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Do Metaphors Move From Mind to Mouth? Evidence From a New System of Linguistic Metaphors for Time

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Abstract

Languages around the world use a recurring strategy to discuss abstract concepts: describe them metaphorically, borrowing language from more concrete domains. We "plan *ahead*" to the future, "count *up*" to higher numbers, and "*warm*" to new friends. Past work has found that these ways of *talking* have implications for how we *think*, so that shared systems of linguistic metaphors can produce shared conceptualizations. On the other hand, these systematic linguistic metaphors might not just be the cause but also the *effect* of shared, non-linguistic ways of thinking. Here, we present a case study of a variety of American English in which a shared, non-linguistic conceptualization of time has become crystallized as a new system of *linguistic* metaphors. Speakers of various languages, including English, conceptualize time as a lateral timeline, with the past *leftward* and the future *rightward*. Until now, this conceptualization has not been documented in the speech of any language. In two studies, we document how members of the U.S. military, but not U.S. civilians, talk about time using conventionalized *lateral* metaphors (e.g., "move the meeting *right*" to mean "move the meeting *later*"). We argue that, under the right cultural circumstances, implicit mental representations become conventionalized metaphors in language.

Keywords: Time; Metaphor; Linguistic convention; Semantic change

1. Introduction

In English, we "plan *ahead*" to the future, "count *down*" to lower numbers, "*warm*" to new friends. These phrases exemplify a strategy that recurs in languages around the world: Abstract concepts are described metaphorically using words and phrases whose meanings, originally and primarily, are more concrete (Kövecses, 2005; Lakoff & Johnson, 1980).

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These metaphorical expressions are frequently more than one-off turns-of-phrase. We don't just "plan *ahead,*" but we can also "look *back*" on the past, "*approach*" a deadline, and experience time "*flying by*." In these and countless other expressions, the domain of Space is used systematically to discuss the domain of Time, with specific, recurring associations—for instance, between *length* and *duration* ("a long day") or *front/back location* and *past/future* ("look *ahead* to the future"). These metaphorical expressions for Time, therefore, form a cohesive system—and systems of metaphorical expressions exist for other domains, too. Here, we investigate the historical origin of systematic, conventional metaphors in language. *Where* do these metaphor systems come from?

One influential approach says that these systematic expressions are often the *linguistic* manifestation of preexisting systems in *thought*. On this "thought-first" account, linguistic communities begin by conceptualizing some abstract domain by mapping it to another, often more concrete, domain. Perhaps, they conceptualize *time* as *sagittal space*; or *affection* as *physical warmth*; or *power* as *vertical location*. These shared, implicit conceptualizations might themselves have various origins, ranging from innate biases (e.g., Casasanto, 2010; Casasanto, Fotakopoulou, & Boroditsky, 2010; Lourenco & Longo, 2010; Srinivasan & Carey, 2010), to the morphology and kinematics of our bodies (e.g., Jostmann, Lakens, & Schubert, 2009), to recurring experiences (e.g., Casasanto, 2014; Lakoff & Johnson, 1999). Regardless of their origin, the critical premise of this "thought-first" approach is that metaphorical mappings between two domains can begin in the *mind* and later become conventionalized in *language*. Said otherwise, *linguistic* metaphors are often historical byproducts of shared, implicit, nonlinguistic "*conceptual* metaphors" (Dudschig, de la Vega, & Kaup, 2015; Gibbs, 1994; Lakoff & Johnson, 1980; Sweetser, 1991). Versions of this general account have been put forward in various disciplines, including cognitive psychology (Gentner, Bowdle, Wolff, & Boronat, 2001), historical semantics (Lakoff & Johnson, 1980; Traugott, 1975), and developmental psychology (Clark, 1973).

Some of the best evidence for the "thought-first" account is that systems of linguistic metaphor typically have analogs in non-linguistic thought. For example, in English, importance is described in terms of heaviness (e.g., "weighty topics," "heavy conversations," "dense papers"). But people also *think* about importance in terms of heaviness. In one experiment, participants who held heavier (vs. lighter) objects subsequently gave higher ratings of job candidates (Ackerman, Nocera, & Bargh, 2010), monetary value (Jostmann et al., 2009), and the seriousness of diseases (Kaspar, 2013)—as if the experience of physical heaviness primed, implicitly, the more abstract concept of importance. Similarly, English speakers talk about the past and future as if they are *back* and *ahead*, and they also think in that way: They lean forward when thinking about the future (Miles, Nind, & Macrae, 2010), gesture forward spontaneously when talking about the future (Casasanto & Jasmin, 2012), and are faster to move forward in response to future-related stimuli (Rinaldi, Locati, Parolin, Bernardi, & Girelli, 2016; Sell & Kaschak, 2011; Torralbo, Santiago, & Lupiáñez, 2006; Ulrich et al., 2012). Thus, systems of linguistic metaphors are typically accompanied by analogous systems of thought, exactly as we would predict if *linguistic* metaphors can be the product of preexisting *conceptual* metaphors.

At the same time, there are good reasons to suspect that in some cases, systematic linguistic metaphors might be the *cause*, rather than the effect, of non-linguistic conceptual metaphors. Indeed, habitually using new, systematic metaphorical expressions is known to create new habits of metaphorical thought. For example, Dutch participants were taught to talk about musical pitch using new spatial metaphors (e.g., "*thick* pitch" for "*low* pitch," "*thin* pitch" for "*high* pitch"). Afterward, the task-irrelevant thickness of visual stimuli had a systematic effect on their pitch perception, suggesting that learning to talk about pitch in terms of physical thickness caused them to *think* about pitch as if it were physical thickness (Dolscheid, Shayan, Majid, & Casasanto, 2013). Similarly, after English speakers were taught to talk about temporal sequences as if they were arrayed vertically (e.g., "I brushed my teeth *above [/after]* I ate breakfast"), they began to think about temporal sequences along the vertical axis (Hendricks & Boroditsky, 2017). Learning a new system of *linguistic* metaphors, therefore, can create new *conceptual* metaphors in the speaker's mind.

This causal impact of language on thought suggests a different interpretation of the widespread co-occurrence of metaphorical language and metaphorical thought. Some of the overlap may reflect metaphorical systems that actually originated in *language*—perhaps as idiosyncratic rhetorical flourishes, perhaps as creative responses to communicative demands, perhaps due to fortuitous speech errors that conflate domains that are coupled systematically (e.g., differences in power are often accompanied by differences in height). Once such expressions become conventionalized within a language community, people may use the relations implied by the language to structure their mental representations. In these cases, shared conceptual metaphors, therefore, might be the *effect*, not the cause, of conventional linguistic metaphors—in short, a "language-first" account of the co-occurrence of community-wide metaphorical language and thought. This possibility is consistent with extensive work on linguistic relativity, supporting the notion that features of natural languages can systematically shape the way speakers think (for review, see Wolff & Holmes, 2010).

Indeed, there is a surprising dearth of direct evidence for the "thought-first" account of the origins of systematic metaphorical expressions. The historical record, for instance, is replete with semantic changes that appear, in retrospect, to have been driven by a shared, implicit conceptualization (Sweetser, 1991; Traugott, 1975). Lexical items that are originally reserved to describe perceptual experience ("rough surface") are gradually extended to more abstract senses ("rough experience") in ways that suggest an underlying metaphorical conceptualization (e.g., Sweetser, 1991; Xu, Malt, & Srinivasan, 2017). But this diachronic evidence cannot provide evidence for the "thought-first" account, since it is impossible to measure directly the implicit conceptual representations of historical language communities. A more direct demonstration of the "thought-first" account would involve synchronic evidence of the emergence of a novel system of metaphorical expressions, within a language community that is known to already conceptualize the domain in the same way. Unfortunately, the pervasiveness of metaphors that are both linguistic and conceptual makes it difficult to capture, in real time, the emergence of a *new* system of metaphors. For instance, while there is substantial evidence that communities *think*

metaphorically about time (as space) and affection (as warmth), these communities already speak using corresponding linguistic metaphors, too.

Thus, we set out to find an instance that filled in this evidential gap—a case study in the historical relation between metaphorical thought and language. We sought an instance where members of a linguistic community were known to think about a domain metaphorically, but where that metaphorical construal was only now becoming crystallized in speech. This would serve as a proof-of-concept of the "thought-first" account—that a metaphorical construal in *thought* can emerge eventually as a new system of metaphorical expressions in *language*. By buttressing the "thought-first" account, such a case study would have implications for theorizing about the historical emergence and contemporary distribution of linguistic metaphors. For instance, it would help explain the ubiquitous co-occurrence of metaphorical systems in language and thought. And it would support an account of the cross-linguistic pervasiveness of certain metaphors: If recurring experiences or innate biases produce cross-culturally shared ways of *thinking* metaphorically, then these should also result in cross-culturally shared ways of *talking* metaphorically (Clark, 1973; Gibbs, 1994; Lakoff & Johnson, 1980).

Here, we describe just such a case study: an instance of an established *conceptual* metaphor that preceded the emergence of a conventionalized system of *linguistic* metaphors. Speakers of American English are known to *conceptualize* time as a left-to-right path (a "mental timeline"; e.g., Tversky, Kugelmass, & Winter, 1991) but never *speak* about time using the language of lateral space (e.g., "can we move the deadline to the left [/right]?"). Here, we document a subcommunity that has conventionalized the use of a system of lateral metaphors for time: members of the U.S. military.

Below, we begin by reviewing what is currently known about spatial metaphors for time in both language and thought. We then give some context for our case study of the U.S. military, before turning to our empirical studies of their system of lateral (left/right) metaphors for time.

1.1. The coupling of language and thought about 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 both temporal speech and temporal understanding (for reviews, see Boroditsky, 2011; Núñez & Cooperrider, 2013; Winter, Marghetis, & Matlock, 2015).

English speakers, in particular, speak about time as though it were represented along the sagittal (front-back) axis. The future is "ahead." The past is "behind." You can look "forward" to an event in the future, and think "back" to the past. This system of metaphorical expressions is both conventionalized and highly productive, so that novel, unusual sagittal metaphors are readily understood by native speakers (e.g., "Don't just look ahead, passively, toward your future—get on a motorcycle and race toward your goals!").

The way English speakers *talk* about time, moreover, aligns with how they *think* about time. When they 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 (Rinaldi

et al., 2016; Sell & Kaschak, 2011; Ulrich et al., 2012). 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 backward when talking about the past (Casasanto & Jasmin, 2012). Multiple sources of evidence, therefore, suggest that English speakers not only speak but also *conceptualize* time along the back-to-front sagittal axis.

Similar systems of spatial metaphors have been documented in many languages around the world (Núñez & Cooperrider, 2013). Most follow the same pattern as English, with the past associated with space behind the body, and the future with the space in front. Some languages, however, deploy other conventions. Aymara, an indigenous language spoken in the Chilean Andes, also uses the sagittal axis, but reverses the English mapping: Past events are in *front* and future events *behind* (Núñez & Sweetser, 2006). Mandarin Chinese uses vertical terms (up/down) to describe temporal sequences: Earlier events are *up* and later events are *down* (Boroditsky, Fuhrman, & McCormick, 2010; Fuhrman & Boroditsky, 2010; Miles, Tan, Noble, Lumsden, & Macrae, 2011; Yang & Sun, 2016). For speakers of both Aymara and Mandarin, moreover, the spatial construal deployed by their language is also evident in their non-linguistic *thought.* Speakers of Aymara, for instance, gesture in ways that are congruent with their sagittal spatial metaphors, even when they are not using the metaphors in speech (Núñez & Sweetser, 2006). Speakers of Mandarin think about temporal sequences using the vertical axis (Gu et al., 2013; Miles et al., 2011; Yang & Sun, 2016), even during non-linguistic tasks (Boroditsky et al., 2010; Fuhrman et al., 2011). Thus, in linguistic communities around the world, there is often a tight coupling between *temporal language* and *temporal thought* (Núñez & Cooperrider, 2013; Winter et al., 2015).

But there are exceptions. In addition to a sagittal (front-back) construal of time, speakers of English and other languages also conceptualize time as a left-to-right path. For instance, when asked to arrange physical depictions of sequences of events, they arrange them from left to right (Boroditsky & Gaby, 2010; Tillman et al., 2017; Tversky et al., 1991). During natural speech, they gesture to the left for earlier events and to the right for later ones (Casasanto & Jasmin, 2012; Cooperrider & Núñez, 2009). And English speakers are faster to indicate that one event occurred *earlier* than another by responding on their *left* side, but faster for *later* events when responding on their *right* (Fuhrman & Boroditsky, 2010; Miles et al., 2011; Walker et al., 2014; Weger & Pratt, 2008). In the minds of English speakers, therefore, the past and future are not just "behind" and "ahead," but also to the left and right.

This shared conceptualization of time, however, is absent from the English language itself. English speakers can say that they look "back" on the past, but they would never say, in standard speech, that they look "to the left." Indeed, while a left-right conceptualization of time is thought to be widespread in literate cultures (Núñez & Cooperrider, 2013), there is no documented language that talks about time using the lateral axis—for example, with the past to the left and the future to right. This is thus a linguistic gap, where a widespread, stable, shared *conceptual* metaphor has not yet been

conventionalized as a system of *linguistic* metaphors. According to "thought-first" accounts of the evolution of metaphorical language, therefore, this is a metaphor that is ripe to make the leap from mind to mouth.

1.2. Case study: The U.S. military

Anecdotal evidence from members of the authors' families suggests that one community of English speakers has, in fact, started to use left-right metaphors when talking about time: members of the U.S. military. According to these anecdotes, members of the U.S. military can reschedule a meeting to an earlier [/later] time by asking to move it "*to the left [/right].*" These and similar expressions were not seen as poetic or unusual, but as a standard way to talk about time.

This appears to be an established, but still emerging, phenomenon. For instance, the U.S. military has two distinct types of members: Officers, who are generally college-educated and in charge of leadership and planning; and Enlisted members, who are responsible for implementing Officers' plans. According to anecdote, these lateral spatial metaphors are especially pronounced among Officers, compared to Enlisted members. Conversations with members of the U.S. military, moreover, suggested that this novel system of linguistic metaphors is already governed by dialect-specific conventions—for instance, a preference for dynamic descriptions ("Friday's meeting was *moved to the left*, to Wednesday") rather than static descriptions of temporal relations ("Wednesday's meeting *is to the left of* Friday's meeting").

This linguistic subgroup's use of lateral metaphors could thus provide an opportunity to document a process that has been posited by "thought-first" accounts: the emergence of a new system of *linguistic* expressions that reflects an established *conceptual* metaphor. Here, in two empirical studies, we investigated this linguistic innovation. In particular, we established whether left-right linguistic metaphors are conventional for members of the U.S. military and explored the subtle conventions that govern the use of these expressions. While our judgments as native English speakers suggest that these constructions are unconventional in Standard American English, and we suspect that most native English readers will agree, we also collected quantitative judgments from a sample of civilians, which served as a baseline against which to compare military members' judgments.

In Study 1, military and civilian participants rated the acceptability of sentences about time. Informal discussions with members of the U.S. military suggested that lateral metaphors were most acceptable when they used dynamic language (e.g., "move" a meeting). We thus elicited acceptability ratings about four types of sentences: Standard (*The meeting was moved 2 days earlier, from Friday to Wednesday*), Dynamic-Lateral (*The meeting was moved 2 days to the left, from Friday to Wednesday*), Static-Lateral (*The meeting on Wednesday is 2 days to the left of the meeting on Friday*), and Ungrammatical (*From the meeting was 2 earlier days, Friday to Wednesday pushed*). If the use of lateral metaphors for time in the U.S. military reflects a general association between time and lateral space, then military members might treat both types of lateral phrases (i.e., both dynamic and static) as equally acceptable. On the other hand, if the practice reflects a new linguistic

convention, lateral metaphors may be restricted to particular linguistic constructions or contexts (Feist & Duffy, 2015); military members, for instance, may systematically prefer lateral metaphors that employ a *dynamic* framing. In Study 2, we replicated the findings from Study 1 and also investigated whether military personnel are aware that these metaphors are specific to their linguistic subcommunity and not shared with the larger community of English speakers. Together, these studies offer a snapshot of a shift from an established, non-linguistic *conceptual* metaphor to a conventional system of *linguistic* expressions.

2. 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.

2.1. Methods

2.1.1. Participants

Active Duty members of the U.S. military (n = 23) participated for $10, and civilian undergraduates at UC San Diego (n = 25) participated for course credit. The military participants included four Army, one Navy, and 18 Air Force. They included eight Officers (leaders who hold positions of authority) and 15 Enlisted (non-Officer) members. Most military members were native English speakers, and all self-reported the highest level of English-language proficiency on a five-point scale from "poor" to "fluent." We recruited in person on a joint military post, as well as through word of mouth in the U.S. military community. All participants were naive to the goals of the study. Data collection was planned to continue until we reached 25 military participants or the end of the academic quarter. Because civilian data collection was easier, we aimed for a slightly larger civilian sample.

2.1.2. Materials

There were four sentence types:

1. Standard, which used "earlier" or "later" to describe the rescheduling of an event (e.g., "The meeting was moved 2 days earlier, from Friday to Wednesday.").
2. Dynamic-Lateral, which used "left" and "right" to describe the rescheduling (e.g., "The meeting was moved 2 days to the left, from Friday to Wednesday.").
3. Static-Lateral, which used "left" and "right" to describe the relative timing of an event which was not rescheduled (e.g., "The meeting on Wednesday is 2 days to the left of the meeting on Friday.").
4. Ungrammatical, which used the same words as a Standard sentence but in a scrambled order (e.g., "From the meeting was 2 earlier days, Friday to Wednesday moved.").

The full set of stimuli can be found in the Supplemental Materials.

To examine the generality of any eventual linguistic conventions, we varied these sentences along a number of dimensions: whether the event occurred earlier or later; whether the description used the timescale of hours, days, or months; and whether the description crossed a standard temporal boundary or remained entirely within a standard period of time (e.g., an event is rescheduled to later in the same week, from Tuesday to Friday, or to another week entirely, from Friday to the following Monday.) These were fully crossed within each sentence type, for a total of 12 sentences of each type.

2.1.3. Procedure

The study was completed on a computer. To motivate the use of these lateral metaphors, which we hypothesized would seem quite unusual to civilian participants, we told participants to imagine that these sentences were produced by a non-native speaker. They were instructed to rate the acceptability of sentences (n = 48) uttered by this colleague, based on how participants would normally talk at work. Acceptability ratings used a seven-point Likert scale (1 = totally unacceptable, 7 = totally acceptable).

All participants saw the same 48 sentences (12 per phrase type) in a random order. Each sentence was presented on its own page. Participants then supplied standard demographic information (education, age, and language background), and military participants reported their service branch (Army, Navy, etc.), rank, and the year they joined the service. Civilians reported whether they have close friends or family members who have served in the military, and if so, which branch they served in and for approximately how long. No other measures were collected.

2.1.4. Exclusions and analyses

Three participants (1 military, 2 civilians) did not rate Standard sentences at least one point higher than Ungrammatical ones and were eliminated from further analysis. Ratings were standardized by participant (i.e., z-scored), and all reported means reflect these standardized ratings, thus controlling for individual differences in response range. Standardized ratings were analyzed using linear mixed-effects models, using the maximal converging random effects structure justified by the experimental design (Barr, Levy, Scheepers, & Tily, 2013), with random intercepts and slopes for both participants and items. For analyses that include the four sentence conditions, conditions were forward-difference coded: Standard > Dynamic-Lateral > Static-Lateral > Ungrammatical. Analyses that distinguished between Officers and Enlisted personnel were also forward-difference coded: Civilian > Enlisted > Officer.

2.2. Results

Ratings did not differ by timescale (i.e., hours, days, and months; p = .80) or by boundary (i.e., whether the rescheduled meeting was in the same or a new day, week, or year), so we collapsed timescales and boundaries for all subsequent analyses.

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. Standard items were rated as more acceptable ($M = 0.96$) than Dynamic-Lateral phrases ($M = 0.21$, $b = 0.75 \pm 0.14$ *SEM*, $t = 5.5$, $p < .001$), which were more acceptable than Static-Lateral phrases ($M = -0.23$, $b = 0.44 \pm 0.10$ *SEM*, $t = 4.6$, $p < .001$), which in turn were more acceptable than Ungrammatical phrases ($M = -0.94$, $b = 0.71 \pm 0.13$ *SEM*, $t = 5.3$, $p < .001$). As predicted, there was no evidence that military and civilian participants differed in their ratings of Standard phrases ($M_{\text{civilian}} = 1.02$, $M_{\text{military}} = 0.91$; $b = 0.11 \pm 0.12$ *SEM*, $t = 0.9$, $p = .38$), though they did differ in their relative unacceptability of Ungrammatical phrases, with military members especially disapproving of this type of phrase ($M_{\text{civilian}} = -0.75$, $M_{\text{military}} = -1.10$; $b = 0.35 \pm 0.14$ *SEM*, $t = 2.5$, $p = .02$).

We next tested our critical prediction: These patterns of acceptability for lateral phrases would differ systematically for civilians and members of the military. Indeed, we found an interaction between phrase condition (Standard vs. Dynamic-Lateral) and population ($b = 0.49 \pm 0.23$ *SEM*, $t = 2.2$, $p = .04$), demonstrating that while the two groups did not differ in the acceptance of Standard phrases, military members were more accepting of Dynamic-Lateral phrases than civilians were. There was also an interaction between Dynamic-Lateral and Static-Lateral phrases and the two populations ($b = -0.31 \pm 0.14$ *SEM*, $t = -2.3$, $p = .03$): While military members accepted Dynamic-Lateral phrases more than civilians did ($M_{\text{military}} = 0.39$, $M_{\text{civilian}} = 0.00$), the two groups converged on acceptability judgments of Static-Lateral phrases ($M_{\text{military}} = -0.20$, $M_{\text{civilian}} = -0.27$).

To investigate whether these lateral expressions had more acceptability among those with more military responsibility—for example, among Officers compared to Enlisted personnel—we added a fixed effect of subpopulation (civilian = 1, Enlisted = 2, Officer = 3; centered so the mean was 0). See Fig. 1. We replicated the main effects that Standard sentences were more acceptable than Dynamic-Lateral ($b = 1.01 \pm 0.18$ *SEM*, $t = 5.7$, $p < .0001$), which were in turn more acceptable than Static-Lateral ($b = 0.03 \pm 0.12$ *SEM*, $t = 2.4$, $p = .02$), which were themselves more acceptable than Ungrammatical ($b = 0.49 \pm 0.12$ *SEM*, $t = 2.7$, $p = .009$). These selective preferences, however, differed by military subpopulation: Officers rated Dynamic-Lateral phrases as much more acceptable than Enlisted members did ($M_{\text{officer}} = 0.51$ vs. $M_{\text{enlisted}} = 0.17$), whereas their ratings of Standard phrases were more similar ($M_{\text{officer}} = 0.88$ vs. $M_{\text{enlisted}} = 0.97$; $b = -0.65 \pm 0.25$ *SEM*, $t = -2.5$, $p = .02$). As a result of Officers' increased acceptance of Dynamic-Lateral phrases, the difference in acceptability for Dynamic-Lateral compared to Static-Lateral phrases was greater for Officers than Enlisted members (Dynamic-Lateral minus Static-Lateral: $M_{\text{enlisted}} = 0.37$, $M_{\text{officer}} = 0.71$; $b = 0.44 \pm 0.15$ *SEM*, $t = 3.0$, $p = .005$). Officers were also marginally less accepting of Ungrammatical phrases (compared to Static-Lateral) than Enlisted members were (Static-Lateral minus Ungrammatical $M_{\text{enlisted}} = 0.75$, $M_{\text{officer}} = 0.99$; $b = 0.50 \pm 0.26$ *SEM*, $t = 2.0$, $p = .06$). There were no other interactions between phrase type and subpopulation (bs < 0.26, ps $> .40$). These results indicate that Officers, whose roles tend to

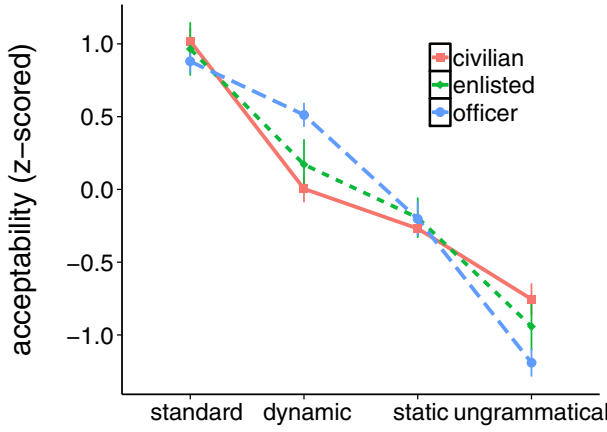

Fig. 1. In Study 1, compared to civilians, military personnel (especially Officers) were more accepting of Dynamic-Lateral phrases (e.g., "meeting was moved to the left"). There was no difference in civilians' and military members' acceptance of Static-Lateral phrases. Error bars = *SEM*.

include the most leadership and planning, are especially accepting of Dynamic-Lateral sentences, as compared not only to civilians, but to their Enlisted counterparts as well.

Finally, as an exploratory analysis of the nuances of this emerging linguistic convention, we investigated whether meetings that were moved later ("to the right") differed in acceptability from those moved earlier ("to the left"), as suggested by initial anecdotal evidence. Indeed, across both military and civilian populations and all phrase types, meetings that were moved to the right were rated as more acceptable than those moved to the left ($M_{right} = 0.09$; $M_{left} = -0.09$; $b = 0.22 \pm 0.09$ *SEM*, $t = 2.4$, $p = .02$), perhaps reflecting the relative frequency of rescheduling meetings to later times (the right) compared to earlier times (the left) in real life. Furthermore, we found an interaction between phrase type (Dynamic-Lateral vs. Standard), population (military vs. civilian), and reschedule direction ($b = -0.40 \pm 0.15$ *SEM*, $t = -2.7$, $p = .006$). We thus zoomed in on these Dynamic-Lateral phrases, while distinguishing between Officer and Enlisted members of the military. This analysis revealed that, compared to civilians, both Officer and Enlisted members especially preferred phrases in which a meeting was "moved to the right" over those in which a meeting was "moved to the left" (Enlisted: $M_{right} = 0.07$; $M_{left} = -0.07$; $b = -0.25 \pm 0.12$, $t = -2.09$, $p = .04$; Officer: $M_{right} = 0.09$; $M_{left} = -0.09$; $b = 0.23 \pm 0.10$ *SEM*, $t = 2.3$, $p = .02$). Officer and Enlisted members did not differ significantly from each other ($b = 0.02 \pm 0.13$, $t = 0.14$, $p = .89$). Therefore, the acceptability of dynamic-lateral phrases among members of the military appears to be especially pronounced for particular usages (i.e., when events are moved later).

Finally, we verified that the main effects were not driven by any demographic differences between the three populations. While Officers and Enlisted members did not differ in age ($M_{officer} = 39.6$; $M_{enlisted} = 39.3$; t (12.7) = 0.05, $p = .96$) or years of military experience ($M_{officer} = 17.3$; $M_{enlisted} = 18.9$; t (8.2) = 0.2, $p = .81$), military members were significantly older than the civilian participants ($M_{military} = 39.4$; $M_{civilian} = 19.4$;

t (22.8) = 8.4, $p < .00001$). Nevertheless, accounting for age did not affect any of the critical findings (see SOM).

To ensure that the acceptability ratings by civilians in our sample were not specific to undergraduate students, we replicated the civilian ratings using a non-student civilian sample (see Supplementary Materials). Like the undergraduate civilians, this non-student civilian sample found Lateral sentences significantly less acceptable than Standard phrases; in fact, this non-student sample was even less accepting of lateral sentences, not distinguishing them from ungrammatical sentences.

2.3. Discussion

Study 1 confirmed that a system of lateral metaphors has become conventionalized among members of the U.S. military, a subculture of American English speakers. If this reflected a general conceptual or linguistic 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*, especially when used to delay an event, suggesting that this is a targeted linguistic convention, restricted to particular linguistic constructions.

3. 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 varieties of English spoken in the military, and not shared with the larger civilian population.

We also aimed to confirm that differences between military and civilian acceptability ratings truly reflected differences in how these groups thought about the acceptability of the language constructions, rather than differences in the groups' abilities to interpret the phrases. To rule out the possibility that military members understood the meaning of these phrases in a way that civilians did not, we also included a forced-choice interpretation task, where participants had to indicate when an event would occur if it were moved "to the left" or "to the right."

3.1. Methods

3.1.1. Participants

Members of the U.S. military (n = 29) participated for $10. Civilian undergraduates (n = 36) participated for course credit. Military participants included 6 Army, 6 Navy, nine Air Force, and 3 Marines (5 did not identify their branch); 10 were Officers, 12 were Enlisted, and 7 did not identify their rank. Of these, 11 were veterans (often still working with active duty military), and 18 were active duty. As in Study 1, most military

members were native English speakers, and all self-reported the highest level of English-language proficiency on a five-point scale from "poor" to "fluent." Data collection was planned to continue until we reached 36 military participants or the end of the academic quarter.

3.1.2. Materials

Materials were identical to Study 1 with two differences. First, to confirm that lateral metaphors can be used with a variety of verbs, we also included items that used the verb *push* (e.g., *pushed* 2 *months*), in addition to items using the verb *move* as in Study 1. Second, to reduce the total number of items, we did not vary the timescale (i.e., weeks, months, or years), since it had no effect on acceptability in Study 1. The full set of stimuli can be found in the Appendix.

3.1.3. 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 forced-choice 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 2 months to the right, from November to* ___.) Choices included all odd-numbered months (January, March, etc.) and *I don't know*.

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

Participants were randomly assigned to complete the acceptability ratings (both in a military and civilian context) or forced–choice block first. For the acceptability ratings, context order (i.e., military vs. civilian context) was assigned randomly. There were 32 sentences for each of the three task components; every participant saw every sentence in a random order.

Exclusions and analyses were unchanged from Study 1. Participants were eliminated from further analysis if their mean rating for Ungrammatical sentences was not at least one point less than their mean rating for Standard sentences. This excluded five participants (2 military, 3 civilians). Veteran status did not affect judgments ($ps > .26$), so analyses collapsed across current and former military personnel. Similarly, there were no effects of verb (*move* vs. *push*), so analyses were collapsed over both verbs.

We first investigated main effects and interactions by generalizing participants as either military members or civilians. When members of these two populations differed in their

responses, we further divided the military members by whether they were Officers or Enlisted personnel, as in Study 1.

3.2. Results

3.2.1. Acceptability ratings: How do military members and civilians view the different phrase types?

Although a primary goal of Study 2 was to examine whether context (military vs. civilian) altered acceptability judgments, it was also an opportunity to replicate Study 1. For this reason, we first collapsed over context to conduct the same analyses as in the prior study. Although some main effects and lower-level interactions will become significant or non-significant when context is included in the analyses, we report the main effects and lower-level interactions in detail here to assess the consistency between Study 1 and Study 2.

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 ($M = 0.99$ vs. $M = 0.25$; $b = 0.71 \pm 0.09$ *SEM*, $t = 7.5$, $p < .0001$), which were more acceptable than Static-Lateral phrases ($M = -0.03$; $b = 0.28 \pm 0.06$ *SEM*, $t = 4.7$, $p < .0001$), which in turn were more acceptable than Ungrammatical phrases ($M = -1.21$; $b = 1.2 \pm 0.10$ *SEM*, $t = 11.9$, $p < .0001$).

We next attempted to replicate our main finding from Study 1: Compared to civilians, military participants had a selective preference for lateral metaphors, especially dynamic ones. We replicated our critical finding that the populations differed in their preference for Dynamic-Lateral phrases compared to Standard ones (Standard minus Dynamic-Lateral: $M_{\text{military}} = 0.33$; $M_{\text{civilian}} = 1.07$; $b = 0.74 \pm 0.18$ *SEM*, $t = 4.1$, $p < .001$). Moreover, acceptability for Static-Lateral (vs-Dynamic-Lateral) phrases differed between the two populations ($b = -0.21 \pm 0.18$ *SEM*, $t = 4.1$, $p = .0001$): Military personnel reported a difference in acceptability between Static-Lateral and Dynamic-Lateral phrases that was more than double that of civilians (military: Dynamic-Lateral $M = 0.45$, Static-Lateral $M = 0.06$; civilians: Dynamic-Lateral $M = 0.08$, Static-Lateral $M = -0.10$), suggesting a strong, selective preference by military personnel for dynamic, rather than static, lateral metaphors. In order to investigate whether the populations differed in their overall preferences for Static-Lateral phrases (i.e., compared to Standard phrases), we constructed another model in which Standard phrases were treated as a baseline against which all other phrase types were compared. This revealed that, overall, military members thought that Static-Lateral phrases were more acceptable than civilians did ($M_{\text{military}} = 0.06$, $M_{\text{civilian}} = -0.10$; $b = -0.99 \pm 0.10$ *SEM*, $t = 9.8$, $p < .00001$), replicating a numerical but statistically non-significant effect from Study 1. Thus, all forms of lateral metaphors were rated as more acceptable by military members, compared to civilians, although this effect was especially pronounced for dynamic rather than static phrases.

As in Study 1, we next investigated whether this linguistic convention was especially entrenched among military Officers, and present but less pronounced among Enlisted

military personnel. Civilians and Enlisted personnel differed in their acceptance of Dynamic-Lateral phrases, compared to Standard ones ($b = 0.54 \pm 0.24$ *SEM*, $t = 2.3$, $p = .03$). While both civilians and Enlisted personnel thought Dynamic-Lateral phrases were less acceptable than Standard ones, this dispreference was twice as large for civilians (Standard minus Dynamic-Lateral: $M = 1.07$; $b = 1.07 \pm 0.12$ *SEM*, $t = 8.9$, $p < .0001$) than for Enlisted personnel (Standard minus Dynamic-Lateral: $M = 0.54$; $b = 0.55 \pm 0.24$ *SEM*, $t = 2.2$, $p = .04$). By contrast, both civilians and Enlisted military personnel thought that Static-Lateral phrases were worse than Dynamic-Lateral ones (Dynamic-Lateral minus Static-Lateral: $M_{\text{civilian}} = 0.18$; $b = 0.18 \pm 0.05$, $t = 3.3$, $p = .003$; $M_{\text{enlisted}} = 0.37$; $b = 0.35 \pm 0.12$ *SEM*, $t = 2.9$, $p = .01$), and this dispreference did not differ by population ($b = -0.18 \pm 0.13$ *SEM*, $t = -1.4$, $p = .16$). Enlisted military personnel, therefore, had a systematic and targeted preference for Dynamic-Lateral sentences, compared to civilians.

We next examined whether these preferences were even more pronounced among Officers. Compared to Standard phrases, Officers rated Dynamic-Lateral phrases as more acceptable than Enlisted personnel did ($M_{\text{officer}} = 0.45$, $M_{\text{enlisted}} = 0.33$; $b = -0.65 \pm 0.25$ *SEM*, $t = 2.5$, $p = .02$). To explore this effect, we examined the main effect of phrase type (Dynamic-Lateral vs. Standard) in Officers and Civilians separately. While both Officers and Civilians gave numerically lower ratings for Dynamic-Lateral phrases compared to Standard phrases, this difference was small and non-significant for Officers (Standard minus Dynamic-Lateral: $M = 0.23$; $b = 0.23 \pm 0.21$, $t = 1.1$, $p = .30$), but five-times larger and highly significant among Civilians ($M = 1.07$; $b = 1.07 \pm 0.12$ *SEM*, $t = 8.9$, $p < .0001$). Even compared to their Enlisted personnel, military Officers are especially accepting of Dynamic-Lateral phrases—not even distinguishing them, statistically, from Standard phrases.

In addition, unlike Civilians and Enlisted members, Officers did not make a strong distinction between Dynamic-Lateral and Static-Lateral phrases: Officers thought Static-Lateral phrases were only slightly and non-significantly less acceptable than Dynamic-Lateral ones ($M_{\text{Static}} = 0.16$ vs. $M_{\text{Dynamic}} = 0.49$, $b = 0.33 \pm 0.20$ *SEM*, $t = 1.7$, $p = .13$). To test whether Static-Lateral phrases were considered worse than Standard phrases, we recoded phrase type so Standard was the baseline against which all other levels were compared. This confirmed that, among Officers, Static-Lateral sentences were only marginally less acceptable than Standard ones (Standard minus Static-Lateral: $M = 0.56$; $b = 0.56 \pm 0.28$ *SEM*, $t = 2.0$, $p = .07$). Thus, for Officers, Dynamic-Lateral phrases were no worse than Standard phrases, and Static-Lateral phrases were only marginally worse than Standard ones.

Finally, we examined whether acceptability judgments differed based on whether a meeting was rescheduled to a later time (to the right) or to an earlier one. As in Study 1, meetings moved later were more acceptable than those moved earlier ($M_{\text{Later}} = 0.05$ vs $M_{\text{Earlier}} = -0.05$; $b = -0.09 \pm 0.02$ *SEM*, $t = -4.0$, $p = .0002$). This finding was marginally stronger for Standard sentences (those that used the term *earlier* or *later*; Later minus Earlier: $M = 0.16$) than Dynamic-Lateral (using the term *left* or *right*; Later minus Earlier: $M = 0.11$; $b = -0.01 \pm 0.06$ *SEM*, $t = -1.83$, $p = .07$). However, military and

civilians did not differ in their preference for rescheduling meetings to later times over earlier ones (Later minus Earlier: $M_{\text{military}} = 0.11$, $M_{\text{civilian}} = 0.08$; $b = 0.02 \pm 0.03$, $t = 0.74$, $p = .46$).

3.2.2. Does context affect phrases' acceptability?

Next we investigated whether an utterance's *context*—whether it was uttered in a setting with civilians or members of the military—had an effect on its acceptability (Fig. 2 and Table 1). A model that added an additional fixed effect for context replicated the central findings reported above. Standard sentences were more acceptable than Dynamic-Lateral ones, which were in turn more acceptable than Static-Lateral, which were finally more acceptable than Ungrammatical (bs > .29, ps < .00001). And, once again, there was a selective acceptance of Dynamic-Lateral phrases by members of the military, compared to civilians (civilian vs. enlisted; $b = 0.54 \pm 0.24$ *SEM*, $t = 2{,}3$, $p = .03$; enlisted vs. officer: $b = 0.31 \pm 0.30$ *SEM*, $t = 1.0$, $p = .31$).

Overall, there was an effect of context ($b = -0.14 \pm 0.02$ *SEM*, $t = -8.0$, $p < .00001$), with higher acceptability for phrases in a military than civilian work setting ($M_{\text{military}} = 0.04$, $M_{\text{civilian}} = -0.04$). Standard phrases were seen as marginally more acceptable in a military than a civilian setting ($M_{\text{military}} = 1.01$ $M_{\text{civilian}} = 0.97$; $b = -0.07 \pm 0.04$ *SEM*, $t = -2.0$, $p = .05$). Civilians and Enlisted members did not differ in their acceptance of Standard phrases across contexts (for civilians, $M_{\text{military context}} = 1.16$, $M_{\text{civilian context}} = 1.16$; for enlisted, $M_{\text{civilian context}} = 0.87$, $M_{\text{enlisted context}} = 0.86$; $b = 0.01$, $p = .90$), but Officers rated such sentences as marginally

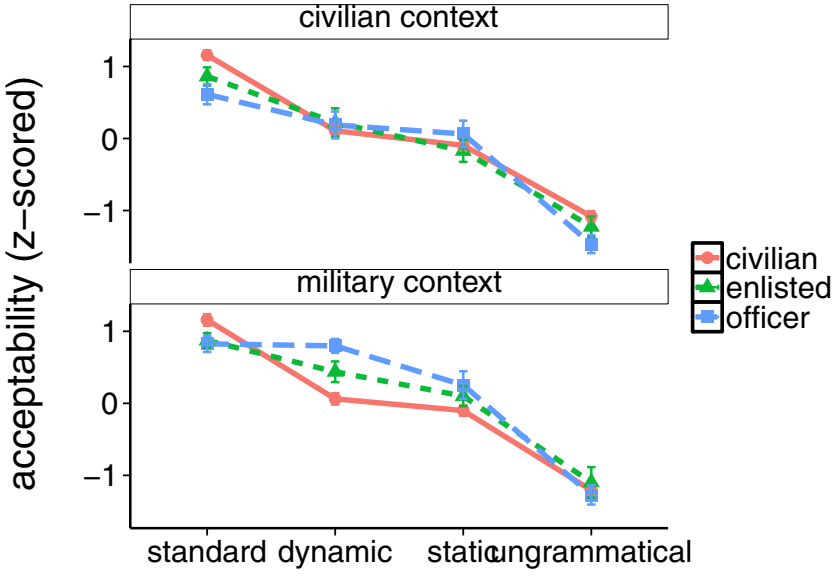

Fig. 2. Effect of context and phrase type on acceptability in Study 2. Overall, military personnel were more accepting of lateral metaphors, in both static and dynamic forms, although this was restricted to contexts where interlocutors were members of the military (right) rather than civilians (left). (Error bars = *SEM*)

more acceptable in a military than a civilian context ($M_{\text{military context}} = 0.83$, $M_{\text{civilian context}} = 0.61$; compared to Enlisted, $b = 0.20 \pm 0.10$ *SEM*, $t = 1.9$, $p = .05$).

We next zoomed in on the phrases of especial interest, the Dynamic-Lateral ones. This subset analysis revealed that acceptability differed across contexts, ($b = -0.26 \pm 0.03$ *SEM*, $t = -7.4$, $p < .0001$), with people viewing them as significantly more acceptable in a military ($M = 0.04$) than a civilian context ($M = -0.04$). This main effect of context was driven by an interaction with population ($b = -0.49 \pm 0.06$, $t = 8.3$, $p < .0001$). Only military members demonstrated context-selective acceptability for these phrases ($M_{\text{military context}} = 0.11$, $M_{\text{civilian context}} = -0.11$; $b = -0.22 \pm 0.02$ *SEM*, $t = -9.5$, $p < .0001$). Follow-up analyses of military members revealed this context-sensitivity was present among Enlisted personnel, who rated Dynamic-Lateral phrases as more acceptable in a military ($M = 0.08$) than a civilian context ($M = -0.08$) compared to civilians ($b = 0.26 \pm 0.08$ *SEM*, $t = 3.4$, $p = .0005$)—but even more pronounced for Officers, for whom the effect was nearly 50% greater than it was for Enlisted military personnel ($M_{\text{military context}} = 0.15$, $M_{\text{civilian context}} = -0.15$; $b = 0.39 \pm 0.10$, $t = 4.1$, $p < .0001$).

When we analyzed Static-Lateral phrases on their own, we found that these phrases were also rated as more acceptable in military workplaces ($M = 0.02$) than in civilian ones ($M = -0.08$; $b = -0.15 \pm 0.03$ *SEM*, $t = -4.6$, $p < .0001$). Once again, this was driven by an interaction between context and population ($b = 0.24 \pm 0.06$, $t = 4.1$, $p < .0001$), with military members selectively preferring Static-Lateral phrases in a military context ($M_{\text{military contex}} = 0.17$, $M_{\text{civilian context}} = -0.06$). We again further analyzed this data using the Officer-Enlisted distinction for military members. The difference in acceptability for Static-Lateral phrases across contexts was greater for Enlisted members ($M_{\text{military contex}} = 0.10$, $M_{\text{civilian context}} = -0.17$) than civilians ($M_{\text{military contex}} = -0.10$, $M_{\text{civilian context}} = -0.10$; $b = 0.28 \pm 0.07$ *SEM*, $t = 3.8$, $p = .0001$), but not for Officers compared to Enlisted (for officers: $M_{\text{military contex}} = 0.25$, $M_{\text{civilian context}} = 0.06$; $b = -0.08 \pm 0.09$ *SEM*, $t = -0.9$, $p = .37$). However, compared to Dynamic-Lateral phrases, civilians did not rate Static-Lateral sentences as less appropriate in a military than civilian context (Dynamic-Lateral minus Static-Lateral: $M_{\text{military contex}} = 0.16$, $M_{\text{civilian context}} = 0.20$; $b = 0.04 \pm 0.06$ *SEM*, $t = 0.7$, $p = .48$), nor did Enlisted members

Table 1
Z-scored acceptability ratings (*SEM*) for participants by sentence type, military status and rank, and context (civilian or military colleagues)

	Civilians		Enlisted		Officers	
	Civilians Context	Military Context	Civilians Context	Military Context	Civilians Context	Military Context
Standard	1.16 (0.06)	1.16 (0.08)	0.86 (0.44)	0.87 (0.10)	0.61 (0.14)	0.83 (0.11)
Dynamic-lateral	0.11 (0.07)	0.06 (0.08)	0.22 (0.20)	0.44 (0.14)	0.19 (0.19)	0.80 (0.10)
Static-lateral	−0.10 (0.08)	−0.10 (0.07)	−0.17 (0.15)	0.10 (0.14)	0.06 (0.18)	0.25 (0.19)
Ungrammatical	−1.08 (0.07	−1.21 (0.07)	−1.23 (0.14)	−1.10 (0.21)	−1.47 (0.12)	−1.27 (0.13)

(Dynamic-Lateral minus Static-Lateral: $M_{\text{military contex}} = 0.34$, $M_{\text{civilian context}} = 0.32$; $b = 0.06 \pm 0.10$ *SEM*, $t = 0.6$, $p = .58$), but Officers did (Dynamic-Lateral minus Static-Lateral: $M_{\text{military contex}} = 0.54$, $M_{\text{civilian context}} = 0.12$; $b = -0.42 \pm 0.08$ *SEM*, $t = -5.1$, $p < .0001$).

Thus, military personnel appear to recognize that their use of lateral metaphors is restricted to their variety of English and would be unacceptable in contexts that were populated primarily by civilians. This metalinguistic awareness was especially pronounced among officers.

3.2.3. Forced choice

One alternative explanation of this result is that, rather than reflecting a novel linguistic convention, these differences in acceptability are merely a consequence of increased familiarity among military personnel with nonlinguistic uses of lateral space to represent time. We addressed this concern with the forced–choice interpretation task, which investigated whether individuals could interpret these novel expressions, even if they judged them to be linguistically unacceptable.

We first analyzed accuracies for each sentence type by population. There was no difference in overall accuracy between civilians and military members ($p = .19$). Participants were overall less accurate for Static-Lateral (78.9%) than Dynamic-Lateral statements (94.7%; $b = 2.07 \pm 0.63$ *SEM*, $z = 3.3$, $p = .001$; Table 2), but this did not differ by population (military vs. civilian; $p = .30$). There were no other main effects of phrase type or interactions between phrase type and population (ps $> .15$).

Thus, military and civilian participants showed no differences in the *ability* to interpret the sentences with lateral metaphors, despite differing in how acceptable they found them. This suggests that the increased acceptance of lateral phrases among members of the military did not merely reflect improved interpretability, but instead reflects the emergence of a genuine linguistic convention.

3.2.4. Acceptability of dynamic-lateral phrases across Studies 1 and 2

Finally, we combined the data from both studies to investigate how the acceptability of dynamic-lateral phrases was distributed within our three populations: civilians, enlisted military personnel, and military officers. For each individual, we calculated a measure of

Table 2
Performance on the forced–choice interpretation task, for each of the phrase types and for both populations. Mean accuracy (*SEM*)

	Accuracy	
Condition	Civilians	Military
Standard	96.6 (1.6)	99.1 (0.5)
Dynamic-lateral	93.9 (3.2)	95.4 (1.2)
Static-lateral	73.9 (5.6)	83.9 (4.2)
Ungrammatical	78.8 (5.3)	78.2 (7.5)

their acceptance of lateral metaphors, relative to ungrammatical and standard phrases, using their mean ratings: $(M_{\text{dynamic}} - M_{\text{ungrammatical}})/(M_{\text{standard}} - M_{\text{ungrammatical}})$. This measure places an individual's acceptance of dynamic-lateral phrases on a continuum from ungrammatical (0) to standard (1), thus controlling for individual differences in response range. (Values less than 0 indicate that dynamic phrases are even less acceptable than ungrammatical phrases, whereas values greater than 1 indicate that they are even more acceptable than standard phrases). For participants in Study 2, we used only their ratings from the military context. This approach confirmed the results of both studies. Within-population variability is illustrated in Fig. 3, which shows the distribution of lateral metaphor acceptability within each population. Civilians thought lateral metaphors were significantly less acceptable than standard phrases ($M = 0.52$, 95% CI [0.42, 0.61]); $t_{46} = -10.1$, $p < .00001$). Military officers were much more accepting of dynamic lateral phrases ($M = 0.91$, 95% CI [0.79, 1.02]) and did not distinguish them significantly from standard ones ($t_{22} = -1.7$, $p = .09$). Other military personnel lay in between ($M = 0.74$, 95% CI [0.79, .98]), significantly more accepting of dynamic lateral metaphors than civilians ($t_{67} = -2.2$, $p = .03$) and numerically less accepting than officers ($t_{43} = -1.3$, $p = .19$).

4. Discussion

Can shared ways of *thinking* metaphorically give rise to new conventionalized ways of *speaking* metaphorically? In two studies, we found that members of the U.S. military, a subcommunity of American English speakers, have appropriated and conventionalized a lateral metaphor for time. While English speakers generally conceptualize time as a left-to-right path, members of the U.S. military have begun to accept metaphorical expressions like "move the meeting to the right" that use the language of lateral space to describe temporal relations. This case study fills an evidential gap, since "thought-first" accounts assert that systematic metaphorical expressions can be the *linguistic* manifestation of preexisting systems in *thought* (e.g., Lakoff & Johnson, 1980). Demonstrating this purportedly pervasive relationship has been challenging, since, in linguistic communities around the world, conceptual metaphors typically already have systematic linguistic counterparts. Thus, the adoption of lateral spatial metaphors by the U.S. military provides a unique and rare opportunity to document the shift from a cultural pattern of thought to a conventionalized system of linguistic metaphors.

The current results contribute to our understanding of the causal relations between metaphorical thought and language. Learning to use novel linguistic metaphors is known to create new conceptual metaphors in the speaker (Hendricks & Boroditsky, 2017). In one study, English-speaking participants learned linguistic metaphors that placed earlier events either above or below later ones (i.e., *breakfast is above dinner* or *breakfast is below dinner*; Hendricks & Boroditsky, 2017); afterward, they exhibited metaphor-consistent responses on an implicit measure of their mental space-time associations. Our results suggest that the causal arrow can also point in the opposite direction. Not only can

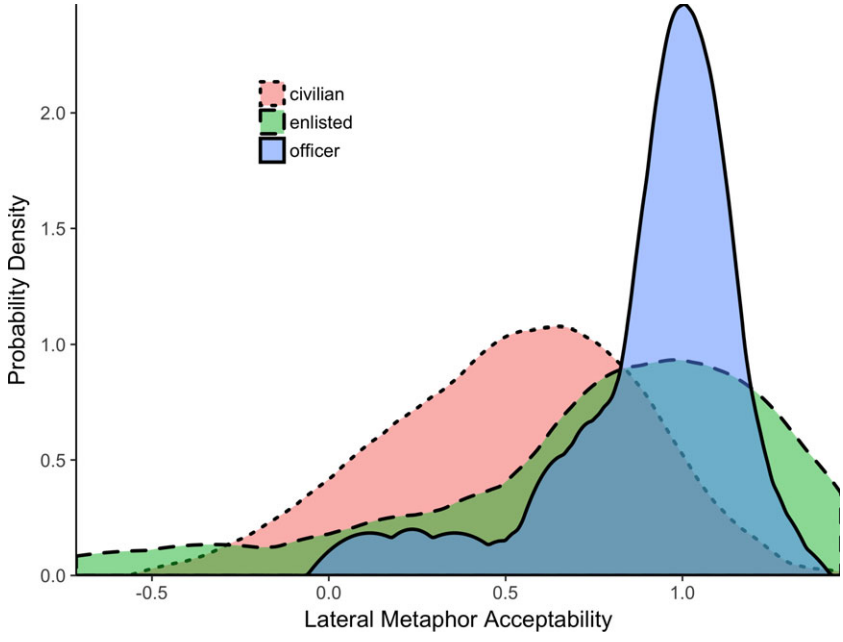

Fig. 3. Individual variability in the acceptability of dynamic-lateral phrases, within each of the three populations, combining Studies 1 and 2. Relative acceptability of lateral metaphors is along the horizontal axis; probability density is along the vertical axis. Acceptability of lateral metaphors varied among civilians, but it was centered approximately halfway between standard (1) and ungrammatical (0) phrases. Officers were in agreement that dynamic lateral metaphors were highly acceptable, and they did not distinguish them significantly from standard phrases. Other military personnel also accepted lateral metaphors to a higher degree than civilians, though their acceptance was not as pronounced as among officers.

metaphorical language shape mental representations, but our mental representations can also make their way into conventionalized language. There appear to be bidirectional causal relationships between metaphorical language and metaphorical thought.

We also aimed to distinguish whether the documented practice was solely a case of lexical substitution (i.e., regardless of surrounding language context, people substitute *right* for later and *left* for earlier) or marked the emergence of an entire system of linguistic conventions. While systems of linguistic metaphor are typically productive, allowing speakers to generate novel expressions, they also tend to be governed by idiosyncratic conventions. For instance, in Standard American English one can say that a meeting was "pushed *up*" to an earlier time, but not that a meeting was "pushed *down*" to a later time. In the case of lateral metaphors, military personnel preferred expressions that involved *moving* an event (i.e., Dynamic-Lateral phrases) over similar phrases that merely described temporal relations (i.e., Static-Lateral phrases). There were also hints that these lateral phrases were most acceptable when moving an event later ("to the right"). These nuances suggest the emergence of idiosyncratic conventions governing the use of this metaphor system. An informal poll of members of the U.S. military who did not participate in the current studies suggested possible explanations for the greater preference for

moving events right than left. For one, they reported that events are usually postponed, not rescheduled to earlier times, so it may just be rarer to need phrases like "moving the meeting to the left" than phrases like "moving the meeting to the right." Furthermore, as mentioned above, when events are moved to an earlier time, they are often referred to in Standard American English as being *moved up,* but unconventional to describe a postponed event as *moved down*. Phrases like "moved right" may fill that linguistic gap for postponed events, in a way that is unnecessary for events rescheduled to earlier times.

Additional informal discussions with members of the military suggested that dynamic constructions may be more acceptable than their static counterparts because the military emphasizes dynamic planning and action rather than static description. On the other hand, the particular choice of action verb—"push" versus "move"—mattered less, which suggests that the metaphor affords a certain degree of creative productivity. These lateral expressions, therefore, have many of the hallmarks of a conventionalized system of linguistic metaphor, exhibiting both idiosyncratic constraints and creative productivity.[1]

4.1. The birth and life of lateral metaphors for time

Why have military members, in particular, adopted lateral metaphors that are absent from civilians' language? This answer will likely involve factors operating at different levels, from the individual to the institutional, all working together to support and regiment the use of this linguistic metaphor system. At the smallest unit of analysis, there may be something special about people who are inclined to join the military. Perhaps they are predisposed, for some reason, to adopting lateral linguistic metaphors for talking about time. However, this seems unlikely—and even if it were true, it would probably be insufficient to account for the widespread establishment of a novel linguistic convention. Instead, we propose that a suite of specific cultural and socio-institutional features of the U.S. military created an optimal environment for the emergence of a system of lateral metaphors, which prior work has suggested supports the emergence of conceptual metaphors (Gibbs, 2011).

At the cultural level, the initial emergence and widespread acceptance of these linguistic metaphors may have been encouraged by the ubiquitous and highly regimented use of a specific kind of temporal artifact. Duty Rosters are documents that keep track of the assignments for each member of a military unit and are thus a critical and recurring part of military work life. Duty Rosters are standardized and governed by specific regulations (Army Regulation [AR] 220-45). Each row represents an individual. Each column represents a successive date, ordered from left to right. Unlike standard American calendars, in which each row only has 7 days across, Duty Rosters arrange days in a continuous line extending rightward—potentially endlessly, when implemented as a digital spreadsheet. These artifacts could have created recurring contexts in which left-right language became both natural and efficient.

In addition, the culture of the U.S. military puts a high value on minimizing ambiguity —as demonstrated, for example, by their use of a 24-h clock instead of the more common American practice of using a 12-h clock. Unlike many of the standard phrases that

currently exist in Standard English for speaking about temporal sequences, lateral metaphors are completely unambiguous with regards to the direction of temporal change (Duffy & Feist, 2014). When a meeting is moved "forward," it could have been moved earlier *or* later, depending on one's construal (Boroditsky, 2011). But when a meeting is moved "to the left," there is only one possibility—it was moved earlier. Given their enculturation to avoid ambiguity, members of the U.S. military may have been inclined to accept and conventionalize these lateral metaphors.

At the socio-institutional level, the U.S. military is both highly insular and hierarchical. Military members often live and work together in closed communities—and when they are working internationally, they can be surrounded by locals with whom they do not share a language. Within such closed communities, linguistic innovations may be more likely to spread, and new members may be incentivized to adopt non-standard linguistic conventions as a way to achieve in-group status. Moreover, the military is marked by a highly hierarchical, top-down power structure. Thus, conventions, linguistic or otherwise, that originate at the top of the institution are likely to percolate down throughout the rest of the military—for instance, from officers who adopted lateral metaphors to talk about Duty Rosters, to the enlisted members who must carry out their assigned roles. By combining insularity, a strictly hierarchical power structure, and highly regimented cultural artifacts that make extended use of lateral timelines, the U.S. military may have created a perfect environment for the emergence and establishment of this novel system of linguistic metaphors.

The current studies cannot uniquely identify the causal relations between language, physical artifacts, cultural artifacts, and the conceptualization of time within the U.S. military. Our results demonstrate a link between thinking laterally and talking laterally among members of the U.S. military. Because civilians share the same lateral conceptualization of time but not the associated linguistic practice, we can infer that the military linguistic practice was not the origin of the lateral convention for thinking about time. However, our data cannot speak to the possibility that military members' linguistic practices, once established, may in turn strengthen their mental timelines, with mutually reinforcing causal influences between temporal language and temporal thought. As a result, military associations between sequential time and lateral locations may be more robust or automatic than they are for civilians; future work might consider using more implicit measures to examine differences in conceptualization across groups. Indeed, we suspect that language use, physical artifacts, and cultural practices exert multi-directional effects on each other, all conspiring together to maintain the cohesive cognitive ecosystem in which military members think about time.

Another remaining question is whether and how this linguistic innovation may spread outside the U.S. military to the larger community of English speakers, and perhaps even to other languages entirely. While the military community is quite insular, it is not completely disconnected from the civilian world. Military officers, in particular, often transition to civilian careers—in part because, at the higher levels of the military, there are fewer opportunities for promotion than there are officers vying for them. These officers, as we have shown, also happen to be the segment of the U.S. military who have most

reliably adopted this new metaphor system. Military officers are thus a likely vector for the spread of this metaphor system into the larger community of English speakers. Future work might continue to reveal the spread of the metaphors documented here by studying the practices of people early in their military career (such as cadets, who are future Officers, and recruits, who are future Enlisted members) or people who have close friends or family members in the military. Moreover, this system of metaphors may eventually spread beyond English. Indeed, while most of our participants were native speakers of English and all reported the highest level of proficiency in English, some also reported native proficiency in other languages; given the communicative benefits of this new system of metaphors, people may eventually adopt versions of it when speaking other languages.

Moreover, as demonstrated by their success on the interpretation task (Study 2), civilians *can* make sense of these lateral metaphorical expressions, however unusual they may seem. This confirms a major prediction of "thought-first" accounts of the origin of systematic linguistic metaphors: Our civilian participants could make sense of these metaphors, presumably, because they already have an analogous *conceptual* metaphor (Fuhrman et al., 2011; Núñez & Cooperrider, 2013; Tversky et al., 1991; Winter et al., 2015). It is thus a small leap for civilians to adopt these systematic linguistic expressions as a conventionalized part of their language. In addition, as discussed above, these expressions offer the benefit of reducing ambiguity, compared to equivalent phrases in Standard English (e.g., "moved ahead" can mean earlier or later). We predict that civilians will eventually adopt this system of lateral metaphors, driven by their alignment with a preexisting conceptual metaphor, the mobility of military officers, and the expressions' lack of ambiguity.

4.2. Future work and conclusions

This work opens the question of whether there are 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 2 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)?

For practical security reasons, there are unlikely to be any corpora containing extensive speech produced by military members, but if one did exist, it could shed additional light on the nuances of these metaphors, the contexts in which they are used, and whether they reduce miscommunications. For instance, based on the anecdotes that inspired this line of work, lateral metaphors appear to be used primarily for communicating sequential (earlier/later), rather than deictic (past/future), relationships. Although the current studies did not focus on this aspect of the linguistic practice, this specificity for sequential time is consistent with a prediction made by Núñez and Cooperrider (2013): that lateral metaphors are inherently non-deictic because they involve displacing the spatial construal outside the ego.

Together, the two studies presented here provide a proof-of-concept of an oft-theorized causal influence of metaphorical thought on language: Not only can linguistic metaphors give rise to new ways of thinking, but entrenched patterns of thinking can also give rise to new metaphors in language. Given the right cultural milieu, metaphors can move from mind to mouth.

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Note

1. A reviewer noted two curious differences between military and civilian acceptability ratings: in Study 1, military personnel appear to rate the ungrammatical sentences as less acceptable than civilians; in Study 2, military personnel appear to rate standard sentences as less acceptable than civilians. Unlike the large and robust differences in the acceptability of lateral metaphors, however, these differences were numerically small and did not replicate between studies. Moreover, inspection of the raw (i.e., non-z-scored) ratings revealed that the apparent difference in Study 1 was driven by military personnel giving more extreme responses on both ends of the scale (more accepting of standard phrases, less accepting of ungrammatical phrases; see supplemental Figure S2), perhaps driven by a cultural aversion to ambiguity within the military. In Study 2, the raw ratings did not differ for standard or ungrammatical sentences, only for lateral metaphors (see supplemental Figure S3).

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Supporting Information

Additional Supporting Information may be found online in the supporting information section at the end of the article.

Figure S1. Civilians unaffiliated with UC San Diego (N = 25), recruited through Amazon Mechanical Turk, were highly accepting of Standard phrases (e.g., "moved 3 days earlier") but highly disapproving of Lateral phrases, both Dynamic (e.g., "moved 3 days to the left"), and Static (e.g., "is 3 days to the left"). Error bars = SEM.

Figure S2. In Study 1, military members gave more extreme responses on both ends of the scale, perhaps because of a cultural aversion to ambiguity in the military.

Figure S3. In Study 2, military and civilians' raw (non-z-scored) responses did not differ for ungrammatical or standard sentences. However, they differed for both types of lateral phrases.

Table S1. All stimuli used in Study 1.

Table S2. All stimuli used in Study 2.