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### **Authors**

Hendricks, Rose K.

Bergen, Benjamin K.

Marghetis, Tyler

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# When metaphors in the mind become metaphors in the mouth: Documenting the emergence of a new system of linguistic metaphors for time

Rose K. Hendricks (rhendricks@ucsd.edu)

Benjamin K. Bergen (bkbergen@ucsd.edu)

Cognitive Science, UC San Diego, La Jolla, CA 92093 USA

Tyler Marghetis (tmarghet@indiana.com)

Psychological and Brain Sciences, Indiana University, Bloomington

## Abstract

Languages exhibit striking semantic diversity, but different languages often share core metaphors. Conceptual Metaphor Theory (Lakoff & Johnson, 1980) claims that universal human experiences give rise to conceptual representations that are then expressed in language. But languages change slowly, making it difficult to observe implicit conceptualization affecting linguistic convention in real time. Here, we describe a shared conceptualization previously absent from speech that has now become conventionalized in linguistic metaphors. In two studies, we document how members of the US military talk about time using conventionalized *lateral* metaphors (e.g., ‘*push the meeting right*’ to mean ‘*move the meeting later*’). We show that military members, unlike civilians, consider such sentences to be acceptable—sometimes even more acceptable than more standard phrases. Moreover, military personnel seem unaware that these lateral metaphors are specific to their linguistic sub-community. Our findings suggest that implicit mental representations can become conventionalized metaphors in language.

**Keywords:** time; metaphor; linguistic convention; semantic change

## Introduction

Every language uses metaphor (Kövecses, 2005), and many of these metaphors appear universal or nearly universal. Core metaphors like AFFECTION is WARMTH occur in many languages, while the reverse, AFFECTION is COLD, does not (Kövecses, 2010). Why? The leading explanation is that these cross-linguistic regularities reflect universal, or nearly universal, human experiences (e.g., Clark, 1973; Lakoff & Johnson, 1980). For instance, since being held by a caregiver is likely a nexus of warmth and affection, human infants learn to associate these experiences. On this account, recurring correlations in experience lead to mental representations that relate the two domains. And these representations, in turn, spill out into language, so that the

same experiences come to be described similarly across the world’s languages.

However, this is not the only way in which mental representations and linguistic metaphors could have come into alignment. For instance, the causal direction may have been reversed: widespread, recurring patterns of thought may have arisen from exposure to linguistic metaphors, rather than the other way around (see Gibbs, 2011 for review). Indeed, there’s substantial evidence that, at least in the short term, exposure to linguistic metaphors primes conceptualization (e.g., Thibodeau & Boroditsky, 2011).

In fact, there is a surprising dearth of evidence that shared mental representations can give rise to novel linguistic conventions. While the historical record is replete with changes in linguistic semantics that appear, in retrospect, to be driven by conceptualization (Sweetser, 1991), we cannot assess the conceptual representations of historical people in a lab. If implicit patterns of thought give rise to linguistic conventions, we should be able to observe the emergence of new linguistic metaphors in real time. But the pervasiveness of core, cross-linguistic metaphors means that it’s rare to find people who lack either the linguistic or conceptual manifestation of an otherwise universal metaphor.

To determine whether metaphor spreads from thought to language, we need to observe a linguistic community beginning to use metaphorical language that aligns with their prior conceptual representations. This would shed light on why so many languages share linguistic and conceptual metaphors. We believe we have found one such case.

## The coupling of language and thought about time

Of all the concepts that we understand metaphorically, the best studied is *time*. Within a given culture or community, individuals think and talk about time in ways that are both stable and shared. This often involves using space to structure their speech and understanding of time (for reviews, see Boroditsky, 2011; Núñez & Cooperrider, 2013).

Specifically, English speakers think and speak about time as though it were represented along the sagittal (front-back)

axis. The future is ‘ahead’ and the past is ‘behind,’ and these manners of speaking align with physical behavior. When English speakers make decisions about events, they are faster to respond to future events by moving forward, and faster to respond to past events by moving backward (Sell & Kaschak, 2011; Ulrich et al., 2012; Rinaldi et al., 2016). They are faster to make time judgments when future-related words are shown in front of an image of a person and past words behind (Torralbo et al., 2006). When imagining the future, people lean forward, and when thinking about the past, they lean back (Miles et al., 2010). And they gesture forward when talking about the future, but backwards when talking about the past (Casasanto & Jasmin, 2012).

This use of the sagittal axis has been documented in many languages around the world (Núñez & Cooperrider, 2013). Most follow the same pattern as English, but not all: In Aymara, past events are in front and future events behind, in both language and gesture (Núñez & Sweetser, 2006).

Similarly, Mandarin Chinese uses vertical (up/down) terms systematically and productively to talk about time. Earlier events are *up* and later events are *down*. Native Mandarin speakers also *think* about time vertically, with earlier events above later ones (Boroditsky et al., 2010; Fuhrman et al., 2011; Miles et al., 2011; Yang & Sun, 2015).

Thus, there is often a tight coupling of the spatial *language* used to talk about time and spatial *thought* used to conceptualize time. There is empirical evidence that this alignment can originate in linguistic metaphors (Hendricks & Boroditsky, 2015). After English-speaking participants learned metaphors that placed earlier events either above or below later ones (i.e., *breakfast is above dinner* or *breakfast is below dinner*; Hendricks & Boroditsky, 2015), they then exhibited metaphor-consistent responses on an implicit measure of their mental space-time associations. Language can be a formative force for mental representations.

Despite overlaps between temporal language and temporal thought, there is not a one-to-one correspondence between the two. In addition to their sagittal (front-back) mental time-line, English speakers also map time to the lateral (left-right) axis. For instance, when asked to arrange physical depictions of sequences of events, they arrange them from left to right (Tversky, Kugelmass & Winter, 1991; Boroditsky & Gaby, 2010). During natural speech, they gesture to the left for earlier events and to the right for later ones (Cooperrider & Núñez, 2009; Casasanto & Jasmin, 2012). And English speakers are faster to indicate that one event occurred earlier than another by responding on their left side, and faster for later events when responding on their right (Fuhrman & Boroditsky, 2010; Miles et al., 2011; Weger & Pratt, 2008; Walker et al., 2014).

However, these left-right mental timelines are absent from language. English speakers can look ‘back’ on the past, but never ‘to the left.’ There is a linguistic gap, therefore, where a widespread *conceptual* metaphor has not surfaced as a *linguistic* metaphor. If a cognitive representation were to leap to a linguistic representation, it would most likely first take hold in a sub-community of English speakers who use left-right linguistic metaphors to talk about time.

### Case Study: The US Military

Anecdotal evidence from members of the authors’ own families suggests that one community of English speakers has started to use left-right metaphors when talking about time: members of the United States military. According to anecdote, one might propose to move a meeting to a later time by asking to ‘move the meeting *to the right*.’ If these reports were true, then this group would provide an opportunity to study a system of conceptual metaphors as it takes linguistic hold in a language community. Here, in two empirical studies, we sought to document this apparent linguistic innovation. In particular, we aimed to understand whether left-right linguistic metaphors are more acceptable to members of the military than to civilians, as well as the linguistic conventions association with these metaphors.

In Study 1, military and civilian participants rated the acceptability of sentences about time. The sentences were presented in four main conditions: Standard (*The meeting was moved two days earlier, from Friday to Wednesday*), Dynamic-Lateral (*The meeting was moved two days to the left from Friday to Wednesday*), Static-Lateral (*The meeting on Wednesday is two days to the left of the meeting on Friday*), and Ungrammatical (*From the meeting was two earlier days, Friday to Wednesday pushed*). We included lateral metaphors in two conditions (Dynamic and Static) because anecdotal evidence suggested that Dynamic uses may be more acceptable than Static.

Study 2 replicated the findings from Study 1 in a new sample of military and civilian participants. In addition, we investigated whether military personnel are aware that these metaphors are specific to their linguistic subcommunity. Together, these studies create a snapshot of the early stages of a shift from an exclusively *cognitive* representation to a novel linguistic convention.

## Study 1

In Study 1, participants rated the acceptability of sentences. Features of the sentences allowed us to measure whether, when, and to whom lateral (left-right) linguistic metaphors are acceptable.

## Methods

**Participants:** Active Duty members of the US military ( $n = 23$ ) participated for \$10, and civilian undergraduates at UC San Diego ( $n = 31$ ) participated for course credit. The military participants included 4 Army, 1 Navy, and 18 Air Force. They included 8 Officers and 15 Enlisted members.

**Materials:** There were four types of sentences: a) Standard: using *earlier* or *later* to reschedule; b) Dynamic-Lateral: using *left* and *right* to reschedule; c) Static-Lateral: using *left* and *right*, but no rescheduling; d) Ungrammatical.

An equal number of sentences referred to events that were a) earlier and later; b) on the timescale of hours, days, and months; and c) required crossing a temporal boundary (events take place in different days, weeks, or years; i.e., Friday to Monday) and were within a temporal boundary (i.e., Tuesday to Friday). These additional features allowed us to examine whether conventionality differed in these various contexts.

**Procedure:** The study was completed on a computer. Participants were instructed to imagine a new colleague whose native language was not English and rate the acceptability of sentences ( $n = 48$ ) uttered by this colleague, based on how participants would normally talk at work. Acceptability ratings used a 7 point Likert scale (1=totally unacceptable, 7=totally acceptable). Each sentence was presented on its own page. Participants then supplied standard demographic information (education, age), and military participants reported their service branch (Army, Navy, etc.), rank, and years of service. No other measures were collected.

**Exclusions and Analyses:** We subtracted each person's mean Ungrammatical rating from their mean Standard rating. Three participants (1 military, 2 civilians) did not rate Standard sentences at least one point higher than Ungrammatical ones, and were eliminated. Ratings were standardized by participant (i.e., z-scored), and then analyzed in a linear mixed-effects model. All hierarchical models used the maximal converging random effects structure justified by the experimental design (Barr et al, 2013), with random intercepts and slopes for both participants and items.

## Results

Figure 1 shows military personnel and civilians' acceptability ratings for the four sentence types. We first verified that participants from both populations rated the Standard phrases as most acceptable and the Ungrammatical phrases the least acceptable, with the Lateral phrases in between. Ratings were analyzed with a mixed-effects model with a fixed effect of Sentence Type (Standard > Dynamic-Lateral > Static-Lateral > Ungrammatical); we

used forward difference coding to test for pairwise differences between consecutive levels. Ratings did not differ by timescale (i.e., hours, days, and months;  $p = .80$ ), so we collapsed timescales for all subsequent analyses. Standard items were rated as more acceptable than Dynamic-Lateral phrases ( $b = 0.75 \pm 0.14$  SEM,  $t = 5.5$ ,  $p < .001$ ), which were more acceptable than Static-Lateral phrases ( $b = 0.44 \pm 0.10$  SEM,  $t = 4.6$ ,  $p < .001$ ), which in turn were more acceptable than Ungrammatical phrases ( $b = 0.71 \pm 0.13$  SEM,  $t = 5.3$ ,  $p < .001$ ).

We next tested our critical prediction: That these patterns of acceptability would differ systematically by population. We thus added a fixed effect of population (civilian = 1, enlisted = 2, officer = 3; centered so the mean was 0). Standard phrases were used as a baseline. Once again, every type of sentence (Dynamic-Lateral, Static, Ungrammatical) was less acceptable than Standard (all  $b$ s  $< -0.75$ ,  $p < .001$ ). As predicted, there was no evidence that military and civilian participants differed in their ratings of Standard phrases ( $b = -0.07 \pm 0.08$  SEM,  $t = -0.8$ ,  $p = .4$ ), nor was there evidence that the relative unacceptability of Ungrammatical phrases differed by population ( $b = -0.14 \pm 0.12$  SEM,  $t = -1.3$ ,  $p = .2$ ). Similarly, military and civilian participants did not differ in the acceptability of Static-Lateral phrases, compared to Standard phrases ( $b = -0.14 \pm 0.12$  SEM,  $t = -1.3$ ,  $p = .2$ ).

Acceptance of Dynamic-Lateral phrases, however, differed across populations ( $b = 0.32 \pm 0.14$  SEM,  $t = 2.3$ ,  $p = .027$ ). To make sense of this effect, we zoomed in on Dynamic-Lateral items and used forward-difference coding to compare the three populations. Civilians gave the lowest rating to the Dynamic-Lateral items ( $M = 0.0$ ), while enlisted military participants rated these items as more acceptable ( $M = 0.17$ ,  $b = -0.22$ ,  $p = .07$ ), and military officers rated these items as even more acceptable than enlisted military personnel ( $M = 0.51$ ,  $b = -0.43$ ,  $p < .001$ ).

## Discussion

Study 1 confirmed that a specific subset of lateral metaphors has become conventionalized among a subculture of American English speakers: members of the US Military. If this reflected a more general conceptual difference—perhaps a willingness among military personnel to think about time along a left-to-right timeline—then this should have been reflected in increased acceptability for all lateral expressions. Instead, military personnel were especially accepting of lateral metaphors that used the *dynamic language of movement*, suggesting that this is a genuine linguistic convention, subject to the quirks and idiosyncrasies of cultural norms.

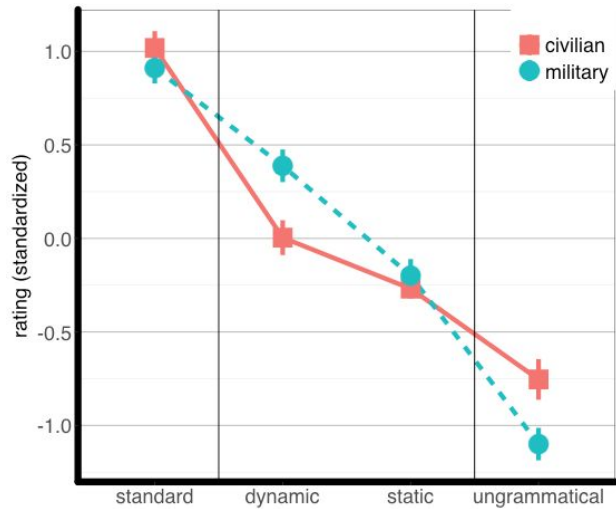


Figure 1. In Study 1, compared to civilians, military personnel were more accepting of Dynamic-Lateral phrases (e.g., ‘meeting was moved to the left’). There was no difference in civilians’ and military members’ acceptance of Static-Lateral phrases. Error bars = SEM.

## Study 2

Study 2 was designed to replicate and further explore this linguistic conventionalization. In addition, we sought to determine whether military personnel are aware that lateral metaphors are specific to the dialect of English spoken in the military, and not shared with the larger civilian population. Anecdotal evidence suggested that military personnel might be unaware that this system of linguistic metaphors is not shared widely among English speakers.

### Methods

**Participants:** Members of the US military ( $n = 14$ ) participated for \$10. Civilian undergraduates ( $n = 27$ ) participated for course credit. Military participants included 3 Army, 1 Navy, and 10 Air Force; 5 were Officers, 5 were Enlisted, and 4 did not identify their rank.

**Materials:** Materials were identical to Study 1 with two differences. First, based on anecdotal evidence that lateral metaphors were commonly used with the verb *push*, we included items with *push* (e.g., *pushed two months*). Second, to reduce the total number of items, we did not vary the timescale, since it had no effect on acceptability in Study 1.

**Procedure:** Participants completed two randomly-ordered tasks: the Acceptability Rating task from Study 1, and a forced choice Sentence Completion task.

The Acceptability Rating task was based on Study 1, with one critical difference: participants completed two randomly-ordered blocks of acceptability ratings, one in which they were asked to imagine all their colleagues were

in the military, and another in which they imagined all of their colleagues were civilians. Manipulating the utterances’ context in this way allowed us to test whether military participants were sensitive to the community-specificity of the lateral-dynamic metaphors.

In the Sentence Completion task, participants read the same sentences as in the Acceptability Rating task, but with a blank in place of month (e.g., *The meeting was moved two months to the right, from November to \_\_\_\_*.) Choices included all odd-numbered months (January, March, etc.) and *I don’t know*. Because of space limitations, we must analyze these data elsewhere.

To refresh participants between these tasks, they completed a brief ‘spot the differences’ game, in which they had 45 seconds to count as many small differences as possible between two nearly identical images.

**Exclusions and Analyses** were unchanged from Study 1. No participants were excluded.

### Results

As in Study 1, we first verified that participants from both populations rated the Standard phrases as most acceptable and the Ungrammatical phrases the least acceptable, with the Lateral phrases in between. Once again, Standard items were rated as more acceptable than Dynamic-Lateral phrases ( $M = 0.91$  vs.  $M = 0.21$ ;  $b = 0.73 \pm 0.14$  SEM,  $t = 5.4$ ,  $p < .001$ ), which were more acceptable than Static-Lateral phrases ( $M = -0.10$ ;  $b = 0.31 \pm 0.07$  SEM,  $t = 4.3$ ,  $p < .001$ ), which in turn were more acceptable than Ungrammatical phrases ( $M = -1.03$ ;  $b = 0.83 \pm 0.16$  SEM,  $t = 5.3$ ,  $p < .001$ ).

We next attempted to replicate our main finding from Study 1: That military participants had a selective preference for lateral metaphors, compared to civilians. First, we replicated the finding that, overall, every type of sentence (Dynamic-Lateral, Static-Lateral, Ungrammatical) was rated as less acceptable than the Standard phrases (all  $b$ s  $< -0.69$ ,  $p$ s  $< .001$ ). Next, we replicated our critical finding that the populations differed in their preference for Dynamic-Lateral phrases ( $b = 0.57 \pm 0.05$  SEM,  $t = 10.6$ ,  $p < .001$ ). While civilians thought the Dynamic-Lateral phrases were far worse than the standard ones ( $b = -0.96 \pm 0.05$  SEM,  $t = -20.2$ ,  $p < .001$ ), for enlisted military personnel the difference was more than half of what it was for civilians ( $b = -0.47 \pm 0.08$  SEM,  $t = -5.9$ ,  $p < .001$ ), while for military officers the Dynamic-Lateral phrases were actually considered to be significantly *better* than the Standard ones ( $b = 0.18 \pm 0.06$  SEM,  $t = -3.0$ ,  $p < .01$ ).

There was no evidence that the populations differed in their judgements of Ungrammatical phrases ( $p > .7$ ). However, unlike in Study 1, the populations *did* differ in

their acceptance of Static-Lateral phrases ( $b = -0.43 \pm 0.05$  SEM,  $t = -8.1$ ,  $p < .001$ ). As with the Dynamic-Lateral phrases, civilians were the most dismissive ( $M = -0.28$ ), followed by enlisted personnel ( $M = 0.15$ ), and finally officers ( $M = 0.43$ ) — although note that, here, officers did not prefer Static-Lateral phrases to the Standard phrases.

Finally, we investigated whether an utterance's *context* — whether it was uttered in a military or civilian context — had a significant effect on its acceptability (Figure 2). This full model replicated the findings reported above. There were only two other significant effects. The first was an interaction between context and population ( $b = 0.18 \pm 0.06$  SEM,  $t = 2.9$ ,  $p < .001$ ), driven by an 'opposite context' effect: military participants thought phrases were generally less acceptable in a civilian context, and vice versa. This may be due to participant uncertainty about norms in unfamiliar environments. The second was a three-way interaction between population, context, and Static-Lateral (vs. Standard) phrases ( $b = -0.20 \pm 0.09$  SEM,  $t = 2.3$ ,  $p = .02$ ). This was driven by the fact that officers did not exhibit the 'opposite context' effect for Static-Lateral phrases — they liked them equally in both contexts. Thus, even in a hypothetical civilian context, military participants thought the lateral phrases were significantly more acceptable than actual civilians did.

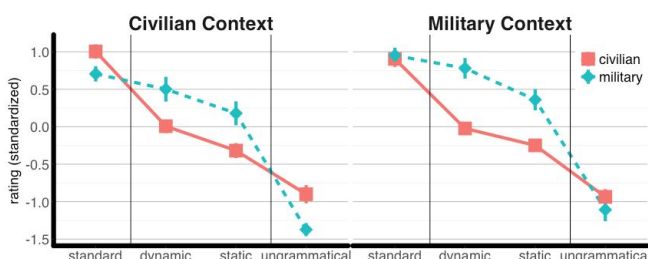


Figure 2. In Study 2, military personnel were again more accepting of lateral phrases, this time for both static and dynamic versions. This pattern was repeated both when the phrases were uttered in a civilian context (left panel) or a military context (right panel). In other words, military participants thought that rescheduling a meeting 'to the right' is acceptable among civilians. Error bars = SEM.

## Discussion

Conventionalized linguistic structures and cultural patterns of thought are often consistent (e.g., Boroditsky et al., 2010; Fuhrman et al., 2011; Winter, Marghetis, and Matlock, 2015), and prior work has provided evidence that learning new metaphors for talking about time can create new mental representations (Hendricks & Boroditsky, 2015). However, there is little direct evidence of the purportedly more pervasive, reverse relationship: cultural

patterns of thought creating new conventionalized linguistic structures. In two studies, we provided evidence that one subset of American English speakers—members of the US military—have adopted a conventionalized system of metaphors for expressing mental representations that are pervasive in the minds of English speakers in general, but otherwise absent from language. Specifically, we found that members of the US military, especially Officers, consider sentences containing left-right metaphors (and only these types of sentences) as more acceptable than civilians do.

We also explored the nuances of the left-right metaphors based on military members' acceptability ratings for sentences with different features. In general, military personnel judged Dynamic-Lateral sentences — which express an event *moving* from one time to another — to be more acceptable than similar Static-Lateral sentences that express the same relationship without movement. This nuance in military members' acceptance of left-right metaphors is evidence that these new left-right linguistic conventions do not merely reflect a broad association of time with the lateral axis, but instead reflect specific linguistic conventions.

By showing that at least one subculture of American English speakers has conventionalized left-right linguistic metaphors for time, we demonstrate that the relationship between conventionalized structures in language and patterns in thought is bidirectional: not only can language shape mental representations, but our mental representations can also make their way into conventionalized language.

Why have military members adopted lateral metaphors that are absent from civilians' language? One hint may lie in the artifacts they use. Duty Rosters are documents that keep track of the work assignments for each each member of a military unit. Duty Rosters are standardized and governed by instruction manuals (Army Regulation [AR] 220-45). Each row represents an individual. Each column represents a successive date, ordered from left to right. Each cell thus indicates the task that was assigned to that individual (row) on that day (column). Unlike a standard American calendar, in which each row only has 7 days across, Duty Rosters arrange days in a continuous line extending rightward, potentially endlessly. One duty roster, for instance, had hundreds of columns, each representing a successive day.

The current work cannot distinguish between two explanations for how this linguistic innovation has spread. On the one hand, new linguistic conventions could have emerged spontaneously through the interaction with frequently consulted artifacts like Duty Rosters in a relatively linguistically encapsulated community. On a complementary account, these conventions may be the product of top-down, institutional decrees, where linguistic decision-makers within a community—affected no doubt by

the same convergence of conceptualization and material artifacts—themselves influenced linguistic habits through prescriptions for ways to talk about time. Future work will continue to document the history and use of these left-right linguistic conventions to distinguish between these two accounts. Similarly important to explore are the cognitive consequences of adopting lateral metaphors for time. Can adopting lateral linguistic metaphors facilitate reasoning about temporal change? Does it reduce miscommunication (e.g., allowing speakers to avoid ambiguous descriptions like *Wednesday's meeting was moved forward two days*)? Or might it increase other kinds of miscommunication, for example when English speakers communicate with Hebrew and Arabic speakers, whose mental timelines run right to left, counter to English speakers' (Tversky et al., 1991)? In sum, this work reveals a potentially fertile new way to study the give and take between individual conceptual metaphors and community-wide, conventionalized linguistic structure.

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