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Evolution of word meanings through metaphorical mapping: Systematicity over the past millennium



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ABSTRACT

One way that languages are able to communicate a potentially infinite set of ideas through a finite lexicon is by *compressing* emerging meanings into words, such that over time, individual words come to express multiple, related senses of meaning. We propose that overarching communicative and cognitive pressures have created *systematic directionality* in how new metaphorical senses have developed from existing word senses over the history of English. Given a large set of pairs of semantic domains, we used computational models to test which domains have been more commonly the starting points (source domains) and which the ending points (target domains) of metaphorical mappings over the past millennium. We found that a compact set of variables, including *externality*, *embodiment*, and *valence*, explain directionality in the majority of about 5000 metaphorical mappings recorded over the past 1100 years. These results provide the first large-scale historical evidence that metaphorical mapping is systematic, and driven by measurable communicative and cognitive principles.

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1. Introduction

Every natural language faces the challenge of having to express a potentially infinite range of ideas through a finite set of words (cf. [von Humboldt, 1836](#); [Chomsky, 1957](#); [Pustejovsky, 1995](#)). One way in which languages meet the challenge of maintaining a compact lexicon is by compressing emerging, yet to be lexicalized ideas, into existing word forms. The most common form of compression in the lexicon, both in English and in other languages, is *polysemy*: Cases where a single word has multiple, related senses (e.g., [Breal, 1897](#); [Brugman, 1988](#); [Geeraerts, 1997](#); [Lakoff & Johnson, 1980](#); [Pustejovsky, 1995](#); [Srinivasan & Rabagliati, 2015](#); [Sweetser, 1991](#)). One prominent mechanism that generates polysemy over the course of history is *metaphorical mapping* (e.g., [Lakoff & Johnson, 1980](#)), whereby new word meanings are created by mapping an existing sense of a word from its own *source domain* to another *target domain*, based on structural similarities between the domains. For example, the English word *grasp* originally conveyed a physical action (source), as in “grasp a fruit,” and was later extended to express an abstract sense of understanding (target), as in “grasping an idea,” thus construing ideas as objects that can be held and controlled. In the present study, we test whether there is *systematic directionality* in how new metaphorical senses have developed over the history of English. That is, given a pair of semantic domains, can we predict which

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domain served historically as the source and which as the target of metaphorical mapping, based on considerations of broader communicative and cognitive pressures?

Consistent with the idea that metaphorical sense extension is systematic, prior research (e.g., Lakoff & Johnson, 1980; Sweetser, 1991) has suggested that mappings between semantic domains tend to be *asymmetric*: They occur in one direction but not the other (e.g., for *grasp*, it is “action” → “knowledge” but not “knowledge” → “action”). However, directionality in historical metaphorical mappings has not been evaluated *at scale* against records of historical semantic change, leaving open whether metaphorical mappings truly reflect predictable patterns. Using an historical corpus of the English lexicon, we seek to investigate – at a large scale – the historical directions of metaphorical mapping by testing whether some domains have more commonly served as the starting points of historical extensions (the source domains) while others have more commonly served as the ending points (target domains). For example, in the case of *grasp*, the “physical action” sense first appeared in English around 1300 CE, preceding the abstract sense of “understanding” that emerged around 1600 CE (Kay, Roberts, Samuels, Wotherspoon, & Alexander, 2015a). Our analysis examines systematicity in the directionality of historical metaphorical sense mappings in the English lexicon.

Directions of metaphorical mapping need not be systematic: Instead, the evolutionary path of meaning change could be varied and unpredictable across words. Although some words, like *grasp*, may have begun with a relatively concrete sense that was subsequently extended to a more abstract sense, other words may have been extended in the opposite direction, from abstract to concrete senses. For instance, *irritable* initially conveyed an abstract sense of “anger,” as in an “irritable person” (1662 CE; Kay et al., 2015a), but it was subsequently used to convey a more concrete, physical meaning, as in “irritable skin” (1791 CE; Kay et al., 2015a). A particular word’s path could be shaped by the ever-changing cultural conditions and resultant communicative needs that have caused words to develop new meanings across history (cf. Aitchison, 2001). The contributing factors may be variable across words and across eras of history, resulting in little systematicity on a large scale.

However, an alternative possibility is that the direction of metaphorical sense extension is systematic, because it is shaped by enduring functional pressures on language evolution. Recent work in computational cognitive science has suggested that many aspects of language and cross-linguistic variation can be understood in terms of general design principles, such as the need for linguistic structures to minimize cognitive effort and support informative communication and language learning (Zipf, 1949; see also Kemp & Regier, 2012; Kirby, Tamariz, Cornish, & Smith, 2015; Piantadosi, Tily, & Gibson, 2011; Regier, Kemp, & Kay, 2015). Applying this perspective to polysemy, systematic directionality in mappings may result from language users minimizing the costs associated with communicating novel ideas and learning a lexicon: Mappings will tend to be driven by their ease of construction, their effectiveness as communication devices, and/or their learnability by children. The mappings should thus provide a cognitively economic and hence *efficient device* for compressing new ideas into an existing lexicon. If there is a consistent set of cognitive principles and processes underlying ease of construction, effectiveness for communication, and/or learnability, recurring patterns of mappings should arise across domains and time.

But this perspective says little about what the underlying *constraints* on the directionality of metaphorical mappings might be. An independent line of research, from cognitive psychology and linguistics, provides suggestions about the specifics: Namely, that the processes that give rise to metaphorical polysemy may reflect conceptual structure (Lakoff, 1987; Sweetser, 1991). One prominent proposal in this vein is *Conceptual Metaphor Theory* (CMT; Lakoff & Johnson, 1980; Reddy, 1979), which posits that people reason about abstract concepts – such as “understanding” – via metaphorical mappings from knowledge domains that are more concrete and tied to bodily experience – such as “physical action.” Although CMT is controversial as a theory of cognition, other theories also predict that concrete and embodied word senses will be extended to more abstract senses because this type of extension may be the most useful for communication and learning (Murphy, 1997; Srinivasan & Carey, 2010; Thibodeau & Durgin, 2008). For example, it could be easier to communicate about something abstract – for which achieving shared reference is difficult – by analogically referring to a more concrete meaning, for which shared reference is easier, and this advantage may apply in word learning as well as discourse processing. Further, because concrete and embodied meanings tend to be frequent (Hanley, Hunt, Steed, & Jackman, 2013; cf. Winter, Thompson, & Urban, 2014), they may be more readily retrieved as sources for meaning extension by speakers who need to communicate a new idea.

Prior research has not explicitly linked the perspective of efficient language design with the study of the cognitive foundations of polysemy or metaphorical mapping. We bridge this gap by analyzing directionality in a large set of metaphorical mappings between source and target domains spanning 1100 years, dating from Old English to the present. To our knowledge, this is the first large-scale study to evaluate the systematicity of the directionality in polysemous metaphorical mappings against the record of historical change in a lexicon. We expect that if metaphorical mapping provides an efficient cognitive device for compressing ideas into a communicative and learnable lexicon, the historical directions of change through which new senses are created for words should be highly systematic, and they should be explained by a compact set of variables relevant to the cognitive processes involved in generating, learning, and using word meanings.

2. Methods

We identified six candidate variables from the literature that could explain directions of metaphorical mapping based on communicative and cognitive considerations. We used human participants’ ratings of these variables to try to predict directions in metaphorical domain mappings recorded in the history of English. In the following, we describe: (1) each of the

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