of the sphere were more suggestive of manner of motion. As noted above, judgments of confidence were consistent with changes across both schemas for both groups of speakers, as long as the changes were consistent across schemas. This indicates that, while participant focus

may have been driven by metaphor-congruent schemas, they were still sensitive to both aspects of the stimuli. This latter finding supports the view that language probabilistically influences other cognitive functions as opposed to those that consider language to have a more discrete effect on other aspects of cognition.

Evaluative judgment is a core component of decision-making, especially in the socio-political domain, and it is highly reliant on the image schematic information shared across percepts and concepts. Such image schematic information is also key to the cognitive function of metaphor. The present work represents a preliminary step in linking evaluative judgment and its reliance on image schematic information to cross-linguistic variation in metaphor use. Future studies along these lines should shed further light on how the image schematic information intrinsic to metaphorical language shapes evaluative judgment in discussions of the economy, as well as discussions of other important socio-political domains.

Acknowledgements

References

Barsalou, L. (2010). Grounded cognition: Past, present, and future. *Topics in Cognitive Science*, *2*, 716–724.

Berger, C., & Calabrese, R. (1975). Some exploration in initial interactions and beyond: toward a developmental theory of interpersonal communication. *Human Communication Research*, *1*, 99–112.

Boers, F., & Demecheleer, M. (1997). A few metaphorical models in (western) economic discourse. In W. Liebert, G. Redeker, & L. Waugh (Eds.), *Discourse and perspective in cognitive linguistics.* Amsterdam/Philadelphia: Benjamins.

Casasanto, D., & Boroditsky, L. (2008). Time in the mind: Using space to think about time. *Cognition*, *106*, 579–593.

Chan, T., & B.Bergen. (2005). Writing direction influences spatial cognition. In *Proceedings of the twenty-seventh annual conference of the cognitive science society* (pp. 510–516). Hillsdale, NJ: Lawrence Erlbaum Associates.

Charteris-Black, J., & Ennis, T. (2001). A comparative study of metaphor in Spanish and English financial reporting. *English for Specific Purposes*, *20*, 249–266.

Fisher, R., & Yates, F. (1963). *Statistical tables for biological, agricultural, and medical research.* Edinburgh: Oliver and Boyd.

Fuertes, J., Gottdiener, W., Martin, H., Gilbert, T., & Giles, H. (2012). A meta-analysis of the effects of speakers accents on interpersonal evaluations. *European Journal of Social Psychology*, *42*, 120–133.

Fuhrman, O., & Boroditsky, L. (2010). Cross-cultural differences in mental representations of time: Evidence from an implicit non-linguistic task. *Cognitive Science*, *34*, 401–450.

Gutiérrez, E., Shutova, E., Lichtenstein, P., de Melo, G., & Gilardi, L. (2016). Detecting cross-cultural differences using a multilingual topic model. *Transactions of the Association for Computational Linguistics*, 71–81.

Keefer, L. A., Landau, M. J., Sullivan, D., & Rothschild, Z. K. (2014). Embodied metaphor and abstract problem solving: Testing a metaphoric fit hypothesis in the health domain. *Journal of Experimental Social Psychology*, *55*, 12–20.

Lakoff, G., & Johnson, M. (1980). *Metaphors we live by.* Chicago, IL: University of Chicago Press.

Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to western thought.* Basic books.

Landau, M. J., Sullivan, D., & Greenberg, J. (2009). Evidence that self-relevant motives and metaphoric framing interact to influence political and social attitudes. *Psychological Science*, *20*(11), 1421–1427.

Langacker, R. (2001). *Concept, image, and symbol.* Berlin, Germany: De Gruyter Mouton.

Norman, G., Norris, C., Gollan, J., Ito, T., Hawkley, L., Larsen, J., ... Berntson, G. (2011). Current emotion research in psychophysiology: he neurobiology of evaluative bivalence. *Emotion Review*, *3*, 349–359.

Nunez, R., & Sweetser, E. (2006). With the future behind them: Convergent evidence from aymara language and gesture in the crosslinguistic comparison of spatial construals of time. *Cognitive Science*, *30*, 401–450.

Talmy, L. (2000). *Toward a cognitive semantics.* Boston, MA: MIT Press.

Thibodeau, P. H. (2016). Extended metaphors are the home runs of persuasion: Don't fumble the phrase. *Metaphor and Symbol*, *31*(2), 53–72.

Thibodeau, P. H., & Boroditsky, L. (2011). Metaphors we think with: The role of metaphor in reasoning. *PloS one*, *6*(2), e16782.

Traugett, E. (1978). On the expression of spatiotemporal relations in language. In J. Greenberg (Ed.), *Universals of human language. vol. 3: word structure.* Stanford, CA: Stanford University Press.

Triandis, H., & Osgood, C. (1958). A comparative factorial analysis of semantic structures in monolingual Greeks and American college students. *Journal of Abnormal and Social Psychology*, *57*, 186–196.

Zwaan, R. (2008). Experiential traces and mental simulations in language comprehension. In M. de Vega, A. Glenberg, & A. Graesser (Eds.), *Symbols and embodiment: Debates on meaning and cognition.* Oxford, UK: Oxford University Press.